WHAT COUNTS AS LEARNING

Open Digital Badges for New Opportunities

The Digital Media + Learning Research Hub
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FOREWORD

The chance to rethink what counts as learning, how to recognize and make visible the learning that takes place anywhere, anytime, on any device — indeed, to build an entirely new social and technical system for issuing credentials — is a rare opportunity, one that does not present itself often. Open digital badges[1] are simple tools that have the potential to change our current system of credentialing, creating ways to recognize more diverse learning pathways and opportunities for both learners and institutions for generations to come. How, then, do we go about building on this potential? How do we design relevant, innovative, and transformative badge systems that connect people's multiple spheres of learning and link them to new opportunities?

This research is an early response to designing badge systems grounded in actual practice. It provides a building block for anyone interested in designing open digital badge systems, and also for educators, policymakers, technologists, humanists, scholars, and administrators who have a stake in how badge systems might impact learning, assessment, and opportunities for lifelong learners. The following chapters are based on several years of conversations with leading thinkers at the MacArthur Foundation, Mozilla's Open Badges, HASTAC (Humanities, Arts, Science, Technology Alliance and Collaboratory), and the growing community of badge researchers, designers, practitioners, and developers that has emerged from the Badges for Lifelong Learning initiative.[2] Lessons shared here are the result of thousands of hours of outreach, workshops, conversations, collaborations, and synthesis over the past two years, all of which was dedicated to thinking through, together, the institutional, technical, cultural, social, and economic obstacles, opportunities, imperatives, and liabilities of digital badging systems.[3]

The topic of badge system design is very much a "living" conversation that cannot be captured in any one document, especially during these early years of innovation when pilots and prototypes represent the sum of what we know. Badge system design is also an "open" conversation; Mozilla runs weekly Open Badges community calls that anyone can join by phone or computer (http://community.openbadges.org), and HASTAC's Badges for Lifelong Learning community hosts open discussions about badges online (www.hastac.org/digital-badges). The Design Principles Documentation project (http://dpdproject.info), a parallel research effort that systematically tracked all 30 Badges for Lifelong Learning systems from conceptualization to implementation, has made case studies and research findings openly available online. Researchers can follow the open digital badges group on Mendeley[4] to discover or contribute scholarly badge research, or join the Badge Alliance (http://badgealliance.org), an emerging, open network of organizations and individuals committed to growing a connected badge ecosystem. Using this document as a primer for understanding some of the key concepts behind open digital badges is a good starting point, but the best way to become immersed in badges, learning, and system design is through live conversations happening either at conferences or online through MOOCs, webinars, and community calls. Badge systems are native to an open, social, interactive web, so it is no surprise to find a similar ethos driving the design conversations.

1 Badges have also been referred to as "micro-credentials," "achievements," "digital badges," "educational badges," and "open badges." For consistency, the terminology used in this article is "badges," to represent the technology involved in open digital badges.

2 Building the Badges for Lifelong Learning movement: hastac.org/blogs/slgrant/2013/07/23/building-badges-lifelong-learning-movement

3 *What Counts As Learning: Open Digital Badges and New Opportunities* summarizes the Digital Badges: Lessons Learned project Q&As that were submitted by the 30 Badges for Lifelong Learning Competition grantees as part of their Digital Media and Learning Competition interim reports, which were published on HASTAC.org in 2013.

4 Open Digital Badges group on Mendeley: http://www.mendeley.com/groups/4666291/open-digital-badges/papers/

INTRODUCTION

Open digital badges have gained traction since 2011 because they meet needs not currently being met, not only for learners ranging from Kindergarten through college, but for lifelong learners transitioning from one career to another, or for employees staying current with their careers. The patchwork way our learning is currently recognized means that many of our abilities are unevenly recognized or not recognized at all. A veteran who is expert in military logistics must go back to school to get credentials demonstrating proficiency when her skills may surpass what required courses offer. For many learners, acquiring traditional credentials has become more important than the competency, mastery, and proficiency they are intended to represent. President Bill Clinton made mention of this when he announced the 2 Million Better Futures[5] commitment to badges during the 2013 Clinton Global Initiative:

> I got interested in [badges] because of my concern that the unemployment rate among returning military veterans persisted for years after the financial crisis at about 25 percent higher than the national average. And veterans were repeatedly required to go back to college and get degrees in subjects where the study involved far less scope of responsibility than they had already shouldered as members of the military. It may be that the principal beneficiaries of this are people who have served our country in the various military services, and their ability to flow more quickly into appropriate jobs in the economy will benefit all of us.
>
> – Bill Clinton, 42nd President of the United States

There are legions of people who acquire skills, abilities, and knowledge outside classroom walls who lack the necessary credentials to verify what they know and can do. Students who are highly competent or proficient in skills not taught or assessed in schools lack a standardized way to demonstrate their abilities to others. Employees struggling to shift careers after their companies are downsized can face insurmountable obstacles returning to school as adult learners, and without credentials to communicate their knowledge and skills find themselves unemployed or working in low-paying, unskilled jobs. Many learners have abilities, skills, or qualities that are graded or recognized in traditional classroom settings, but evidence of those strengths disappear into databases and stacks of papers, or accumulate in portfolios that are unwieldy to navigate.

Other learners may acquire some of their most valuable skills online through open educational resources, or through libraries, museums, and after-school programs, and then cobble together résumés based largely on self-promotion. An emerging practice among employers and college admission officers is to use search results and social media sites to comb for clues about prospective candidates. The sum effect is that traditional credentials recognize a narrow spectrum of the full learning pathways many of us chart in our lives. Traditional credentials legitimize certain types of learning, often favoring certain types of learners, subjects, and assessments, and that means a tremendous amount of learning is not being recognized, a juggernaut that open digital badges can address. However, despite the potential for badges to recognize this expanded landscape of learning, designing relevant and impactful badge systems is a considerable challenge.

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5 2 Million Better Futures became the 10 Million Better Futures in 2014: http://10mbetterfutures.org

We know from research in other disciplines such as human-computer interaction and technology-mediated social participation that for every Facebook, Wikipedia, or Twitter, there are many more technological platforms that fail. "For all the public and corporate enthusiasm and the proclamations of utopian visionaries, the reality is that many sites fail to retain participants, tagging initiatives go quiet, and online communities become ghost towns" (Preece & Shneiderman, 2009). Of course, even long-established systems and institutions can fail, particularly those that cease to be relevant, including traditional institutions of learning. This is perhaps the crux of badge system design — identifying what is relevant and meaningful to learners while adapting and preserving our institutions of learning. To be relevant is to have a connection with the subject or issue. A badge system that mimics traditional systems without making any changes to underlying practices will have little transformative impact on learning, engagement, assessment, and opportunities. It may be technically functional, but will lack relevance to learners in other ways that no amount of technology can fix.

> Badges for learning do not make learners become engaged if they are otherwise wholly disconnected. "Turning badges on" does not create an instant easy solution to learner engagement. They may create a meaningful bridge between content and learning, however, and help learners develop a sense of personal reward, confidence, and connection to the learning process. This doesn't happen in a vacuum, though. Trainers, teachers, and peers can't be separated from the process and must be incorporated into an overall strategy.[6]
>
> – American Graduate badge system

Relevance can be embodied in the learning content itself, or be manifest in both social and human systems. A privilege or opportunity associated with badges may define a system's relevance. Learning experiences that are socially engaging and interest-based can make the system relevant. Conversely, a badge system is irrelevant if it is built on assumptions that learners have universal access to technology, particularly systems that are designed to serve populations who do not. Perhaps most significantly for schools and universities, relevance may be defined by the degree to which students can customize their learning pathways so they are less tethered to more rigid scaffolds. The purpose of the following chapters is to think about the social, academic, and technological relevance that defines badge systems, and the opportunities they can create for the next generation of learners.

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6 The full American Graduate's Digital Badges: Lessons Learned project Q&A is available online: http://www.hastac.org/wiki/project-qa-american-graduate-lets-make-it-happen

CHAPTER ONE:

THE CASE FOR OPEN DIGITAL BADGES

A key concept in this book is the open digital badge itself, which is an image file embedded with information. Compared to traditional credentials that exist separate from the proof of learning associated with them, badges contain information about what was learned, who learned it, and when it was learned, conveniently displayed in one place. In our current system, a limited number of people see the criteria or evidence for how grades and degrees were earned. Badges, however, are transparent and information-rich. Everything is bundled into one click, allowing us to see what someone did to earn the credential, including a link to the evidence behind the learning, maybe a testimonial from the instructor, comments from peers, or even an endorsement from an expert or institution. For example, in the Computer Science Student Network (CS2N)[7] badge system, evidence may include links to source code for a programming badge, online exam scores, or assessments generated by an artificial intelligence tutoring system. In other systems, badges may have an expiration date to signal skills that are subject to renewal each year. The ability to click badges and view relevant information about a learner's skills and knowledge adds a layer of transparency to credentials, making it possible to quickly evaluate the evidence or artifact associated with the learning.

Why badges?

When we lack the time, motivation, or ability to verify a claim about someone, we use credentials as a proxy to verify that claim. This happens when we evaluate the expertise of strangers, for example, or in cases where we ourselves seek to collect, compare, and display our accomplishments to others. Throughout our lives, and through actions and interactions with others, we build reputation among different audiences based on their "best educated guesses" of our "underlying true state of affairs" (Massum & Zhang, 2004). Credentials are one way to convey reputation, but they rely less on "best educated guesses" and more on underlying systems and rules designed to increase our trust that people are who they say they are, and can do what they claim they can do. We use credentials to vouch that an individual has engaged in the learning content, passed the assessment, and met the criteria in a process that is assumed to be replicable, objective, and fair (Schmidt et al., 2009). Today, the main credential-bearing institutions are schools, colleges, and universities. Because they issue credentials, these institutions have an inordinate amount of authority (as well as responsibility and pressure) to decide not only what is valued, taught, and assessed, but how. Badges provide an opportunity to distribute some of that responsibility within traditional institutions of learning and across organizations that already provide high-quality learning content. Open education resources, libraries, museums, after-school programs, and professional associations are only a few examples, as well as co-curricular opportunities that exist within traditional institutions of learning.

Any institution or organization that provides learning content can issue badges at any level of achievement, whether for a 2-hour workshop, a 3-day course, or a 4-year degree. Badges can represent "soft" skills like collaboration, or "hard" skills like math, and they can function inside traditional courses, alongside them, or independently, whether offline or online. However learning can be structured, in whatever way it can be conceived, digital badges can theoretically recognize that learning. Badges are

7 Computer Science Student Network website: https://www.cs2n.org/

remarkably flexible and adaptive to different learning contexts, and they carry tremendous potential to transform both human and technological systems. This flexibility presents challenges, however, because badges tend to *collapse* units of learning that in our traditional system are carved into units of grades, credit hours, diplomas, certificates, and degrees. A badge might represent one assignment in a course, or it might represent successive levels of competency involving hundreds of hours of work. There are discussions about technological solutions to represent these ranges, either through taxonomies or other initiatives that can classify badges, but for now there is neither a common directory nor taxonomies to standardize different "hefts" of learning. What many designers, educators, technologists, and researchers are doing in the interim is to establish trust networks where value is negotiated with organizations willing to recognize the badges. Some organizations have also sought endorsements as a way to signal trust, while others have aligned badges with relevant standards.

Open digital badges also complement other policy initiatives underway; for example, the elimination of seat-time requirements in the United States and a move toward competency-based learning, both nationally and internationally. In a growing number of states, badges are being used to recognize expanded learning time opportunities (ELO) in schools, as well as learning content provided by museums, libraries, and other out-of-school providers. As badge technology evolves, new platforms are emerging that allow learners to mix both traditional and nontraditional credentials alongside other social media features. Some badge systems contain game mechanics like leader boards and progress bars, or features common in reputation systems where people can vote, rank, tag, like, or follow what others contribute. Blending elements of traditional systems with social features found in many technology platforms can makes badge systems relevant and compelling in a variety of ways. Whether badges become impactful for learners depends in large part on how these badge systems are designed and implemented, and how they both conform to and transform existing systems.

Badges for Lifelong Learning: Lessons Learned

In fall of 2013, HASTAC published *Digital Badges: Lessons Learned*,[8] a series of reports from the 30 Badges for Lifelong Learning projects about their experiences during the first year of badge system design. The following discussion is based on an analysis of those lessons, synthesized with themes that surfaced during workshops, webinars, and hundreds of one-on-one conversations over the course of a year. The 30 Badges for Lifelong Learning projects were designed to serve all ages, and represented lifelong learning across traditional and nontraditional institutions of learning. Twenty-two badge systems served K-12 learners engaged in a combination of offline and online learning in and out of school. Over half of the badge systems for K-12 learners aligned to Common Core or other standards, whether in math, computer science, robotics, film, conservation, language arts, oceanography, global competence, and other subject areas. Three systems involved professional development for teachers, and one for librarians. One system served returning military veterans seeking employment in the civilian sector, and one was designed for an undergraduate major in a four-year university. Many of the systems involved collaborations with multiple organizations, including universities, museums, libraries, school districts, out-of-school programs, professional associations, government agencies, and corporations. Three systems were standalone platforms, including one based entirely on peer-to-peer learning.

The more prominent themes that emerged from these reports and the many conversations throughout the development of the projects reflect the role of human systems and values in badge system design. What kind of trust frameworks must be in place before organizational badges have value? Given the

8 Digital Badges: Lessons Learned: http://www.hastac.org/digital-badges#projects

chance to design something entirely new, how do we decide what to value? How do we create value for badges outside the learning environments in which they were earned? Badge systems tend to codify human systems and relationships that previously functioned without explicit policies. How do we design badge systems across institutions and programs with optimal interdependence? Some of the themes that emerged are more operational: How, when, and to whom must organizations communicate what badges are and how the system will work? How many people does it take to build a badge system, and what roles are necessary for an effective collaboration? The design of any kind of system makes values explicit, sometimes intentionally, but often inadvertently, and badges are no exception. What existing attitudes toward learning, assessment, and credentials should be examined before building badge systems? Is it optimal to start from scratch, or is it better to build on existing resources?

Most of the Badges for Lifelong Learning projects are in the earliest stages of piloting their systems and research on them is limited. Much of what exists in the research literature about badge system design focuses on motivation and game mechanics, particularly among college learners in technology disciplines. A team of researchers recently expanded our knowledge of badge system design through the Design Principles Documentation[9] (DPD) project (Hickey et al, 2013), which applied design ethnography to the 30 Badges for Lifelong Learning systems and documented how each of the projects evolved from intended to enacted design practices. The two-year DPD project identified over 40 design principles, including the following: align badges to standards; award formal academic credit for badges; have experts issue badges; provide privileges; recognize collaboration; set goals; use rubrics; use e-portfolios, and many others. These design principles may provide valuable guideposts for organizations at the planning stages when diverse stakeholders come together to negotiate the values, principles, and features of the system. Using this book as a companion to the DPD research will provide the next wave of badge system designers a useful foundation for developing their own systems.

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9 Design Principles Documentation Project: http://dpdproject.info

CHAPTER TWO:

FROM AUTHORITY TO CREDIBILITY

Open digital badges are credentials. They are tokens of trust used to vouch that people are who they say they are, and have the qualities they claim to have. When claims about learning are represented by a credential, whether as a grade, degree or certificate, we trust that those claims are legitimate. When we move from one grade to another, from one school to another, or when we progress throughout our careers, we trust that our credentials will have value. Employers place trust in credentials when considering whether to hire prospective employees. Admissions officers use credentials to decide whether to admit students into colleges and universities. We use credentials as a proxy to signal information about our qualities, abilities, skills, and achievements to others. Badges function the same way, except that they are information rich, transparent, and "interoperable" or portable across many different systems and platforms on the web. They may eliminate some of the guesswork about what traditional credentials say about us, and can connect the lifelong learning that takes place across multiple spheres of our lives, both online and offline, across traditional and nontraditional institutions of learning. In 2011, Secretary Arne Duncan of the United States Department of Education described how learning takes place across multiple spheres and the potential for badges:

> Today's technology-enabled, information-rich, deeply interconnected world means learning not only can – but *should* – happen anywhere, anytime. We need to recognize these experiences, whether the environments are physical or online, and whether learning takes place in schools, colleges or adult education centers, or in after-school, workplace, military or community settings. In short, we must begin to see schools, colleges and classrooms as central points – though still very important ones – in larger networks of learning.
>
> – Secretary Arne Duncan, 2011

This shift away from the relatively static infrastructure of 20th century education to the more fluid 21st century digital systems is what researcher and innovator John Seely Brown refers to as a "new culture of learning" in his book of the same name (Thomas & Brown, 2011). Badges are connectors in this new culture, part of the dynamic scaffolding being built to make learning more visible both within and beyond classroom walls.

Badges are information rich and interconnected

In a well-designed badge, the learning, the criteria, the assessment, and the evidence will be visible in one place, associated with the learner who earned the badge and the organization that issued it. An open digital badge may contain videos, essays, assignments, or exam scores submitted by the learner, as well as the instructor's testimony, peer comments, and perhaps a reflection that provides important context about what was learned and how. Badges are also interconnected, or interoperable, which refers to an open data exchange or infrastructure that allows badges to be shared across multiple platforms or systems. For example, an open digital badge earned in an after-school program could be displayed on a learner's Facebook page or Wordpress blog, or it could be displayed in a digital "backpack" or repository with other badges. Ultimately, the learner decides how his or her data (in this case a badge) can be shared, stored, viewed, and used. This notion of an interoperable digital credential will be explored in more depth below, but for now, consider that these attributes add a layer of transparency to credentials, and this alone has piqued interest in badges as a credible way to validate what people know and can do.

Digital badges are particularly relevant to our changing world because they open up our current system of rating and ranking to more nuanced levels of understanding, and allow a more evidence-based or personalized analysis of learning than traditional credentials provide. Badges combine evidence of learning with testimonials, reflections, assessment, criteria, and other bits of knowledge that enrich our analysis. They create digital footprints that explain more than letter grades do. Badges and the pathways they make visible also address fundamental and persistent questions about individuals and institutions: How do we show what our real learning pathways look like so others can recognize our full range of abilities? They raise fundamental questions about learning and assessment: How do we measure what someone has learned? Who vouches for this learning? More than anything, badges raise questions about opportunity. How can badges create credible paths to new opportunities? These may be familiar questions for schools and universities, but for nontraditional institutions of learning they are less so, and the more inclusive and interconnected network of credentials made possible by an open digital badge infrastructure challenges all institutions of learning to revisit these questions.

From authority to credibility

Our 20th century model of education is based on the "assumption that teaching is necessary for learning to occur " (Thomas & Brown, 2011), and yet digital technologies have made it possible for us to learn anywhere, anytime, from anyone, on any device. As a result, how we learn in the 21st century is shifting from "issues of authoritativeness to issues of credibility" (Davidson & Goldberg, 2009). Moving our learning and assessment paradigms from authority to credibility, while a seemingly minor shift, has profound implications for our institutions and social systems, and challenges our core beliefs about what counts and who determines what gets measured. Credibility is the quality of being trusted and believed in, while authority is about having the power to make decisions and enforce behavior. Grades, degrees, and diplomas represent a system based on authority. Digital badges, while they can certainly invoke authority, emerged in communities that valued credibility, where members cultivate their reputations through social and technical systems.

Moving from authoritative credentials to credible credentials has the potential to make more learning visible. Every learning institution, whether traditional or not, whether online or offline, offers something of value to its learners. Making that learning visible is the core purpose of open digital badges since they provide a credible way to communicate learning to others. In a system that includes badges, learners are no longer limited by transcripts from traditional institutions of learning and Internet search results to convey qualities, skills, achievements, and abilities to others.

CHAPTER THREE:

HOW OPEN DIGITAL BADGES WORK

There are two concepts critical to digital badge technology. First, the technology that makes it possible to share badges anywhere on the web is *open source*, which ensures that no organization "owns" the code. Mozilla, developers of the open source Firefox browser, is responsible for building the Open Badges Infrastructure (OBI), a standard technical specification for badges that makes it possible for anyone to develop open digital badges and tools across the web. This means that badges must contain code that is compatible or aligned with OBI technical specifications if they are to be displayed outside an organization's proprietary or closed badge platform. A badge can be digital by virtue of being online, but it is not *open* or *interoperable* unless it contains standard bits of information that align to the technical specifications of the OBI.

MOZILLA OPEN BADGE INFRASTRUCTURE

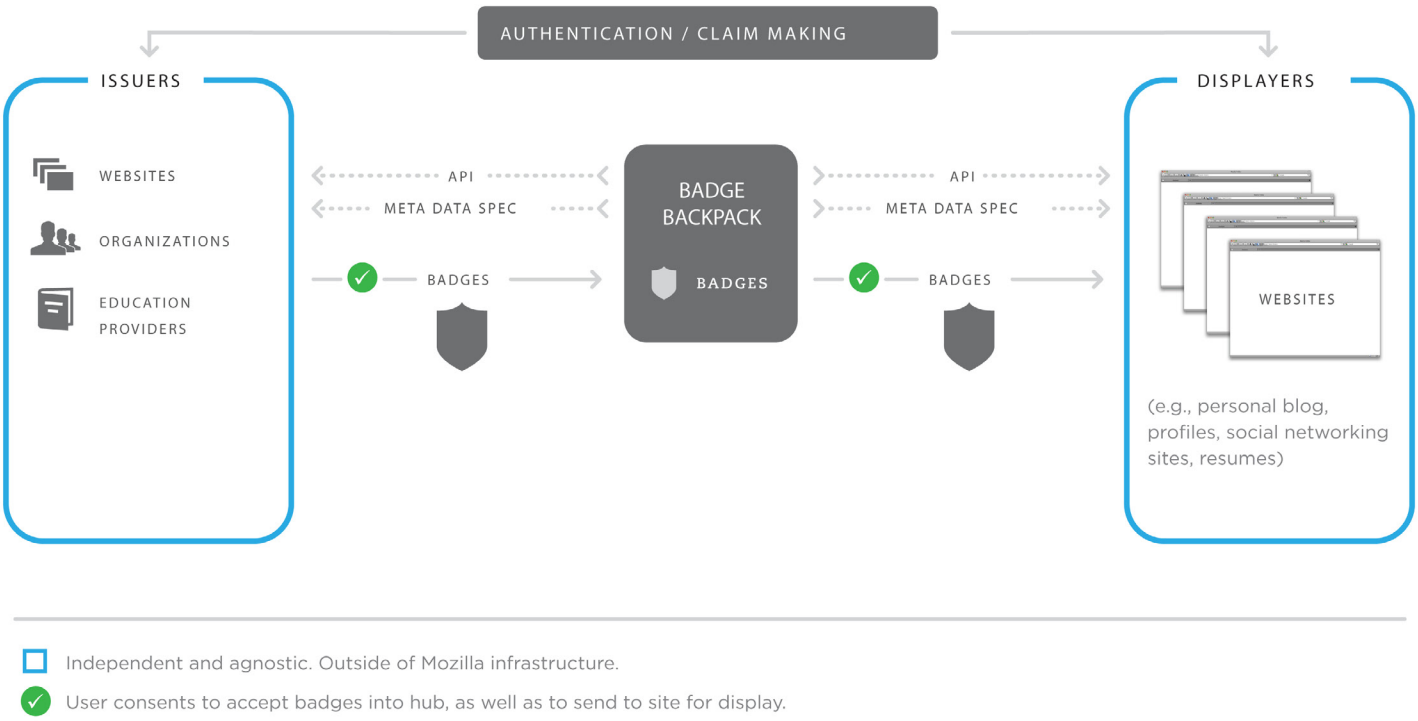

Figure 1. Mozilla's OBI includes the open technical standards that make badges portable across the web.

By analogy, consider how online reputation works in many proprietary systems. Ebay, which implemented one of the earliest, most successful examples of peer-to-peer evaluation, allowed buyers to rate sellers, and that, in turn, made it possible for sellers to generate favorable reputations for their services. Recognizing the value of this reputation, Amazon attempted to allow their customers to import it from eBay for use in the Amazon system (Resnick et al, 2000). In response, eBay protested, claiming that their sellers' reputation belonged to the company and could only be used within eBay's technical platform. The idea that reputation could belong to someone else is a recent phenomenon made possible

by digital technology, but sellers had no recourse because the reputation they generated in eBay was indeed tethered to the company's proprietary technical platform. Reputation in a sociotechnical platform is similar to digital badges — both may be earned within a proprietary context, but they have far more value if they can be shared across multiple contexts. To make it easier to do that, Mozilla created the OBI so organizations can issue digital badges that learners may freely share or display across the web.

Since badges can contain open standard technical specifications that align to the OBI, earners can move their badges outside the system where they were issued. Mozilla's OBI acts as a common language so that many systems can communicate with each other, making it possible to "push" badges outside "silos." This is an important distinction: Mozilla is not the organization that issues badges (although they do issue badges of their own); instead, their primary role is to direct the open source standards and technical specifications that allow institutions to make their badges portable across the web. Figure 1 provides a schematic showing independent badge systems that issue badges, the open technical standards of the OBI, and the display sites where learners can share their badges.

A second concept that is critical to open digital badges is *metadata*. Every open digital badge contains metadata, or "data about the data." Since metadata is not a common term, analogies are useful here. A digital camera generates metadata associated with each photo that describes the camera, the settings, the date, and perhaps the location where the image was taken. A library card catalog contains cards with metadata about a book's author, the publication date, and the location of the item in the library. An open digital badge contains metadata about the learner, the badge description, the issuing organization, the date it was issued, criteria to earn the badge, the web address that links to "evidence," and other information that make it compatible with the OBI. These metadata include a set of standards that make it possible for other systems to process and recognize the badge, allowing it to travel outside the platform in which it was earned and issued.

Cross-section of an open digital badge

The following is a basic description of the technical process for creating a badge. While it is possible to create "hand-made" badges following the steps below, platforms and tools are emerging that automate this process.[10] These steps are simply to illustrate in greater detail how open digital badges work.

There are three layers to the actual open digital badge technology: 1) an interactive graphic image; 2) the machine-readable metadata that has been saved or "baked" into the badge; and 3) the web page that includes criteria, evidence, and relevant information. This latter information layer, sometimes called the "criteria page," (Figure 3) is the one that most viewers of the badge will review, and it will look like a simple web page or "window" that opens when the graphic icon of the badge is clicked (Figure 2). Some organizations have developed their own tool to create the actual digital badge while others have opted to use a third-party service that can do this (and more).

1. An organization creates a graphic for the badge and saves it as a PNG image file (plans are in the works to accommodate SVG files). A PNG file is a common non-patented image file developed for the web, and for now is the most common file type being used for digital badges. Like other image files (i.e., JPEG, GIF) PNG's are able to contain information, or metadata, which makes digital badges "open." Compared to other image file types, PNGs are easier to code for, and there are more open source libraries available for developers who want to code for them.

10 The Open Badges community maintains a spreadsheet listing different issuing platforms and features: http://bit.ly/openbadgeplatforms

Figure 2.
The image file, or PNG file, is the outward facing graphic interface of the badge.

2. After developing the graphic for the badge as a PNG file, metadata or information is hardcoded into an invisible "text chunk" of the file at the point when a badge is assigned to someone. There are three different groups of metadata written in JavaScript Object Notation code (JSON) that together define a badge. The assertion metadata are specific to each earner, whereas the badge class metadata define the badge for anyone who might earn it. The issuer metadata define information about the organization and is applied to all of the badges issued. Badge metadata align to standard technical specifications, including the badge earner's email address (the mechanism through which the badge is issued), the badge description, badge issuer, date of issue, and information about the criteria, assessment, and evidence about the learning. Digital badges contain both required and optional metadata, such as the following fields:

   Required badge assertion metadata fields to be OBI-compliant:

   - Recipient
   - Issue Date
   - Badge Title or Name
   - Image URL
   - Description
   - Criteria
   - Issuer

   Optional metadata fields:

   - Expiration Date
   - Evidence URL

3. Saving the JSON metadata in the PNG file is referred to as "badge baking" and can be done with any specialized tool designed to construct valid open badges from metadata and images. Mozilla and other organizations have developed several open source badge-baking tools to streamline the badge creation process. As more tools are created and integrated into pre-existing platforms, badge baking will likely become easier. For example, Wordpress, Blackboard, Moodle, and Drupal platforms now offer badge-baking tools, and Google is developing a course builder site that will generate badges. Before a badge is "baked," metadata are constructed. First, badges are defined, and metadata about the issuer organization and badge class are created. Next, when badges are earned, assertion metadata are created. Baking is said to have occurred when the badge is sent to Mozilla's Backpack.

4. Badge metadata saved as an "assertion" file on an organization's server allows each badge to have its own unique assertion URL on the Internet, which contains the snippet of JSON metadata describing the badge. A sample assertion address might be: http://example.org/badges/assertions/50c3c51d2726. The random numbers on the end of this address represent a unique ID for each badge.

5. An assertion file may be hosted on the issuing organization's website. This "hosted assertion" allows viewers of the badge to confirm or verify that it has not been modified or tampered with from the moment it was issued. An open badge contains a link to the hosted assertion; if the badge and assertion links are identical, this confirms that the badge has not been modified.

6. Another method of verifying the integrity of a badge is to cryptographically "sign" a badge, which occurs when an issuing organization holds matching public and private key pairs that link to the public key in the assertion. Signing algorithms ensure that the badge assertion could only have been "signed" by the organization that holds the secret private key. Signed assertions make is possible to validate the badge even when it cannot communicate with the server that issued it, but only if the issuer's public key has already been stored.

7. There are different ways to "claim" a badge once it has been earned. The following implementation describes how an earner might claim the badge through an email, although it is possible to earn badges directly from a website, or to deliver them directly to the Mozilla Backpack. Once the badge has its own assertion address, the institution or organization can send an email with a URL link for the badge to the badge earner. The email address of the badge earner is the mechanism that links the badge to the learner.

8. The learner must click the URL link in the email in order to "claim" the badge.

9. Claiming a digital badge by email is similar to claiming a sew-on badge—if the badge earner does not pick it up, he or she cannot share it or display it. The difference between a digital badge and a sew-on badge is that the digital badge is unique to the badge earner.

10. If the learner wishes to share the badge elsewhere on the web, he or she may "push" it to the Mozilla Backpack, which is an authorized data repository where people can collect, manage, and display their badges before moving them to other OBI-compatible systems on the web. From the Backpack, learners can manage badges, set privacy levels, and group or share them. The Backpack allows users to share links to public collections of badges where the earner can describe each one.

11. When a badge is displayed publicly in the Mozilla Backpack, anyone can click it. Once clicked, the badge will display a link to the criteria page and information that describes the badge, the badge earner, and the badge issuing organization. Figure 4 shows a screenshot of a criteria page. Other applications that support badges provide similar features so that viewers can understand the content and meaning of the badges.

Assessment Expert

Marina Michael, Elementary School Teacher earned this badge by participating in the Educational Assessment BOOC. The earner of this badge has gained and demonstrated exptertise about Educational Assessment. This expertise is associated with a specific self-defined curricular aim and educational context. This badge was earned by earning each of the three badges below and completing a comprehensive final. Each of those badges was earned for completing 3-4 weekly assignments, interactive with classmates, and completing an exam.

Criteria for issuance

The earner of this badge:

- Gained substantial expertise concerning the practices, principles, and policies concerning educational assessment.
- Connected their new expertise to a particular curricular aim and context that represents their role in a particular educational system.
- Earned three prior badges (linked below) and completed a final exam.

To earn each of the three prior badges, participants were required to:

- Complete three or four extended assignments where they explored how assessment policies, principles, or practices were relevant to particular curricular aim and context.
- Interact with their classmates via threaded comments on their assignments.
- Endorse their classmate's assignments as being complete.
- Promote classmate's assignments as being exemplary.
- Complete an online exam.

Each of these other badges contains detailed evidence regarding the earner's participation.

Evidence

Comprehensive Exam (open December 2 through 11) - *Complete!*
Passed the exam with at least 70 out of 100%.

Figure 3. After clicking on the badge icon, viewers will see a criteria page.

CHAPTER FOUR:

WHAT ARE BADGES WORTH? VALUES & RELEVANCE

Broadly defined, values are "guiding principles of what people consider important in life" (Fleischmann, 2014) and can have explanatory power in predicting behaviors and attitudes. The value of badges, or the "so what?" question after they have been earned is the thorniest issue facing organizations who design badge systems. What are badges worth? Open digital badges are designed to have value that employers and schools will recognize. However, any new credential intended to have value between institutions will run into the same challenges that many new currencies encounter. A shared, collective belief in the value of specific badges is more likely to occur when there is an established trust network in place. Strengthening existing relationships across trust networks at the outset of badge system design, or building new ones, increases the value that badges will have with those organizations. Identifying which organizations and partners will participate in a trust network can also improve badge system design. For example, school districts willing to accept teacher professional development badges may use a specific performance management platform and insist that integration with their technology is essential to widespread badge acceptance. Connecting these dots can also go a long way to building trust among learners who are unsure if there is value in badges outside the organization, especially for those who may lack traditional credentials or sufficient work experience.

> If we started over, we would kick off the program by imparting the meaning and value surrounding the badge ecosystem. We would begin with a strong story to explain why badges were important or why they were of value.[11]
>
> – Cooper-Hewitt Museum's Design Exchange

Badge system design also has the potential to select what kind of learning is valued, how that learning is assessed and recognized, and how (and whether or not) learners are motivated to participate. This can be influenced by the assumptions and values that developers bring to the design task (Hirscheim & Klein, 1989), and the pragmatic and technical choices that reflect these values, ultimately defining how people learn and participate. Values can also be enacted by specific design principles. For example, several of the Badges for Lifelong Learning projects aligned badges with privileges like internships, or designed the badges to have external value to employers. Value was also embodied in badges by aligning them to standards or formal academic credit, or in systems that involved expert assessment. Badge system designers need to think carefully about values throughout the development process, and where possible, let the system be guided by values relevant to the learners, the organization developing the system, and important stakeholders willing to be involved in the wider trust network.

Values conflicts

Designing a system that is relevant to learners while also embodying the values of the badge-issuing organization is a fundamental challenge, and a highly iterative process. Values inform decision-making, and decisions in turn influence the design of technology, which impacts user behavior, often leading to new patterns of interactions and social contexts (Shilton, Koepfler, & Fleishmann, 2014). Choices made while designing new technologies will influence the way people associate with one another, sometimes

11 The full Design Exchange's Digital Badges: Lessons Learned project Q&A is available online: http://www.hastac.org/wiki/project-qa-design-exchange

in unintended ways (Nissenbaum, 2009), and overlooking assumptions and values can lead to low engagement or poor adoption from the people the system was intended to serve. Values are also embedded within learning theories and assessment practices, and conflicts between the two are surprisingly common. While it might seem sensible to design instruction and assessment practices around complementary theories, the opposite tends to occur. "Assessment and instruction are conceived as often curiously separate in both time and purpose" (Graue, 1993). Even though new theories of learning may reflect social and technological changes, enduring and often hidden beliefs about learning tend to persist in some of our most entrenched and influential assessment practices. For example, cognitive, constructivist, and sociocultural learning theories that spread during the latter part of the 20th century have led to curriculum reform best summarized as "all students can learn" (Shephard, 2000). Contrast that with empiricist learning theories of the 19th century and the scientific methods that accompanied them, fanning widespread belief that intelligence was fixed and "each individual should be educated according to his abilities." This view is preserved in much of the high-stakes objective testing still prevalent today (Shephard, 2000). As Hickey wrote while reflecting on the 30 Badges for Lifelong Learning systems, "the evidence contained in badges will embody the values of the program or organization that issued them" (2013). This is true not only for evidence, but for the system as a whole. Institutional policies, human systems, and sociotechnical design features will embody values in pervasive ways, and conflicting values can lead to disastrous outcomes. In the Design Principles Documentation (DPD) project, researchers wrote that "[A] number of the projects ended without a functional badging system because projects simply could not manage to negotiate the claims, evidence, and assessments to associate with their badges" (Hickey et al., 2013).

Being explicit about values to be embodied in the assessment practices, technical features, and the wider trust networks can create more cohesive systems with fewer values conflicts. Digital technologies have become the "default mode of social ordering" (Introna, 2007), and whatever values emerge in the design process will have a significant impact not only on learning outcomes but can have explanatory power in predicting behaviors and attitudes as well. "For those who wish to invent new ways of interacting online, it is vital that they recognize that any badge system carries with it a set of ethical expectations, and badge systems are likely to perform better if those expectations are consistent, cohesive, and appropriate to the context" (Halavais, 2012).

Value in the badge "ecosystem"

For innovators and badge system designers working in today's learning environments, there are positive signs that a badge "ecosystem" is emerging. Hundreds of organizations, including cities, universities, school districts, and professional organizations pledged to issue or accept badges through the 2 Million Better Futures[12] badging commitment launched by the MacArthur Foundation at the Clinton Global Initiative. The initial response surpassed expectations and the commitment was increased to 10 Million Better Futures a year later.[13] In 2011, roughly 300 organizations submitted applications to the Badges for Lifelong Learning Competition to build badge systems before very few developers and learning organizations knew what they were. Two years later, Chicago began building a full-scale badge system[14] for its citywide Summer of Learning initiative. Dallas, Los Angeles, Columbus, Pittsburgh, and Washington, D.C. launched their own badge systems before results from Chicago's badging experience had even been

12 Clinton Global Initiative and the 2 Million Better Futures Initiative: www.2MBetterFutures.org

13 Badge Alliance announces 10 Million Better Futures for the 2014 Clinton Global Initiative http://badgealliance.org/10-million-better-futures-through-open-badges-commitment-made-at-cgi-america-2014

14 Chicago Summer of Learning: http://bit.ly/ChicagoSummerLearning

fully analyzed.[15] By 2014, there were more than 1,000 institutions issuing more than 100,000 badges, and hundreds of new organizations were launching new models of badge systems each month (Mozilla, 2014). Pearson, Educational Testing Services (ETS), Blackboard, and other recognized corporations with stakes in the broader learning ecosystem have committed to open digital badges. Meanwhile, universities, community colleges, school districts, and other large education networks are experimenting with badge systems of their own. With this emerging interest and investment in badges, the question is: *Why are nontraditional and traditional institutions of learning building open digital badge systems even before fully functioning use cases have been deployed and evaluated?* The answer has to do with the standardized way open digital badges recognize diverse kinds of learning and assessment. More importantly, badges connect multiple spheres throughout lifelong learning, and make pathways of learning visible to others, opening up new opportunities for more people than the current system.

Traditional institutions of learning are critical centers of education in today's world, but they bear an unequal load when it comes to recognizing all of the skills and qualities that are essential or valuable to today's learners. In response, traditional and nontraditional institutions of learning are designing systems that integrate badges into their organizations. The net effect of emerging badge systems is an expanding ecosystem of credentials that are no longer tethered predominantly to schools and universities. Many nontraditional learning institutions are issuing credentials for the first time, building badge systems that provide their learners new ways to display and share badges with others. Designing a credential system outside entrenched accreditation practices may position nontraditional institutions of learning to explore new types of assessments and pedagogical approaches in innovative ways.

Innovation does not come simply from building badge systems, however. If schools begin to issue badges that can be displayed on the web, on mobile phones, social media platforms, personal blogs, or websites, but make no changes to underlying systems of assessment and learning designed for the 20th century, they will fail to make these new systems relevant to 21st century learners. Open digital badges are relatively agnostic; they can be overlaid on all kinds of learning programs, and can be connected to a variety of assessment practices. Just as there are many types of learning content and programs to deliver that content, there are many types of badge systems, including ones that are combinations of offline and online learning. A badge ecosystem is a transformative way to recognize learning pathways with credentials, but the most significant opportunities exist in learning and assessment that is relevant for today's learners and workers.

Not surprisingly, innovative approaches are happening among institutions that historically have never issued credentials, especially badges that are expected to hold value beyond their programs. Museums, libraries, professional associations, youth organizations, and after-school programs represent only a handful of entities that see potential for badges to impact their learners. These organizations represent a wide range of learning content, pedagogical approaches, and assessment types. As educators consider how to measure what matters, they make assessment and design decisions that not only impact their learners, they expand what knowledge is valued and evaluated.

Developing a highly credible way to assess, recognize, and display what someone knows challenges our current system and raises profound questions about what makes credentials credible and who decides what counts. Building a badge ecosystem is not strictly about creating widespread exchange networks for credentials. It is about advancing the vision of an educational system more in tune with today's social, economic and political realities, in which learning is social, hands-on, active, networked, personal,

15 Cities of Learning: http://citiesoflearning.org

effective, and connected to the real-world.[16]

In today's digital environment, badges are common features in social media, reputation systems, and game-based learning environments that pervade the web. While platforms like StackOverflow.com, Wikipedia, and Microsoft's Xbox may have inspired online learning systems like KhanAcademy.org to adopt badges, the value or portability of these badges is relatively limited. Khan Academy and Wikipedia's badges are "closed," meaning that they lack the open technical standards that make them compliant with Mozilla's Open Badges Infrastructure (OBI), prohibiting their portability outside the systems in which they were earned.

The openness and portability of digital badges underpins how people learn anywhere, anytime, within and beyond traditional schools in a networked society. Until open digital badges emerged, learning happened anywhere, anytime, on multiple devices, in many contexts, but a standardized form of *recognition* did not. The learning that happens online, out of school, through professional associations, in peer communities, in museums, libraries and other networks of learning has value, but the knowledge and skills gained through these organizations are rarely or haphazardly recognized with a credential. It follows, then, that the purpose of open digital badges is not only to promote the portability of credentials, but to also shift social norms about what kinds of learning gets counted and who decides whether it is valued.

Creating a massively networked infrastructure where credentials can be exchanged freely across the web is a major campaign that does have its critics, however. While the Open Badges Infrastructure is distinct from the individual badge systems being designed by online and offline institutions, there must be a critical mass and acceptance of badges circulating in the ecosystem for them to reach their full potential. While enthusiasm and interest has been widespread, we are still in the earliest stages of development and there are few use cases in which open badges have been recognized by employers or college admissions. Many of the Badges for Lifelong Learning projects, which are among the earliest systems to issue badges, are still in pilot stages with relatively limited uptake from actual learners. During Chicago's inaugural Summer of Learning initiative, approximately 150,000 badges were issued to less than 1,000 learners, and of those learners, only a percentage claimed 50,000 badges,[17] one indicator of whether a badge earner saw value (or knew how to) share the badge with others. It is too early to tell how widespread badge adoption will be, and until then, prototypes and pilots tell only a limited story. While some skeptics are eager to forecast failure, advocates compare badges to the spread and adoption of email over the past four decades. A projected 5.2 billion email accounts will exist by 2018,[18] an impressive increase in users since the early 1970s when email was first deployed and technologists were trying to predict whether anyone would find email useful. Whether badges will follow a similar rate of diffusion is difficult to predict.

16 From Connected Learning Principles: Reimagining the experience of education in the information age: http://connectedlearning.tv/connected-learning-principles
17 http://erinknight.com/post/62719859964/csol-how-did-we-do
18 www.radicati.com/wp/wp-content/uploads/2014/04/Email-Statistics-Report-2014-2018-Executive-Summary.pdf

CHAPTER SIX:

WHAT ASSUMPTIONS CAN TEACH US ABOUT BADGE SYSTEM DESIGN

Interest in badges should trigger questions about how other credentials work, how people learn, how teachers teach, how learning is assessed, how courses and programs are designed, how grades are assigned, how institutions are accredited, and most importantly, what our organizations and learners truly value. If traditional credentials — grades, degrees, diplomas, certificates — are simply digitized without redesigning underlying layers of assessment and other aspects of the learning experience, the transformative potential of open digital badges will not be realized. Examining assumptions about traditional practices, identifying the institutional policies and technologies that shape learning — this is where the real work of badge system design begins.

If badges are to transform our current system in more than superficial ways, we need to examine what it means for credentials to be open and digital, and how these features influence the design task. This also means examining long-standing human systems that are in place, including legacy policies and practices that influence our ideas about learning. How traditional learning occurs, where it takes place, how it is recognized, and how it is made visible in the current credential system is where all badge system design originates. This is true for traditional institutions of learning as much if not more so for nontraditional institutions. Whether the badge system is being designed for libraries, professional associations, museums, after-school programs, or traditional brick-and-mortar schools, the credentialing systems we know from our own youth are likely to influence our assumptions, and those values may be codified into new badge systems if they go unexamined.

Consider a simplified overview of how traditional institutions of learning issue credentials today. There are variations to this scheme, but the following describes the basic arc of learner progression through institutions of learning. Beginning in Kindergarten, a school determines which youth are permitted to progress from one grade level to another by requiring that students meet certain criteria at specific points in time; for example, they must demonstrate sufficient attendance and satisfactory performance on exams and assignments alongside peers largely clustered by age. After successful completion of course requirements, students accrue grades that accumulate into grade point averages and high school diplomas. The institutional scaffold determines progression through sequenced stages of learning, and systems of accountability affect what is assessed, which, in turn, influences what and how learning is taught. Successful completion results in a credential.

Grades

We often associate credentials with degrees or diplomas, but a credential is a "qualification, achievement, quality, or feature used as a recommendation or form of identification" (Simpson & Weiner, 1989). Grades are a type of credential, often expressed in traditional institutions of learning as numbers that correlate with letters ranked from high to low. Grading "exemplifies our deepest convictions about excellence and authority" (Davidson, 2012), and while it primarily pervades formal assessments throughout K-20 learning, it also selects and sorts which post-secondary institution of learning students will attend, or whether they will attend at all.

We want desperately for numbers to represent objectivity, to assure us that there is less subjectivity in the grading system than there is. We also want rating and ranking to give us a relative sense of intelligence, mastery, or competence, either in relation to other students, or against a set of standards.

Whatever its merits or lack thereof, ranking is not likely to disappear anytime soon, but badges represent a new kind of evaluation that some advocates hope will relegate grades to less prominent data points. In today's traditional learning environment, a letter grade or grade point average is often used to communicate a learner's ability or achievement to others, without directly associating it with the test, essay, or project it represents. If grades were to accompany the *evidence* of learning, contextual factors surrounding the grade become more apparent. Badges, in comparison, can contain both evidence and grades. A badge might tell us where a student ranks in relation to peers in a course, or within a school, or across a district or state, or along a grade point average continuum. But, a badge also makes it possible for us to evaluate the evaluation. Someone's B minus might be our idea of an A plus. We might see something exceptional in work that receives a C. We may decide that the criteria for one course are so different from others of the same description that the grades are not comparable. Grading does not tell us anything about the credential system itself and how the student's work is situated within that particular context. Grades reflect a time when ranking and authority was valued. Badges reflect a belief in the merits of competency and credibility.

Numbers and letter grades make it easy to rank and sort, but the web supports the interoperable, information rich, and transparent credential system of badges, and that weakens the argument for using grades exclusively, at least for nontraditional institutions of learning issuing credentials for the first time. We are moving from systems of authority to systems of credibility, where proof of learning is a click away and credentials are portable. This is not to say that grades have no place, only to say that they have biases and limitations worth examining, and may become a less meaningful way to recognize and communicate learning.

Participation badges

What badges also do is make more explicit the choices that go into course design. There are variables in most grading systems that we cannot gauge because the system — course design, syllabus, evidence of learning, criteria, assessment, and measurement — is largely opaque. What is on the syllabus? How does it compare to syllabi used by other instructors teaching the same course or content? Is the assessment instrument valid? Badges can make course design decisions transparent so that someone viewing the badge becomes an active participant in the evaluation process. In this respect, badges have much in common with portfolios, particularly digital or e-portfolios in which work can be viewed online. One feature that separates badges from straightforward portfolios is standardized transparency about other information commonly associated with learning, such as course criteria and assessment, as well as optional information (endorsement, testimony, expiration date, issue date, etc.), and the interoperability that makes it possible for learners to display badges in pathways, visualizing their learning in ways that grades or portfolios are less equipped to do.

This raises an important feature about transparency at the course level. First, set aside for a moment that grades are often associated with academic performance. According to many syllabi and course requirements, they also represent participation, often as much as 30 percent of a grade in some classes. This is a significant comment about what is valued. Participation matters, and in some courses, it matters as much as exams and assignments do. We already have a history of grading students for participation and defining it with a credential. In the current conversation about badges, however, awarding a badge for "just showing up" tends to divide opinion about the value of what many refer to as *participation* badges. Critics of these badges claim that they dilute the credibility of badges in the wider ecosystem. Proponents of participation badges believe that showing up is how learners discover interests and abilities that can enrich relevant academic experiences in school. For example, a high school student

who attends a maker faire may discover *arduino* for the first time, which triggers an interest in programming, perhaps leading to an increased interest in math so she can pursue a career in computer science. A middle school student may learn how to design murals using LEDs at a 2-hour workshop at his local library, which could inspire an interest in science his teachers have never been able to spark. Our assumptions that participation does not warrant a credential says more about our belief that learning is limited to performance on exams and assignments. It also suggests that we are uncomfortable making a learner's interest equal to academic achievement, even though interested and engaged students tend to be motivated learners. A participation badge earned in an out-of-school context creates a digital footprint that an educator can use to recommend similar interests, one step on a learning path that was otherwise not visible.

Participation grades on syllabi can also represent some of the most important so-called soft skills we value, like collaborating within a group, contributing to class discussion, making an effort at being on time, and regular attendance. These are valued qualities that are difficult to gauge without some kind of third-party reference, but this information largely disappears by the time grades are expressed on a transcript. Badges are a way to surface relevant information about how we participate, whether individually or in groups, and make this knowledge visible.

Participation badges have other purposes outside the classroom. Attending conferences and workshops can be an important part of academic and professional learning. Organizing a panel, moderating panelists, presenting papers, and giving presentations are examples of different levels of participation that are valued activities among researchers, scholars, and professionals. Conference and workshop organizers are experimenting with badges as a way to encourage and recognize contributions that have value to participants, a new type of learning analytic that has previously not been widely captured.

Participation badges can also be used to demonstrate how open digital badges work to learners who have never encountered them. The act of earning a badge makes what may be a novel concept more concrete, so that learners experience what it means to claim it, where to display it, how to move it around the web, and what it looks like online. Depending on the learners and their fluency with digital systems, the simple act of earning a badge for participation can be easy, informative, or challenging.

CHAPTER SEVEN:

BUILDING LIFELONG LEARNING PATHWAYS

Traditional credentials issued by universities and schools do not and cannot recognize all the learning that happens, nor do schools always have the capacity to teach, assess, and recognize many of the skills valued outside the institution. And, like many social systems that predate the Internet, most of our existing credential systems lag behind massive shifts in how we work, play, and learn. We are at a critical juncture in which our credential system — the very same system that determines mobility from high school to college, from school to employment, from one opportunity to another, from one socioeconomic class to another — is tethered to the most narrow definitions of learning. This not only impedes the flow of talent through society, it hinders how we make learning visible to others.

Badges lend themselves to a flexible and modular type of curricular design, not only within an institution, but across multiple organizations as well. This is important to the learner for two reasons. First, it allows learners more autonomy and agency in demonstrating how and what they learned, and where they learned it. A high school student may want to share what she learned about 3D printing with her math teacher, or demonstrate the leadership and collaboration skills she gained by participating in Girls Who Code, a nonprofit that teaches programming. Second, as more institutions create digital badge systems, more learning pathways may become visible to learners. This growing ecosystem has been there all along, but with badges, it becomes visible in a more standardized way. A learner who discovers how to create special effects at a maker faire through his city's Summer of Learning program may discover there are badges for sound engineering at his local library, for example. Seeing that there are other badges, he may recognize a potential learning pathway that makes it possible to further develop his interests.

Connected learning experiences expand and diversify meaningful life pathways, and while that should make it easier to create bridges between learning with new opportunities, that connection does not always happen. In the "culture gap between educational systems designed in the industrial age and the emerging learning practices of the knowledge age" (Collins & Halverson, 2009), badges have the potential to make this learning visible in ways that traditional credentials have not. The following sections in this chapter look at ways that badges make connected learning visible for youth, throughout higher education, and for employers.

Badges for youth

Having America's Secretary for Education proclaim that "students, teachers and administrators are hungry to move beyond fill-in-the-bubble tests, toward assessments that are more varied, immediate, and data-rich" (Duncan, 2011) created an overnight conversation about the potential role of badges in education. Badges act as a metaphorical lightning rod for some of the biggest K-12 challenges of the 21st century. Why do many students feel disengaged and alienated in school? When, where, and what are youth learning outside the classroom? Can institutions of learning respond to the way youth are discovering interests, gaining new knowledge, and sharing their learning with others? How should schools prepare youth for post-secondary education, employment, and civic life? Within these overarching questions is one that is also relevant to badges: What counts as learning, and perhaps more importantly, what learning counts?

The responsibility for deciding what to teach, value, and assess has had different effects on traditional institutions of learning. Over the past century, public schools "have been required to do the equivalent of rebuilding an airplane in mid-flight" (Christensen, Horn & Johnson, 2011), trying to adapt to the demands and opportunities of a highly mediated and connected world. Nineteenth century American

schools were designed to prepare citizens for participation in a democracy. By the 20th century, schools were expected to train students for vocations. Today, in the 21st century, public schools find themselves in a frenzy of competition not only at local and state levels, but at the national level too, with American students being among some of the most tested in the world.

Unlike many types of educational reform that focus squarely on schools, badges are about making learning that is already there more visible, and connecting that learning across different institutions. For example, imagine a 7th-grade math teacher looking at a roster of her students the first day of school. She reads down the list and sees that all but six students participated in the city's Summer of Learning initiative in which hundreds of organizations served high-quality programs to youth. Over the summer, more than half the students earned three or more STEAM (science, technology, engineering, arts, and math) badges through local museums, libraries, and community center camps. When she clicks on the badges, she sees that some programs aligned their content to math standards that her students will be covering during the school year. She takes a closer look at one badge in particular, earned by a student who was in her class last year. The badge links to a video demonstrating the solar-powered car built by the student, including a reflection about the steps followed to figure out how fast and how far her car could travel if she altered different features of the design. In this example, badges made visible learning that took place in another sphere, enriching the teacher's knowledge about her student.

Imagine, too, that the grading scheme for this teacher's math class involves 20 percent participation. Her student spent the last year disengaged in class, rarely contributing to class discussions, and was visibly uncomfortable when called on. Yet, her badge tells a different story. By evaluating the evidence of learning nested in the badge, it is clear this student participated enthusiastically with others in her group and emerged as a natural collaborator. The student describes how she applied math formulas to help her compare different test runs down the track, and how she used that knowledge to help her team figure out a way to improve their design. The teacher recognizes that her student has qualities that are hard to see in class, but are visible through the evidence contained in a badge. The same could hold true for other students on the roster, who have earned multiple badges from other learning environments.

In most traditional schools, students are categorized by age and sorted into classrooms so that teachers can teach "the same subjects, in the same way, and at the same pace" (Tyack & Cuban, 1995). Using badges to make learning visible, and to connect that learning in and out of school, provides a way for educators to accommodate different interests and learning styles, and to view a broader cross-section of a student's learning pathway. One promising example of this model is Rhode Island's Providence After School Alliance (PASA), which manages a citywide system of learning that offers high-quality, credit-earning expanded learning opportunities (ELO) within participating schools. More than 70 community organizations provide programming to 40 percent of the city's students, and in 2012, PASA designed a badge system pilot for programs aligned to Common Core standards. The core purpose of the badge system is to visualize the learning pathways that students will create from middle to high school for college admissions and employers. Currently, the badge system extends only to high school, and uptake is limited as the prototype is piloted and the design refined and expanded to reach more grades. What makes this model promising is the existing infrastructure of expanded learning opportunities already operating within schools; badges become a way to magnify the type of learning that takes place in high-quality after-school programs so that others can see it.

In another working example, a team of researchers, educators, and innovators are piloting LevelUp, a unique education management system that tracks individual learning progress and matches student competencies with badge-related educational content in a digital catalog. In this system, a teacher

might check on a student's competency level in 7th grade math and select a standards-aligned math game to further the student's progress toward proficiency in that math standard. The LevelUp system is designed to access third-party badges from outside providers such as libraries, after-school programs, or online platforms. In this system, educators have access to a dashboard that allows them to visualize the differentiated learning of their students, and to growing resources and learning materials that they can recommend. As new learning content and associated badges are added to the catalog, LevelUp will become more robust. For now, educators are focused on the dashboard user experience and how it facilitates highly differentiated and competency-based learning among its students. As more badge-related content is available, the recommendation system will suggest possible pathways of learning to teachers who evaluate what resources might work best for students at different levels of competency.

Momentum to connect badges with K-12 learning opportunities is increasing in other environments, including models like the Hive Learning Networks[19] in New York, Chicago, and Pittsburgh. More than 100 youth-serving organizations participate in each of the Hive networks and coordinate their institutions so that learners can move seamlessly from one learning program to the next, whether that learning takes place in museums, after-school programs, libraries, or online communities. Within these environments, museums and libraries have been at the forefront of badge system design. The Brooklyn Public Library recently announced plans to pilot a badge system integrated with BiblioCommons, a technical platform used by many public libraries. The Smithsonian's Natural History Museum, Cooper-Hewitt's National Design Museum, Smithsonian Quests,[20] New York's Museum of Modern Art, the American Museum of Natural History, and the Dallas Museum of Art have also been experimenting with badge system designs. Many of these organizations are thinking of badges as personalized "data packets" that learners carry with them from one institution to another, displaying their interests, abilities, and achievements as learning pathways.

Badges in higher education

Having a college degree no longer guarantees a good job, but is still a prerequisite for a middle-class life. For many American families, college education has become an economic burden in a climate where student loan debt is close to 1 trillion dollars in America (surpassing both credit card and auto loan debt combined),[21] while government revenues for post-secondary education continue to decrease and colleges regularly increase annual tuition. The cost of attending college has increased 2.6 times since 1980 (National Center for Education Statistics, 2011), and for academic years 2005-2006 to 2010-2011, a staggering 85 percent of students required some form of financial aid[22] (90 percent for students attending for-profit universities), not including loans made directly to parents. Roughly 60 percent of college undergraduate students complete their degree in six years,[23] and many who drop out have debt but no degree to show for their efforts. Over a third of community college students enrolled in two-year associate's degree programs face similar challenges, many taking six years to graduate or transfer.

While students who drop out are more likely to find employment than those without any post-secondary education (18.3 unemployment for high school graduates), they are less likely than college graduates to find jobs (12.7 percent for those with some college education; 6 percent for those with at least a bachelor's degree).[24] For the decade spanning 2012 to 2022, the Bureau of Labor Statistics (BLS) forecasts that

19 Hive Learning Networks: http://hivelearningnetworks.org/

20 Smithsonian Quests: Digital Badging for the Classroom and Beyond: http://smithsonianquests.org/

21 http://libertystreeteconomics.newyorkfed.org/2012/03/grading-student-loans.html

22 http://nces.ed.gov/fastfacts/display.asp?id=31

23 http://nces.ed.gov/fastfacts/display.asp?id=40

24 http://nces.ed.gov/fastfacts/display.asp?id=561

among the ten occupations expected to grow the most, only two require a bachelor's degree (accountant and postsecondary teacher) and six require no degree at all (2012). Data also indicate that there is labor market value for adults with alternative credentials such as professional certification and educational certificates, especially for those with low levels of education and professional degrees. [25]

Meanwhile, in what has been referred to as the "great unbundling of higher education,"[26] anyone with an Internet connection has access to free, open educational content, personalized learning systems, and massively open online courses (MOOCs). Economists predict that university business models may adapt to subscription-style revenues and greater acceptance of credits earned elsewhere. Accredited institutions of higher education could supplement existing systems with alternative credentials that increase the return on investment for all students, improving the economic impact of those who graduate, and providing some degree of value to those who do not.

While some view badges as a threat to a centuries-old monopoly,[27] badges also offer solutions to some of the dogged issues associated with higher education outcomes and return on investment for students. Setting aside the numbers for the moment, consider how institutions of higher education currently issue credentials. After meeting the requirements of a degree, students are given their credentials on stage or by mail, and display them by adding a line of text to their resumes. Degrees and certificates from higher education are critical to meaningful employment, even though course numbers, grade point averages, and credit hours have limited capacity to adequately convey students' skill sets to job providers. Students in a four-year degree program typically engage in a variety of co-curricular learning experiences, including workshops, lectures, internships, co-ops, cultural events, clubs, or study abroad programs. As an example of how badges might augment traditional credentials, consider a hypothetical scenario of undergraduate and graduate students who entered a university-wide STEAM Challenge at Duke University, a campus-wide competition to solicit proposals using science, technology, engineering, arts, and math to solve real-world problems. In their proposal, the students designed a way to accelerate the electrification of isolated communities in Uganda by focusing on a multilingual manual that would educate people about solar technology. Their proposal came in third place, and while they may add this accomplishment to their resumes, evidence embedded in a badge would tell a more illustrative story about the learning and achievement associated with the award. A badge would bring together the criteria for the award, a link to the proposal, an endorsement from the university administering the challenge, and a reflection on the students' idea, including perhaps peer testimonials about their collaborative learning experience. A future employer or graduate school admissions officer would have a much more information-rich way to evaluate this achievement. A university could conceivably use badges to track other kinds of co-curricular experiences that take place on campus, making visible an important type of learning that enhances undergraduate and graduate student experiences.

In the current credential system, college graduates find themselves vying with hundreds of other candidates for a single job by adding additional lines of text to their resumes in an effort to set them apart. They may add a list that includes HTML, Photoshop, fluency in two languages, or other skills they taught themselves or learned online. They may add work experiences that hopefully convey leadership qualities, project management skills, or their ability to collaborate and work in teams. Next to their credentials from universities, colleges, and other schools, graduates may add a few lines of text that approximate

25 www.census.gov/hhes/socdemo/education/data/files/p70-138.pdf

26 www.economist.com/news/united-states/21567373-american-universities-represent-declining-value-money-their-students-not-what-it

27 Badges Earned Online Pose Challenge to Traditional College Degree: http://chronicle.com/article/Badges-Earned-Online-Pose/130241

what they know because there are no credentials to vouch for their competency in any number of skills they possess. Throughout their careers, they may update their resumes with more lines of text about new things they can do, often without credentials to gird that learning. This is not to say all learning must have credentials associated with it, or that there is less value in learning that lacks credentials. However, having an option to display credentials counters an often unspoken and potentially inaccurate part of the job process, in which potential employers cobble together information about a prospective employee through search results and social media profiles. For students who have limited work experience to add to their resumes, badges may give candidates an actual artifact that employers can reference during a hiring interview, a potential advantage that helps graduates demonstrate their fit with the organization.

For now, badges are mainly being implemented as supplements to traditional credential systems already in place. Of course, higher education is not a monolithic institution that serves one function, an observation that tends to get less attention in the press when badges are mentioned. Career centers, academic libraries, service learning, continuing education, corporate education, conferences, co-curricular learning, professional development for faculty and staff — learning happens in many configurations across campuses. Badges lend themselves particularly well to any system that crosses programmatic borders, both within the institution and beyond it. This applies even more so to accredited institutions that already verify and confer credentials.

Recognition of non-credentialed learning applies within traditional university majors and departments as well. The Sustainable Agriculture and Food Systems (SA&FS) major, developed with support from the Agricultural Sustainability Institute (ASI), is an interdisciplinary program for undergraduates within the University of California, Davis College of Agricultural and Environmental Sciences department. Designers at SA&FS have developed a system that validates experiential learning aligned with seven core academic competencies and program requirements.[28] Using a custom-built platform, SA&FS provides a way to validate learning that occurs both within and beyond the core curriculum, giving students a mechanism to make a more comprehensive view of their learning visible to peers, faculty, and potential employers.

Whether badges may one day "challenge the function of higher education as society's primary 'sieve'" (Olneck, 2013) is a subject for debate that is beyond the scope of discussion here. However, it is possible that universities will absorb badges as they did certificate programs, and discover a way to enrich a student's transcript, even for those who fail to graduate. For years, employers have lamented the lack of preparedness of graduates entering the workforce.[29] As Olneck writes, badges may "bring more people, more activities, and more kinds of learning, doing, and being within the embrace of formal, albeit micro-divided, certification" of formal schooling (2013). Institutions of higher education may find that modular badge system designs that are competency-based and credibility-oriented add value to the traditional credentials they already issue.

Badges and employers

In *Open Badges for Lifelong Learning*, a white paper co-authored by the Mozilla Foundation and Peer-to-Peer University,[30] a group of learners are described as experiencing "a problem in making their knowledge and skills visible and consequential in terms that are recognized by formal educational institutions and broader career ecosystems" (Mozilla Foundation, 2011). These learner composites are in-

28 http://www.reconnectlearning.org/wp-content/uploads/2014/01/UC-Davis_case_study_final.pdf

29 http://www.ceri.msu.edu/wp-content/uploads/2012/11/TRecruiting-Trends-11-25-13-FINAL.pdf

30 P2PU.org: https://p2pu.org/en/

tended to reflect how people acquire career-ready skills and knowledge in the 21st century, whether their learning is assessed through experts, computers, or peers, and whether that learning takes place inside or outside school. The scenarios reflect a world where traditional credentials cannot be relied upon to open doors to opportunities, even when learners have the skills and achievements to open them.

A report written for the Educational Testing Service found that 69 percent of employers valued soft skills that are not typically taught in schools (Barton, 2006). When students do acquire these soft skills on campus, degrees and grade point averages do a poor job communicating them. Universities that provide co-curricular experiences have uneven or nonexistent systems for recognizing the learning that happens in some of the most career-ready and relevant experiences these institutions offer. Many students gain experience leading teams, managing projects, collaborating with others, giving presentations, organizing groups, and developing proficiency with different kinds of digital tools. Badges can make this experience visible to employers in ways that traditional credentials do not. This is perhaps the most overlooked aspect of badges in higher education. Degrees and diplomas were never designed to be transparent, and there are good reasons to collapse multiple years of learning into a catchall credential, particularly for employers who lack the time or interest to closely evaluate a candidate's degree or diploma. However, there are industries where transparent credentials would help employers find the skill sets or qualities they seek. An employer cannot assume that an architecture degree from one university is the same as another, nor can employers evaluate if credentials represent competency in any given subject. A potential job candidate who knows how to code may add a line of text about that skill to her resume, but many employers feel the need to administer their own tests to gauge mastery because a bachelor's degree in computer science is generally too opaque. Among recruiters who hire programmers, there is already a precedent to comb social Q&A sites like Stack Overflow, code repositories like GitHub, and even Twitter to help identify potential candidates (Capiluppi, Serebrenik & Singer, 2013).

While many advocates point to Boy Scouts and game achievements as predecessors for open digital badges, a more accurate analogy exists among open source programmers and recruiters. Digital "evidence" is visible in open source communities, and many sites have developed reputation systems that make the attributes and contributions of their coders visible to others in real time. For example, the Open Source Report Card for GitHub gives developers a "global view of their contributions, skills and habits."[31] Viewing a candidate's "evidence" may be common in technology fields, but what about other industries? It is likely that other employers would use similar types of evidence in hiring decisions if it were available. However, while one corporate research paper found that Fortune 500 senior hiring managers believe digital credentials would "ease a pain point for many employers" (Catalano & Doucet, 2013), it is still early to predict how badges will influence employment practices.

Creating an ecosystem in which employers readily recognize badges is by no means a passive process. Stack Overflow, the online social question and answer community for programmers, is a case in point. Stack Overflow became a respected source of highly skilled programmers who openly contributed their expert knowledge and gave feedback to peers online. After recruiters began using the site to find talented programmers, Stack Overflow created Careers 2.0,[32] a platform that allows members to display their contributions or "reputation" to potential employers. Barnes & Noble, Google, Amazon, and others are among the companies that use the site for recruitment. Careers 2.0 and Stack Overflow provide excellent proof-of-concept, although this should not lead badge system designers to adopt a "build it and they will come" approach. It takes time and exposure for trust networks to develop, and while badges may have inherent value to learners and issuers, it can require effort to build acceptance

31 Open Source Report Card: http://osrc.dfm.io/

32 Careers 2.0: http://careers.stackoverflow.com/

and demand among employers. "It is one thing to bring educational content and credentialing data to the celebrated speed and ubiquity of the Internet; it is another to establish fruitful connections with systems of economic value and social capital — systems predicated on economies of scarcity and lack rather than instantaneity and plenitude" (Friesen & Wihak, 2013).

Building value and trust relationships across badge systems can take place in different ways. For some systems, it is a matter of connecting potential candidates with employers who already recognize the skill sets and traits of badge earners, but might not have an easy way to locate them. An example is the Badges for Vets system that connects veterans seeking employment with employers in the civilian sector. In this system, expertise and abilities gained from military experience are displayed in ways that civilian employers find relevant. Companies that recognize how military training prepares workers for a 21st century workforce can filter for specific skills and geo-locate candidates through a feature on the site. In another example, designers of the Who Built America teacher badge system are seeking partnerships with school districts that will recognize the badges as valid professional development. Creating external value for badges is part of overall system design, and may require extensive relationship building among organizations willing to value the credential so that badges have optimal relevance to earners.

In the broader ecosystem, there are hurdles to overcome in order for badges to be recognized by human resources systems. While many employers are aware that academic performance does not necessarily correlate with success on the job, in many sectors the trend is toward hiring algorithms and "biodata" to find the right people. Employers hiring undergraduates straight out of college might create an arbitrary 3.6 grade point average cut-off point, for example; anyone below may never merit consideration, badges or not. Those who make it past the cut-off may be subject to tests that measure "organizational citizenship," a filter designed to predict how well prospective candidates would assimilate into the culture. It is too soon to tell how badges will be recognized in these systems, or how candidates will curate and display their badges in hiring environments, and what kind of norms and tools might emerge across different industries. For now, most of the organizations designing workforce-bound badge systems have pre-existing relationships, or are actively seeking partnerships with companies that will recognize the badges and the learning that goes with them.

CHAPTER EIGHT:
ASSESSMENT

Assessment is one of the most critical components of a badge system. NatureBadges, the Open Source Nature and Science Badge System at the Smithsonian's National Museum of Natural History, summarized their experience the following way, "Any discussion of badges for learning comes back to a really complex discussion about assessment."[33] Having some form of assessment is unavoidable for any badge system in which there is a claim about learning and a link to evidence.[34] Badges are designed to recognize learning; as such, most badges represent assessment of that learning. For that reason, implicit and explicit assumptions about assessment will play a large role in the way a badge system is designed and the impact it has on learners. This cannot be overstated: assumptions about assessment, if not examined, will manifest an organization's values more than any other feature of the badge system. Developing a badge system in the 21st century is an opportunity to think deeply about one of the most confounding aspects of our current educational system. Nineteenth and 20th century assessment practices have impacted not only the learning that happens within traditional institutions, but access to opportunity as well, and an alternate credential system based on relevant assessment practices could create a shift in measuring the attributes and qualities that count most in the 21st century.

Assessment, a form of evaluation we often equate with school, is an "integral part of all human learning" that arises whenever social groups seek ways to mentor and police participants (Gee, 2011). Assessment in traditional education has tended to favor quantifiable measurements that are considered, "replicable and objective" (Schmidt et al, 2009). This approach may work well for some skills but not all, including 21st century skills that require different methods altogether. For example, in the S2R Medals program developed by Makewaves, badges "are designed to reflect real-world transferable skills, including social media creation, reporting, interviewing, editing, time management, collaboration, responsibility, motivation, and mentoring others."[35] Experts in specific skill areas are involved in assessing and recognizing the learning because that principle is meaningful and relevant to the learners, more than a strictly quantifiable mechanism of assessment such as multiple-choice exams.

If "assessment is about shaping the direction of society and its members" (Schwarz & Arena, 2013), organizations need to take a step back and examine how assessment practices communicate hidden values that do not align with the goals of forward-looking learning institutions. For many of us, assessment is rooted in practices that are largely unexamined; as a consequence, values and assumptions get designed into assessment practices, often unwittingly. Consider the example of a hypothetical organization that values leadership, critical thinking, and problem solving, and sets out to design a curriculum intended to instill these values in the learners. Great care is taken in creating the curriculum, identifying the learning outcomes, and teaching the material. Students are graded for participation as well as performance on exams. The organization then uses multiple-choice tests to assess the qualities it professes to value and awards letter grades as recognition of learning. At no point during the test are learners asked to problem-solve with others or perhaps critique the questions. Yet questioning how an

33 The full NatureBadges Digital Badges: Lessons Learned project Q&A with Smithsonian's National Museum of Natural History is available online: www.hastac.org/wiki/project-qa-naturebadges-open-source-nature-science-badge-system

34 Ross Higashi on assessment and badge system design: www.hastac.org/blogs/slgrant/2013/11/09/5-buckets-badge-system-design-revisited-where-put-assessment

35 The full S2R Medals Digital Badges: Lessons Learned project Q&A is available online: www.hastac.org/wiki/project-qa-s2r-medals

existing system operates and devising alternate ways of doing things are qualities we might expect to see in leaders, critical thinkers, and problem solvers, the type of people this organization seeks to train. When it comes to evaluating these qualities, though, multiple-choice tests may become the default way to assess learning because instructors assume that this will sufficiently measure what counts, or perhaps they find it more efficient to administer the test this way. This is not to say that all multiple-choice tests are bad; in some circumstances, this type of testing may be the right tool. Too often, though, we use what is easiest because we are not familiar with what is available, or fail to think about what is possible. Or, the process of designing an appropriate assessment is never entertained, appears to be too daunting, or is considered too cost prohibitive. Fortunately, innovative instructors and researchers are experimenting with alternative forms of assessment in badge systems designed to recognize collaborative work, deeper learning, and increased engagement (O'Connor & McQuigge, 2013; Charleer, Klerkx, & Odriozola, 2013; Davidson, 2012).

Using the wrong assessment practice can be difficult to recognize for most learners and even some educators. If an English class is taught in English to English-speaking students, and the test is given in Hindi, learners will object, and claim that the assessment is not fair because they were never taught Hindi and cannot understand the questions. When the syllabus and curriculum emphasize one thing, and then assess for another, the disconnection is subtle, and learners are less likely to notice. Moreover, most of us have never been invited to critique the tests we take, nor evaluate whether the instructor was qualified to design, administer, and score the test. Students study the material whether it adequately measures their learning or not. When given the opportunity to design a badge system, however, organizations do have choices. Just as badges give learners more agency about what they learn and from whom, a badge system provides organizations more agency in deciding what and how to assess. Even badge systems that function within traditional institutions of learning may find that they have increased autonomy in deciding what to credential and how.

Building a badge system without examining our assumptions about assessment can lead to a misalignment between what we value, and how those values become manifest in the badge system. Too often, a system focuses on precisely measuring the wrong variables because the relevant ones are never identified. "Assessment is a bit like the famous Heisenberg principle in quantum mechanics: the more precisely you measure for one property, the less precisely you can measure for another. If you're looking for conventional achievement using conventional measures, then by definition you cannot at the same time be measuring by other criteria or measuring other qualities" (Davidson, 2012). It is important to think about the claims being made and the learning outcomes that educators seek before choosing how best to assess. Stealth assessment (Shute & Ventura, 2013) in game-based learning, choice-based assessment (Schwartz & Arena, 2013) designed for 21st century learning, or assessment that combines expert, peer, and computer feedback — conversations about assessment will not be inconsequential in systems that are truly transformative.

There are additional costs to favoring precise assessments that go beyond the obvious problem of administering the wrong test. Assessment can become some of the most defining features of a system — not just of the badge system, nor the educational system, but the larger social systems in which we strive to prosper and engage as citizens. As lifelong test-takers, most of us know this. We also know that tests not only open or close gates to other opportunities, they influence how we think about ourselves. Ecclestone and Pryor refer to this as "assessment careers" (2003), in which assessment systems define our learner identities and influence our dispositions for learning. We develop identities based on how well we take tests; at the end of a test, we decide whether we did well or not, and may go so far as to describe ourselves as being good test-takers, or not. Students know,

whether explicitly or not, that test taking is its own skill, yet somehow that ability has become conflated with ignorance or intelligence, regardless of whether or not the assessment was suited to the learning. Far fewer people finish a test and consider whether it was well designed, or whether it was valid or reliable. Assessment not only measures, it also legitimates some values over others and preferences certain kinds of learning, knowing, and doing that may or may not be relevant to a successful, meaningful life. We have perceptions of ourselves as learners, and these perceptions can be influenced disproportionately by the tests we take, whether those tests or courses are well designed or not. The same is likely to be said of badge systems.

In the Design Principles Documentation (DPD) project, researchers identified general design features or principles used by the Badges for Lifelong Learning projects to recognize, assess, and motivate learning (Hickey et al, 2013).[36] More than 40 design principles were identified, including the following: align badges to standards; award formal academic credit for badges; have experts issue badges; provide privileges; recognize collaboration; set goals; use rubrics; use e-portfolios, and many others. As Hickey et al. point out, the principles must be "tailored to the context and goals of an individual badge system," and figuring out which ones to use should be "made in complex relationships with decisions in other categories of badge system design, such as assessing, motivating, and studying learning" (Hickey et al., 2013). The DPD research team has led several workshops using a deck of cards[37] based on the design features, giving organizations a helpful tool to guide how assessment and other principles might work in alignment with the values, goals, constraints, and contexts of their proposed badge systems. Examining values and evaluating the assumptions we have about assessment are among the first steps to badge system design. If we overlook what is truly transformative about open digital badges, we stand to unwittingly replicate outmoded systems of recognizing and assessing learning. The consequence may be a badge system that looks innovative, yet fails to be relevant to its learners or fails to measure what matters. Much of the instruction that we experience in traditional institutions of learning is designed top-down, with administrators and policy makers determining what must be learned. Badges provide an opportunity to design systems that are relevant and valuable to learners, and to educators and organizations as well.

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36 To read about the Badge Design Principles Documentation Project, visit http://dpdproject.info

37 To view the Badges Design Principles Cards developed by Nate Otto: http://dpdproject.info/cards/

CHAPTER NINE:
DO BADGES WORK?

Untangling the variables that make badges effective is challenging – they often function within complex human and technical systems that can be confounding for researchers. Badges that work well for programmers who actively contribute to Stack Overflow may not work effectively in other Stack Exchange environments where the underlying technical system is identical but the community purpose and member types are different. In many badge systems, especially those that are peer-influenced, badges appear to be "socially entangled with the site, and with the process of learning" (Halavais, Kwon, Havener, & Striker, 2014). Further confounding system design, badges may serve multiple functions. Predating the Internet, badges were used to signal rank and membership within a group, whether on a uniform or figuratively evoked to symbolize the status, achievement, reputation, or membership within a social class (Simpson & Weiner, 1989). Badges provided social proof for desired attributes, and could be both incentive and reward while signaling key information about identity. Physically owning a badge could also indicate whether someone had access to certain privileges and opportunities. Digital badges function in many of the same ways, but they often coexist with other social media features within specific communities and contexts.

Antin and Churchill (2011) proposed five social-psychological functions for digital badges in social media that are similar to analog badges, including instruction, reputation, status, group identification, and goal setting. Instruction-based badges inform others about social norms so that members know what is valued in the community. Badges can also convey reputation, either by signaling interests and levels of participation, or by symbolizing expertise and skills. Achievement badges that are difficult to attain can function as status symbols within a group, or represent personal affirmation to an individual. Badges also allow community members to identify each other both inside and outside the group. Badges can be designed to emphasize some functions more than others, or combine multiple functions together.

Digital badges are used on sites like Stack Overflow, Microsoft's Xbox platform, Wikipedia, and other affinity spaces where reputation is socially and technologically meaningful to members. Badges are "often are being used in settings where autonomy and community are emphasized," (Halavais, 2012), and coexist with other online features designed to increase engagement and activity (including profits for commercial sites), such as commenting, voting, ranking, or algorithms that measure and display reputation. Google News and Foursquare are examples of commercial sites that use badges to motivate people to accomplish certain skills or behave in ways that are valued by the community. Stack Overflow uses badges as part of their points-based reputation system to reward people for "being especially helpful."[38] TopCoder[39] is another reputation system that issues competition-based achievement badges in addition to the "popular ranking system" of the site. Badges also appear in the evaluation practices of cultural production, including music sites Spotify and Indaba Music (Suhr, 2014), where peer assessment and expert feedback coexist. Each of these sites has a distinct culture where badges serve specific purposes, often with different meaning for various member groups within the community.

Wikipedia is an example of a distinct culture that has anything but a uniform response to badges. Currently, there are hundreds of badges called Barnstars used to recognize a wide range "wikiwork" or activity traces in Wikipedia (Kriplean, Bestchastnikh, & McDonald, 2008), including editing work, collaborative action, and types of social support. Despite this established peer-based badge system,

38 Stack Overflow badges: http://stackoverflow.com/help/badges

39 Top Coder badges: http://community.topcoder.com/studio/help/achievement-badges/

Barnstars play a relatively small role among the millions of registered editors on Wikipedia. Even though editors' contributions to the site increased by 60 percent after they were awarded Barnstars (van de Rijt & Restivo, 2012), findings like these are complex. Social participation is rarely uniform, whether in offline or online environments, and designers must carefully balance the right task with "measurement" or "completion" badges (Blair, 2012) that align with the system's values. For example, learners' achievements can be measured against themselves, against others, or against a predetermined standard, so that badges function as a form of feedback. Learners can also be rewarded for completing a task or skill, which can have a positive effect on performance yet dissuade risk-taking or creativity. Barnstar badges are designed to measure achievements against others, which may motivate some editors but not others. Those who would respond favorably to measurement against their own achievements might ignore peer-awarded badges or cease to participate at all.

Over the past decade, considerable effort has been invested in innovations that increase social participation online, with reading and contributing on one end of the spectrum, to collaboration and leading on the far end (Preece & Shneiderman, 2009). Many sites have implemented badge systems as part of this quest for high-quality engagement. However, finding the right balance between meaningful feedback and recognition for different kinds of contributions has proved to be an art form. Participation from "reader to leader" is not necessarily successive, and may change over time in response to variables such as group size, interface design, individual goals, and personality traits, among other possible influences (Preece & Shneiderman, 2009). When participation is voluntary, a smaller group tends to contribute more, and a larger group tends to participate less, a power law so tied to online norms that it is known simply as the "Internet rule." Nielsen was among the first to point out that roughly one percent of users contribute content, nine percent edit, and the rest consume what others produce (2006). Even though social participation has exploded in the last decade, many sites continue to experience variations of the Internet rule, including learning environments like Khan Academy, Coursera, Udacity, edX, and other MOOCs. Designers have therefore experimented with different features to encourage high-quality engagement, including the use of badges, completion certificates, and a variety of sociotechnical and game-based features.

The OBI has shifted the role of badges more toward credentials, which downplays their use as rewards, although many systems blend the two. In open digital badge systems where learning is the primary goal, the three main purposes of badges are to map progress and foster discovery, signal completion with a credential that holds value outside the community, and incentivize learners to engage in prosocial behaviors (Gibson et al, 2013). Of the education-based badge systems described in the research literature, a majority focuses on badges as game components and motivation. In these systems, badges were designed to encourage students "to create" and "be expressive" (Barata et al., 2013), or to recognize "time management" and "carefulness" (Haarenen et al., 2014). Other systems rewarded students for "taking an exam within a certain timeframe" and "responding to student work with especially helpful feedback" (McDaniel et al., 2012), or for "authoring and answering questions" (Denny, 2013). One system awarded positive badges to students who commented on blogs, and negative badges to those who did not (Verbert et al., 2013). Another system awarded badges for "solving exercises with only one attempt," "returning exercises early," and "completing an exercise round with full points" (Hakulinen & Auvinen, 2014). In one study, researchers made badges a proxy for rank instead of representations of certain skills, and used progress bars and storylines to foster "healthy competition" and "exploration" toward more specific goals such as, "increased lecture attendance, class participation, content understanding, problem-solving skills, and general engagement" (O'Donovan, 2013). Another pilot used badges as "an abstraction of learning analytics data" through a data visualization dashboard designed

to "improve collaboration" and increase "awareness of personal activity" (Charleer et al., 2013). While several of these pilots issued OBI-compliant badges, the primary purpose of the badge system was to generate badges that had local value limited to the classroom. The secondary purpose was to allow students to share badges with peers.

Very few of these pilots integrated badges into the course's formal grading system. In one of the few systems that linked badges with grades, some students reported strong negative emotions, leading researchers to conclude that badges should be optional (Haaranen et al., 2014). Another study found that badges and other game components had a positive influence on lecture attendance, but this did not significantly improve student grades (Nah et al., 2014). What these studies suggest is that the type of badge, the type of learner, the design features, and the context in which badges are issued influence motivation in different ways. In systems where badges coexist with other game components like leaderboards, progress bars, and storylines, each component may have a different effect on student motivation. In one study, "masterminds" were more likely to be motivated by badges, whereas "conquerors" were motivated by leaderboards and progress bars, and "seekers" were motivated by storylines (O'Donovan et al., 2013). Researchers have also characterized students as badge hunters, sharers, and dodgers (Boticki et al., 2014), three categories that bear resemblance to the gamer types that Jakobbson identified as part of a two-year ethnographic study on responses to the Xbox achievement system (2011). Hunters care about quantity of badges over quality of contributions, whereas sharers care about sharing badges and quality participation, and dodgers appear to have no interest in badges at all. In each of these typologies, researchers noted that students can be a combination of the different types, and may drift between them depending on the task or context.

In a study of middle school students using the Computer Science Student Network badge system, researchers found that different badges motivated learners depending on their level of expertise (Abramovich, Schunn & Higashi, 2013). Another study on computer science undergraduates found statistically significant differences in learners' behavior, but only with some badge types, and responses to the badge system varied across two courses (Hakulinen & Auvinen, 2014). A system designed to improve engagement, persistence, and diligence among engineering students found that badges effectively increased attendance, participation, and the number of downloads from the class website (Barata et al., 2013). Students in this class were also encouraged to learn from failure. Instead of a traditional grading system where students began with a maximum grade and had to maintain it, they earned points for each task they completed and worked their way up throughout the course. Pedagogy is not often explicitly discussed in these studies, even though, "Technological design and pedagogy have the potential to co-evolve in this new medium" (Bruckman, 2004). Badge system designers that want to encourage creativity, innovation, and risk-taking may find that their pedagogical and assessment approaches evolve along with technical features in order to create the optimal conditions to support desired outcomes.

CHAPTER TEN:

APPROACHES TO BADGE SYSTEM DESIGN

Badge system design is a degree more complex than other types of curriculum development. Badges map well to learning trajectories or pathways, which bear more resemblance to "skill trees" in role-playing games than traditional curriculum development. Skill trees are multi-tiered learning pathways that branch so learners can make choices about how to progress toward competency. For example, a learner might choose to work more broadly across skill sets, or focus more deeply and specialize in one area. Traditional curriculum design, on the other hand, tends to branch very little, if at all, as in the case of many elementary schools where students traditionally have less choice. While many middle schools and high schools offer electives, the overall design of traditional course tracks is analogous to being relatively thick in the trunk and much less flexible, whereas badge systems are well suited to branching, providing more pathway options for students. This creates additional design challenges because it requires thinking about multiple pathways across content areas, and therefore demands a more interconnected architecture for course design than most educators have had to do in traditional institutions of learning.

By way of illustration, consider the following badge system designed to create technology proficiency in learners in an undergraduate university program (Randall, Harrison, & West, 2013). In this example, a badge pathway has been designed to function inside a more traditional institution of learning, demonstrating how badges can co-exist with other types of credentials and curricula. At this university, the program offered students a one-credit course that imparted technology skills to secondary education majors. According to the badge system designers, "The traditional class lecture or workshop format left some technologically proficient students bored and unengaged while less proficient students were lost and frustrated" (p. 92). The goal of the badge system was to motivate students to continue learning a variety of technologies taught during class time, while also encouraging them to learn new technologies outside the course. The designers developed a tiered badge pathway composed of three levels, and students received badges for each new technology they chose to master, eventually earning a master badge to demonstrate competence at each level, and a final badge for integrating technology into the classroom.

Prior to developing the badge system, the course was taught in six separate sections, with three to five instructors teaching each of the sections. Instructors had separate tutorials, rubrics, assignments, and class schedules, and experienced a high level of autonomy in designing their courses. In order to build the badge system, assignments and rubrics created by five instructors across six separate sections had to be standardized and consolidated. One of the main objectives of the badge system was to enable students to learn more efficiently and autonomously on their own while also having access to both face-to-face instruction and online tutorials. A second objective was to provide a more transparent way to showcase skills to potential employers. Because each badge linked to evidence of technology skills mastered in the course, it would theoretically be easier for students to show evidence of their abilities to prospective employers. The tiered, three-level badge system functioned as a skill tree that gave students a much more modular, choice-based approach to competency than a traditional curriculum of required courses would allow. Administrators and educators may recognize that the most challenging aspect of this design is standardizing and streamlining the syllabi of different instructors. Even smaller scale badge systems can create changes to pre-existing human systems. Designing learning pathways within an organization or across multiple institutions can be a complex process that involves careful negotiation of policies between interdependent partners.

Lessons Learned from the Badges for Lifelong Learning Projects

We have much to learn about badge system design, both from approaches we have yet to try, and from pioneering experiences that have paved the way. Some of the most openly available knowledge about badge system design comes from the Badges for Lifelong Learning projects. In 2013, HASTAC published *Digital Badges: Lessons Learned*, a series of reports submitted by the 30 Badges for Lifelong Learning projects in response to a set of questions posed about their experiences building badge systems.[40] A sample of the questions included:

- What are the three most important things you would share with another organization just getting started?
- What are the three main challenges to widespread adoption of your badge system for your organization?
- What were your initial goals in building your badge system?
- What are three things you learned about badge system design?
- What would you do differently if you were to start over?

The following section highlights major themes that emerged from the Badges for Lifelong Learning reports, and is followed by descriptions of each project linking to their full reports.

DESIGN APPROACHES

There is no one best way to design a badge system. With so many different types of institutions, goals, learners, technology platforms, and learning content involved in the 30 Badges for Lifelong Learning projects, it is no surprise that multiple approaches emerged. In the most basic design sense, badge systems require learning content, technological systems, and badges. Some projects designed their badge systems to layer on top of existing learning content and legacy technology platforms. Others co-created learning content alongside a system of badges, and integrated them into a legacy technology system. A handful simultaneously designed the badge system, learning content, and technology platforms together. An early attempt to describe these various approaches summarized them as five "builds" (Grant, 2013):

New build.	The badge system, learning content, and technological platforms are designed simultaneously.
Integrated build.	The badge system and learning content are co-created and integrated into a pre-existing technological platform.
Layered build.	The badge system is layered on top of pre-existing learning content and pre-existing technological platform.
Responsive build.	The badge system responds to pre-existing learning content, and the technological platform does not yet exist, is optional, or is distributed.
Badge-first build.	The badges are designed first and the learning content and technological platform are designed around the badges.

40 Digital Badges: Lessons Learned: http://www.hastac.org/digital-badges#projects

It is too early to tell if there are design approaches that work better for some contexts than others, especially in this trial-and-error phase when organizations are creating systems for the first time. Even so, there is conjecture among badge designers that the "new build" would yield the most transformative system; however, negotiating so many decision-points can become overwhelming. Other designers found that the "badge-first build" meant focusing too much on the badges without considering how they would interact with social, technical, and educational components of the system. Many projects in the responsive, layered, and integrated builds found that they dabbled among the different types before settling on an approach that worked best. MOUSE Wins, one of the projects that began developing a badge system earlier than many other projects, wrote that "Badge systems can be a terrific supplement to existing programming, but the fullest affordances of badge integration seem better realized when learning experiences are being designed in tandem with systems themselves." Other systems found that pre-existing systems could be limiting, especially if the legacy platform was outdated, as in the case of the Pathways for Learning badge system that had to integrate with the Providence Public School District technology: "Build your tech infrastructure with the badges, rather than trying to integrate them with a pre-existing system. This will keep maintenance costs down, while also ensuring that badges feel like an organic part of a multi-tiered system." For many organizations, the only constant was continual iteration, as content was defined and refined concurrently with software development. Sweet Water Aquapons described content and technology as being a "lock-step dance" that was inextricably linked to one another. "At the outset, we determined that we should design our curriculum first, and then build the software to support that curriculum. However, as the software development progressed, we had to re-work much of our curriculum to fit the format of the software. Likewise, the changing curriculum then affected the initial software designs. An awareness of the evolutionary nature of the iterative process would have helped us manage our overall timeline better."

With so much iteration and potential for scope creep, having clear goals became one of the most important and common themes across the projects. As Design Exchange described, having a comprehensive learning strategy with clear goals and outcomes provided a framework that allowed "freedom of flexibility without chaos." Developers found that "Once you start creating badges, it can become very complicated and confusing if you don't have some idea of where you are going or what you want to achieve with a certain badge or type of badge." For systems with multiple stakeholders, partnering institutions, and collaborators, badge system design runs the risk of becoming unmanageable. Design for America underscored this challenge by emphasizing the importance of shared goals and communication for complex designs, "Any large complex system is going to require a large number of people with different expertise and backgrounds. To make them work cohesively requires a shared understanding and set of goals."

Building the team

By its very nature, badge system design tends to fall to teams. When multiple collaborators work across more than one institution, teams tend to grow. Many of the Badges for Lifelong Learning projects, in particular those who built the system in-house with their own programmers and developers, had upwards of 10 people working on their badge system. The average team size for all 30 projects was five to six people, and a handful of teams had two to three people. This did not include communications experts, legal counsel, or other departments involved in the human and technological systems within which many badge systems operate.

Badge systems developed in collaboration with universities tended to have the biggest teams, largely because university teams involved more content or subject experts. One of the largest teams, the Computer Science Student Network badge project had two team leaders and roughly nine core mem-

bers. In addition to the project lead, a co-lead was responsible for the overall badge system, including the research and design of one badge "pathway," or the series of badges learners were eligible to earn toward a final badge in that content area. Additional team members included a cognitive scientist, a technical lead and developer of the system architecture, a computer engineer and co-developer of the architecture, multimedia specialists and a web developer were responsible for training materials and the HTML5 co-debase to make the lessons compatible with iPad, tablet, and smart phones. Two computer scientists were responsible for a second and third badge pathway. Not all teams will be this size, and some of the roles will vary, but the CS2N team highlights some of the potential roles involved in building badge systems.

Building a badge system can be an intensely collaborative process that can span across an institution, and many systems will bridge multiple organizations with diverse stakeholders. Since open digital badges are designed to travel beyond any one institution, the need to work across institutions can become a core part of badge system design. For example, the 4H/USDA Robotics Digital Badges project included approximately 10 people distributed across four organizations: the United States Department of Agriculture (USDA), 4-H National Headquarters, Auburn University, and the University of Nebraska-Lincoln. Their team included four leaders, two junior programmers, a systems architect, a creative director responsible for project management, a pedagogical consultant, and an illustrator.

Many of the medium-sized teams of five or six people used an outside vendor to build the badge system, which made it hard to gauge accurate team size on the development side. For example, a project lead for technical implementation might represent three or four members working on software development, systems architecture, and graphics, but these roles were not included in the count because they were not involved in planning. Team size also has to do with scope and institutional legacy, and what kinds of systems and programming may already be in place. For example, Microsoft's Partners in Learning had a relatively small team of three people. The content, site architecture, and technical platform were already in place, and the main objective was to develop a way to integrate the site with badges, which required less collaboration at the design and development stage. Other projects such as the professional development badge system for the Young Adult Library Services Association (YALSA) took existing content and began mapping it to a curriculum that would live on a micro-site or learning management system that had to be compatible with a legacy platform associated with the American Library Association (ALA). While their core team ranged between 3 to 5 members, there were many more subject area experts involved in developing the core competencies and learning content.

Assign clear project roles, develop a detailed project plan, and get everyone on the same page as early as possible, especially around goals and scope. Badges tend to solve many problems across the institution and each stakeholder may have different needs they want addressed.

Who are my stakeholders?

Stakeholders have a way of defining the boundaries of a system. Identifying stakeholders is a common practice in project management, but it may be even more critical when building a badge system because badges tend to touch many parts of an organization. More importantly, they not only exit the system in the form of an open digital badge, they create connections across institutions. As a result, many badge systems involve stakeholders who act independently of one another. For example, LevelUp is a unique education management system that tracks individual learning progress and helps match competencies with badge-related educational content in a digital catalog. In this system, a teacher might check on a student's competency level in 7th grade math and select a standards-aligned math game to further student progress toward proficiency in that math standard. The stakeholders in the LevelUp system

are students and teachers, and also parents, who will be able to see a more detailed view of their child's progress. Other stakeholders include the University of Denver researchers providing content, Colorado's Adams 50 School District where LevelUp is being designed and piloted, and the Colorado State Board of Education. Because the LevelUp system is designed to accept third-party badges from outside providers such as libraries or after-school programs, there is a relatively complex stakeholder category that includes content providers whose badges can be displayed within the LevelUp System. For every stakeholder, there is a boundary that must be navigated and crossed, with implications that will constrain or change the badge system design. Identifying these stakeholders early on will front-load the design process with critical information that can have implications for system development.

Other stakeholders might not be as obvious as the ones listed above, but are just as important. For example, a marketing department of a major institution may not be familiar with badges, but will have a stake in how badges are branded. It can be challenging to represent a brand on an icon that will be viewed on a mobile device, and if there are partnering institutions involved, marketing may need a primer on how a badge reflects those partnerships on the criteria page. Legal counsel is likely to be another stakeholder, particularly for organizations that are designing badge systems for kids 12 and younger, especially in countries like the United States where the Child Online Protection and Privacy Act (COPPA) prevents minors from disclosing personal information on the Internet. Take time upfront to identify stakeholders, whether within the institution or beyond it, and make sure that they understand what a badge is, how it functions, and spell out any implications there may be.

Find a common language

Collaboration across disciplines and areas of expertise is critical to badge system design, and can challenge even close teams that have experience working with each other. Spend time at the beginning of the project to make sure everyone understands the language of badges, particularly terms that may mean different things to different groups. Try to identify terminology that is specific to badges and explain them in the simplest terms, and watch for assumptions about terms that are familiar but difficult to convey. The Sustainable Agriculture & Food Systems design system found that "Communicating design ideas from content expert to design expert to programming expert is something that requires skill and experience. An interest in badges does not equal the capacity to think with agility and an innovative mindset about the potential of a badging system." A developer may be presented with an alternative assessment method that sounds familiar without understanding the intricacies of what it means to design the system. The same challenges presented themselves in the YALSA professional development badge system. Designers for this system emphasized the need to, "have early conversations with the web development team and/or tech partners to guarantee that all understand the process and goals and that all agree on the process and goals. If that understanding and agreement is not in place, then it's important to seek other partners."

Above all, use seasoned programmers and encourage them to get familiar with the technical documentation and open badges developer community early in the project.

Explain badges early

As early in the process as possible, explain the concept of badges to stakeholders who will come into contact with them. This applies to partners, collaborators, faculty, learners — anyone who will be involved in the badge system needs time to become familiar with the concept, and to continue learning throughout the process. For many institutions of learning, badges will bring together many different groups and programs from across the organization. As the American Graduate program discovered,

"Badges gave a reason for discussing assessment, data, technology, and synergies across educational programs and a tangible symbol around which to shape conversation." It is critical to create a shared understanding among those who have a stake in the system, not just when the system is ready to pilot but during early stages when leadership puts the project in motion. Ideally, the process of explaining badges will take place in a way that generates ownership and commitment among stakeholders; having a hand in shaping a system motivates people to participate in the implementation and adoption of the system. Ask for feedback early and often, and identify conceptual misunderstandings or resistance that could be resolved with simple changes in design. Projects that operate in traditional learning environments found they underestimated how much time and information was needed to educate stakeholders. The Providence After School Alliance (PASA) badge system, which operates within the Providence Public School District, found that the majority of the badging process involved simply familiarizing stakeholders with the concept. Badges represent a new concept and the terminology brings with it a lot of preconceived notions; it can be hard to communicate how badge systems work to those who have a limited understanding of technical systems.

Many projects recommended familiarizing stakeholders with badges before beginning the design process. The 4H Robotics Badge system reflected on this in their evaluation, noticing that "Many youth and adults in our system are not familiar with the concept of badging, the value they have, and how they can be used. We would start the educational process of our system sooner so that when the badge system was ready for deployment more people would be in a state of readiness to start earning badges." Projects that experienced the same issue suggested that organizations create strong stories about how badges work, the value they have to the learners, how badges will alter existing systems, and what benefits they provide educators. Emphasize the ways in which badges solve problems and lead to better solutions than what currently exists, and prepare stakeholders for multiple iterations as feedback is looped back into the design. As badges become more familiar to different learning communities, the need to educate will shift, as Intel and the Society for Science and the Public (SSP) discovered in their badge system. "We feel like our success rate, measured by badge acceptance, is increasing with each phase of badging we offer. We are excited to now have students clamoring, 'Where is my badge' rather than 'What is this badge thing?' Our next challenge seems to be educating the outside world to the value of these badges as related to our programs."

Design relevant badge systems

Badges must be relevant and meaningful to your learners. Map your badges to whatever your community finds valuable, and have a purpose for them that makes them relevant both within and outside your community. To do this, ask your learners what *they* value — avoid assumptions as much as possible. As S2R Medals wrote, "Value is vital. Students need to know that a badge has a real-world value in terms of access to opportunities, further training or employment." Designers for the S2R Medals systems also point out the importance of defining value for other stakeholders, not just learners. "Teachers and parents also require real value in order to justify making time and resources available to support the young people." Many innovative sociotechnical systems end up as ghost towns because designers made assumptions about their users and the broader human and cultural systems to which they belong. This observation was shared by SA&FS, who recognized that faculty would find greater value in the system if it were designed to accommodate their user experience. "A badge system can lead to some real efficiencies in the interactions between faculty and students if designed with both parties' needs in mind. If you want to be successful in realizing this potential, it's really important to think completely through faculty user experience."

There are, of course, many different ways to design for relevance. One is to ask learners directly what they value. YALSA asked for public input from its core constituency and fed that feedback directly into the badge system. During one of their annual conferences, the team ran a focus group and learned that the potential users of their professional development system wanted criteria for earning a badge to be more rigorous. They wanted the YALSA badges to demonstrate a high level of competency so it would be meaningful to employers. Design Exchange ran focus groups, round-table discussions, and one-on-one interviews with their primary audience. They learned that the success of their badge system relied directly on what their learners valued. "When students knew they were being evaluated on both their in-session work and their digital participation to determine internship placement at the end of the program, badge participation was high. However, when similar badges were offered in other workshops, but students were not told they were being evaluated and no tangible reward was offered, participation declined sharply."

Other systems measured relevance in different ways. Badges Work for Vets is a system that translates military experience into civilian skills and uses the badge platform to communicate those abilities to employers. Badges for Vets recognized that tagging the veterans according to skill sets and geo-location software would be highly relevant to employers who wanted to hire military veterans according to geography.

In the MOUSE Wins badge system, relevance is an integral part of the system, not just for learners and educators, but also for the organization. In the MOUSE system, website analytics and feedback tools tell administrators which segments of their learners were most active according to sites and states, or by different demographic groups. Having the ability to compare these different metrics provided valuable information that guided program design so that MOUSE had a good understanding of what their stakeholders found relevant. "Our goal is that ultimately the MOUSE Wins! system provides a reciprocal advantage to the organization and the end-user."

Teachers are stakeholders

Teachers and faculty are critical to the successful design and adoption of badges, and ideally, will be included as key stakeholders in the design process. Planet Stewards found teachers became engaged as co-creators in badge system design for their own learning content after earning badges in a training pilot. "We were surprised at how interested educators are in badges, and once they had experienced pushing their own badges, began to consider how to design learning around collections of badges for their students."

Organizations designing badge systems for students cannot afford to overlook the significance of educators as stakeholders and think carefully about how to create value and familiarize them to badges. American Graduate underscored the importance of developing a relationship of trust so teachers felt safe expressing concerns and articulating any concerns with the system. "Recognize that in technology dissemination, you must train the trainers first, and well, with as much hand holding and scaffolding as they need if you hope to build real engagement." Any program that addresses what both learners and educators value has a better chance of success. Computer Science Student Network found that teachers liked the badges because it helped market their course, and earning a badge awarded a level of prestige. "When a teacher earns a certification, it adds prestige, and they also like the automated assessment tools that we have integrated into the system." Administrators in schools also appreciated that their teachers had earned these badges as a type of certification.

Of course, educators are not a monolithic group and in some contexts, the value of badges is not as evident. LevelUp, a badge platform integrated into an education management system, piloted their system in a public school district in Colorado. "We are not having as easy a time convincing teachers that they

need badges. They all care and need the learning data (competencies and scores) behind badges, but don't care if the format is badges or just data integration into their learning management systems."

In other systems, teachers provide expert assessment to issue higher-level badges. Designers of the S2R Medals system felt that this expert assessment provided important value, but also created potential roadblocks to widespread adoption. If teachers could not comfortably navigate the system, fewer students would benefit from it. To mitigate this risk, S2R Medals created teacher support materials that help teachers work through the program and issue badges.

Build external partnerships

For many badge systems, relevance and value is defined by external partnerships or organizations that agree to recognize badges and the learning that goes with them. For systems in which workforce or college admissions has direct value to learners, identify partners that recognize the badges and build value and relevance as early as possible. This may require significant effort to build relationships and trust, as well as materials that explain badges to partners unfamiliar with them. In many systems, the design of the system was guided by standards deemed valuable by external partners. Computer Science Student Network, for example, designed their certificate-level badges to align with standards relevant to the computer science field. "For badges to become a valid game-changer in education and employment… the badge community needs to align badge efforts with educational and industry needs and develop articulation agreements where badges are recognized as 'proof' of competence. Partnerships need to be developed between education institutions, employers, and badge developers. This will take substantial resources until critical mass is reached."

Effective systems thinking involves dialog with key stakeholders early in the process. External partners should be involved at the start of badge system design when implicit assumptions and beliefs are made explicit. The Pathways for Lifelong Learning (PASA) badge system reflected on their efforts to create badge acceptance among external partners, "If we were to start over, building badge relevance and demand would have begun the design process. PASA would have hosted a 'badging summit' to get all stakeholders familiar with and on the same page about the use of badges. Further, we would have pulled industry leaders into the conversation earlier to ensure the badge design was immediately relevant to their needs."

The alternative is to design the badge system and hope for the best, which can limit uptake. Partners in Learning recognized this with their teacher professional development badge system. "Most of our badges center on teacher professional development and if this isn't a top priority for a country or school district, then earning badges for professional development isn't going to be perceived as high-value." S2R Medals discovered a similar sentiment among students and teachers. "Endorsement by industry and media representatives would make the badges more appealing and provide more perceived weight in terms of credentials."

Iterative design

Badge systems require iteration. Design for America encourages developers to "Put as many aspects of your design in harms way by testing them with real users (or the closest approximations you can find) and iterate upon what you learn from those tests. This becomes more important the more different you are from your users." Many of the projects found that their ideas and designs changed over time. For BuzzMath, this meant showing and asking for a lot of feedback about the system early in the process, and "releasing smaller parts instead of big chunks."

Computer Science Student Network did research on learner motivation throughout the design of their system, and found reason to adjust system design. "A haphazardly designed system could end up

hurting some learners' motivation rather than helping. CS2N badges have been redesigned to include only the types of recognition that were found to have net positive gains in student motivation." In the Design Exchange system, youth helped determine the content and focus on the badges, using multiple methods of input to create the badges. "The more badges we created the more we learned what worked and what still needed work. We developed many badges that were failures but allowed us to learn so much about our participants and about the nature of digital badges as they relate to us."

SA&FS recognized that there is a delicate balance between engaging users and frustrating them. "We want to engage users in the design process, but we don't want to turn them off from using the end product because we didn't give it enough time in development before we release for testing and they get frustrated by a bad user experience." Even so, SA&FS found an agile approach was essential to badge system design. "Be realistic about your expectations for the process and don't be afraid to be agile and do things incrementally and iteratively if possible, with an eye for extensibility into future phases once you have proof of concept, a working prototype or some first element of the system for your students and faculty to play with and get comfortable adopting."

Learning pathways

Designing learning pathways is more complex than developing curricula and defining course requirements. As the CS2N badge system wrote, "Badges are uniquely qualified to both suggest and document flexible learning trajectories toward meaningful milestones. Flexible trajectories are increasingly important with anytime/anywhere learning." During early badge system design stages, think about how badges can enhance current learning programs, but keep an eye on extensibility so that the system can be built out as things evolve. This can be a deceptively complex process, especially for institutions that envision learning pathways that connect across partnering organizations. The National Museum of Natural History's Nature Badges program described how these challenges manifest in the design process. "There is a tremendous amount of interest in and support for badges across Smithsonian museums. The main challenges are creating or using shared assessment criteria so that badges can be connected between very different programs, a system of tagging badges so that users and badge providers can easily find related badges from other organizations, and staff time to integrate existing programs with badge systems."

Similar challenges exist for organizations with learning pathways aligned to standards. In designing pathways for optimal extensibility, CS2N tied top tier badges to certifications already valued and defined by industry, academia, and other key stakeholder groups. CS2N also designed badges and learning content that could be discovered by search engines. "CS2N badges embed an invisible packet of specially formatted metadata information so that they can be easily discovered, understood, and filed correctly by major search engines and learning management systems. CS2N uses the widely supported "learning registry metadata initiative" or LRMI format to align badges with educational standards. This means that not only are LRMI-tagged badges discoverable, but they tell search engines and educational databases directly what standards-aligned skillsets the badges represent."

Of course, learning pathways can be designed within a program, as a way to document pathways and recommend new ones. In the S&FS badge system, pathways replace a system that involves rubric-based competency assessment frameworks. Students check boxes to mark progress, and submit these forms to professors. Badge pathways allow them to organize and view their trajectories over time, which creates coherence. "The students are hearing about the prospect of replacing that system with badges, and are excited that they might be able to have a tool that is easier to use and provides a more connected and enduring picture of their achievements and competency development."

From a practical standpoint, designing flexible and extensible learning pathways can be daunting. Some projects recommend starting with a framework, and then focus narrow and deep on pathways to get a feel for the design process. Planet Stewards completed 20 career pathway badges, but in retrospect would have scaled this down. "It would have been more effective to focus on 10, and go more deeply on the quest design and learning activities. We thought big, but require additional funding to accomplish our larger vision."

User Experience

A bad user experience can ruin the most carefully designed badge system. Of all the feedback from the 30 Badges for Lifelong Learning projects, user experience generated the most impassioned comments. Designers of the SA&FS badge system responded that "Thinking through the user experience is a really critical part of the design process. Getting feedback and engagement from your users early in the design of the system is key. The system will likely fail if you don't get this right."

Design Exchange discovered that technical limitations in the user experience hindered widespread adoption of their badge system. "A 'clunky' platform makes understanding, earning, and sharing badges difficult. As a result, we are finding that students are frustrated when trying to navigate our website and earn badges." Intel and the Society for Science and the Public (SSP) came to similar conclusions. "We found that the biggest challenge is in getting the navigation and user experience right on the badging website, including writing the content in such a way that properly explains the concept of digital badging and how recipients could use them to their advantage."

Like other critical parts of badge system design, designers found it was important to check assumptions. American Graduate recommended talking directly to those who will use the system before designing anything. "Never design a system based on the beliefs of program administrators about how end-users navigate content and requirements. Ask the person who will have fingers on a keyboard, hands on the shoulder of a learner before you code a single thing or design a single badge." This applied to any stakeholder who would be using the system, not only the learners. SA&FS found that "We made some assumptions that faculty would be willing to deal with a less polished interface and a clunkier, back-end experience. Given the demands on their time, that doesn't turn out to be a fair assumption." Overlooking assumptions about how different learners use technology can lead to big oversights. Design Exchange's learners primarily access the Internet through mobile devices, and therefore the mobile user experience became a focus.

Any organization that encourages learners to move OBI-compliant badges to the Mozilla Backpack must think carefully about optimal ways to do this. Once a badge is earned, it can be displayed on the organization's site, appearing in a user's profile for example. For some organizations, the multi-step process of moving open badges beyond the site created a confusing user experience that inhibited the sharing of badges. Partners in Learning struggled to minimize these hurdles. "Users would have to log into both our site and (Mozilla's Backpack) in order to have their Partners in Learning badges show up in the backpack. When they click 'export' on our site, they are prompted for their (Mozilla Backpack) log in." Since the concept of sharing digital badge credentials is a novel idea, getting this user experience right is critical. Without a seamless user experience, learners may not even recognize that sharing across platforms is the primary feature of the open digital badge they earned.

Visual Design

Do not underestimate the design elements of the badges. Design for America discovered through user testing that "Badges need to look like badges!" Some systems had levels of badges that represented different kinds of achievements, or discrete steps on the path to completion. In the Design for America

system, designers did an initial needs analysis that suggested learners would not "react well" to badges. After some testing, however, they discovered that learners did not recognize badges as badges, and confused them with "process icons." The C2SN system discovered similar challenges. "It is important that a viewer be able to instantly distinguish an achievement representing a single lesson completion from an achievement that represents the successful completion of a months-long consolidated project. By structuring badge designs accordingly, a viewer can immediately begin to ascertain the scope of an achievement and begin to understand it in context."

Badges for Lifelong Learning projects recommend focusing on the visual appeal of the badges and think about the way badges will display on different screen sizes, including mobile devices where finer details can get lost. Systems with multiple organizations struggled to communicate a strong brand in a small area, and some used the criteria page to convey institutional branding. For institutions with long-standing policies about logos, badges may be an unfamiliar type of display that falls outside guidelines. If necessary, check to make sure there are no copyright or other issues that might prevent the visual design from going forward.

In general, badge system developers recommend simple designs. Intel and SSP summarized the graphic design process this way, "At first we struggled with badges that had too much wording and too many branding interests. Over time, we realized simple is best. Also, our original badges for the Intel competitions are skeumorphic in design (giving the impression of a textured 3D surface with a glossy finish). Our newest SSP badges, however, favor a cleaner, flatter look more in keeping with a native digital environment and the latest design trends."

The right number and type of badges

While a common theme across Badges for Lifelong Learning projects is that there is no optimum "number" or "type" of badge, many agreed that simplicity is key. S2R Medals wrote that "Looking back we feel our badge ecosystem may be too complicated. If we were to start again we would possibly simplify and create fewer badges to make it easier for people to work through the program independently." Of course, the right number and type of badges should be contingent on careful consideration and discussion about learning outcomes and values. American Graduate framed this in the context of the primary audience. "The right badges for learning are ones that articulate the instructional goals of an organization, represent a process, act, or skill that can be understood both inside and outside the organization (respectively, for community-level and externally-sharable badges), and that are meaningful to the personal growth of the earner, however that may be personally defined."

For this reason, different badge systems gauged the number and type of badges according to their learners, content, and contexts. Nature Badges found that badges were well suited to workshops or other contexts where they represented certification or participation in a program with a clear beginning, middle, and end. "For inquiry-based learning in a free-choice, non-linear, user-driven environment, badge design gets more complicated."

Many of the programs experimented with different types of badges to different effects. In the Design Exchange system, they began trying to engage users with badges that were easy and plentiful to earn. However, learners expressed interest in more pre-professional badges and that influenced future iterations. "We learned that the students want to demonstrate serious skills and collect badges with credentialing that will matter for them as they apply to school and look for internships." In S2R Medals, another youth-based badge system, learners received "stealth" community achievements automatically from the system, and these smaller badges provided welcome feedback about student progress and positive reinforcement of their abilities. In the Who Built America badge system for teacher professional development, design-

ers implemented a badge based on points earned for participating and contributing to discussions. While these points were not visible, teachers earned a community badge after reaching a certain threshold. Teachers could also earn badges for posts marked "useful" by their peers, or for sharing resources.

Badge system technology

If feedback from the Badges for Lifelong Learning projects about badge technology could be summarized in one sentence, it would be this: Hire the most experienced programmers possible. For many of the systems, it was critical to have experienced programmers who could translate badge system design into a working platform. Sustainable Agriculture and Food Systems was among a handful of projects that made the switch to a new development team midway through the design process. "Translating the complexities of a human-centered user experience into the logic of programming language takes time to get right and a great deal of refinement. This can be a longer and more resource-intensive process than what might be expected, especially for those content experts unfamiliar with web development in general and human-centered design in specific, or those web experts unfamiliar with progressive educational theory." Many of the projects experienced major setbacks because less experienced programmers could not grasp the basics of what badges were designed to do. Badges for Vets described their own experience bridging this gap in understanding, "The disconnect with our current web developer became so large we doubt he fully understands the concept of digital badging despite spending the last nine months developing a digital badging website."

Even with experienced programmers in place, Badges for Lifelong Learning projects found it was important to focus "early and hard" on the technical side of badge system design. For organizations that integrated badges into a preexisting web site, database, and communication channels, the technical challenges were long and complex, and required more development hours than initially expected. Badge systems designed to work with public school technology infrastructures were able to develop basic integration, but found that significant effort would be required to create full integration for widespread adoption. As CS2N wrote, "It is not a trivial task to develop, support, and populate a badge system that tracks:

- who earned the badge,
- who issued the badge,
- examples of work (including computational artifacts),
- who recognizes the badge,
- the length of time the badge is recognized, and
- linked evidence of learner work (where applicable)."

There are additional challenges for badge systems serving youth under the age of 13, which must work through technical challenges around the Child Online Privacy and Protection Act (COPPA). Designers must understand the workflow around the Open Badges Infrastructure and how the system will connect to it, which can include technical roadblocks associated with authentication.

At this early stage of innovation, the Open Badges Infrastructure is somewhat limited, and the scope of badging services and software is not robust. Badges for Lifelong Learning developers recommend looking at what is already available on Github, where others from the badges community have shared open source code. A critical part of the design process is having an experienced programmer participate in Open Badges developer conversations and become familiar with key concepts, the status of the code basis, and the dynamic nature of the Open Badges Infrastructure.

CONCLUSION

Badges do the same thing as credentials with one critical difference: they are transparent, meaning that the criteria, learning artifacts, and assessments are directly linked to the badge earner and issuing organization. The transparency of badges obscures deeply held beliefs about how we evaluate the reliability and validity of someone's learning, but it also introduces new considerations about identity management and privacy. We behave in different ways depending on the context, and badges introduce a level of exposure that could inhibit some learners and embolden others. In an ideal learning environment, peers will feel supported in sharing their work. In some learning environments, however, peer evaluation is perceived as peer scrutiny. For example, the S2R Medals badge system discovered that sharing of badges was not universal. "Students varied greatly in their desire to share their badges. For some, badges were key markers of success that students were keen to share with friends, family and potential employers. However, equal numbers were concerned about how their friends would perceive them for showcasing academic achievements, especially in overtly social spheres such as Facebook. Some felt displaying badges for achievements could lead to bullying even though they personally felt positive about gaining them. In these cases students felt more comfortable sharing badges in more formal spaces that they viewed as more 'professional' such as their Makewaves profile."

Every learner engages in complex, overlapping cultural practices in which badges can be irrelevant, disruptive, or complementary. How a student thinks about badges may change over time, or across different contexts. A student who shares her Foursquare badges with friends may feel ambivalent about sharing a badge that recognizes her proficiency in video editing. The same student who sees no value in a badge issued by an after school program where she learned 3-D printing may feel different after an employer or college admissions officer expresses interest in it. We have much to learn about how learners choose to share and display their badges, but there are early signs that identity management for youth and adults is every bit as complex is it would be for other types of social media. Building systems that allow as much privacy permissions as possible allows students options to manage their data in connected learning environments.

New technologies that promise to solve big problems can also become burdened with high expectations. While badges have the potential to fundamentally alter how we represent our learning pathways through traditional and nontraditional institutions of learning, they are not a panacea. Badges cannot create jobs. Nor should they be expected to communicate everything there is to know about a learner, including skills, talents, achievements, and qualities that a person might not want assessed or made public. A poorly designed badge system will not motivate a disengaged student, nor will it replace the teachers, mentors, or peers who are critical to lifelong learning. "Just because courses and educational content are being made available online in unprecedented quantity, it does not follow that issues of quality are also automatically satisfied" (Friesen & Wihak, 2013). If we assume that values, trust, and relationships are as important in digital learning environments as they are offline, badge systems may fulfill some of the expectations and potential they hold for recognizing skills, qualities, abilities, and achievements in connected learning environments.

Badges for Lifelong Learning Project Descriptions

4-H/USDA Robotics Digital Badges

4-H enters the world of electronic credentials with the development and introduction of digital badges in robotics. As part of an e-portfolio of learning, youth will be able to add digital badges that document knowledge, skills, and competencies attained in robotics competitions, platforms, movement, and mechtronics. Robotics badges are the beginning of a new tradition in 4-H.

American Graduate

American Graduate: Let's Make it Happen is a multi-year public media initiative designed to help local communities identify and implement solutions to the high school dropout crisis. A cornerstone of the initiative is to provide top-quality, proven digital educational resources that will engage and motivate middle and high school at-risk youth to stay in school, graduate, and prepare for college and careers. American Graduate Badges provide a pathway to reward and recognize students for their successes and skills attained through participation in key youth media digital education programs, including PBS NewsHour Student Reporting Labs, Roadtrip Nation, and StoryCorpsU.

Badges for Vets

Badges for Vets offers a solution to help returning veterans leverage their unique skill sets by developing badges that visually represent military training and real world skills acquired while serving in any of branch of the US military. At a glance, prospective employers will be able to verify military training completed and know that the veteran applying for a position with their company has the training and skills necessary, making him or her the best possible candidate.

BuzzMath

BuzzMath is designed in accordance with the Common Core Mathemathics Standards, and helps students master concepts based on those standards. BuzzMath badges convey grade-level mastery of required mathematical concepts and demonstrate positive behaviors that lead to mathematical achievement and success.

Computer Science Student Network (CS2N)

Carnegie Mellon University's CS2N is an online learning environment where students, teachers, and hobbyists can earn badges and certifications as they play with, compete in, and learn about computer science and STEM-related topics (CS-STEM). Badges visually document progress to establish concrete curricular trajectories from introductory-level tutorials to industry-recognized certifications.

BadgeStackOS

BadgeStack is a standards-based system designed specifically for badge-empowered, social learning. Learning Times has built the BadgeStack system to be one of the most comprehensive plugins to the open source WordPress software. This effort works to extend and develop an easy-to-use, downloadable, Wordpress-based, robust open source badge-issuing platform.

Design Exchange

Cooper-Hewitt and National Design Museum integrates badging into its successful DesignPrep program for underserved NYC high school students. Design Exchange badges are awarded for student achievements in design disciplines and/or overall design thinking and competencies for in-person and web-based learning. Some of the highest level badges will be accredited by professional organizations such as the Council of Fashion Design in America (CFDA) and AIGA, the professional association for design— bolstering resumes and higher learning applications in addition to a high level badge in Design Thinking.

Design for America

Design for America is a unique online community devised to foster innovation and enable the widespread sharing of knowledge required for a prosperous future. By utilizing the motivational, educational, and connective power of an online badge system, this online community platform will support the professional growth of young innovators and the collaboration of social change makers. Undergraduate designers will be able to track their design projects, share their stories, and learn from each other on the way to solving local problems affecting health, homelessness, the environment, and education.

Disney-Pixar Wilderness Explorers

The Disney-Pixar Wilderness Explorers badging system engages youth in nature-based explorations, offering them a way to learn about wild places and become advocates for wildlife. As these young Wilderness Explorers learn about conservation issues, they become teachers and ambassadors, content producers, and change makers. Badges will provide opportunities for Wilderness Explorers to make real connections in their communities that promote conservation locally and globally.

Earthworks

Earthworks Rising provides an accessible gateway to meaningful, engaged learning and mentoring experiences that empower young people and learners of all ages to cultivate a broader understanding of the importance and cultural value of the Earthworks of North America. The vision, voices and multiple perspectives of Native American culture will direct and guide the content developed for this interactive initiative.

Intel and Society for Science & the Public (SSP)

Intel and SSP badge system will recognize SSP's premier high school science competitions, the Intel International Science and Engineering Fair (Intel ISEF) and the Intel Science Talent Search (Intel STS), which reward independent scientific and engineering research. A badge system based on the Intel STS and the Intel ISEF will recognize independent research and encourage participation in science fairs for student researchers, teachers, mentors, judges, volunteers, and the community at-large. A digital badge system that provides a visual demonstration of achievement will enhance and further elevate accomplishment in the eyes of the students themselves as well as college admissions officers looking for achievements that set these students apart.

LevelUp

LevelUp is a web-based system that enables learners of all ages to develop skills that align to their goals. Learners achieve this by mapping content, curriculum, and everyday learning experiences to their progression on an individualized competency map. LevelUp will enable anytime, anywhere learning to be mapped to many systems, including K-12 schools, colleges, extra-curricular activities, or job training.

Leverage for Digital On-Ramps

The Leverage for Digital On-Ramps project aims prepare all Philadelphians to work and compete in the 21st century economy by providing a digital framework for delivering comprehensive education and workforce training to youth and adults. The Leverage System will be integrated into PAI's Post-Secondary and Career Readiness (PSCR) Course, a developmental multi-year course designed to provide 21st century and post-secondary readiness skills for 900 students.

Moodle as Issuer, Mahara as Displayer

Moodle is an open source online training and course management system and Mahara provides open source e-portfolios with an open source infrastructure for broad-based usage. This partnership allows Moodle to enable badges and permits Mahara to add them to their Gradebook, resulting in a deeply representative electronic portfolio.

MOUSE Wins!

MOUSE provides young people with authentic situated learning environments that support their school community, increases opportunities to apply skills, and offers exposure to new interests and a growing community of supportive peers and adults. The MOUSE Wins! Badge-based Achievement System for National Youth Technology Leadership will scale a national network-wide online badging system called Wins! & Wins! Tracker. The system supports youth in building computational, digital, and workplace literacies and establishes the assessment of community participation and learning as bedrock for our programs' culture.

My Girl Scout Sash is an App

My Girl Scout Sash is an App is a pilot program through which girls, volunteers, educators, and community leaders gain the skills to build simple Android Apps that are informed by, and supportive of, the national Girl Scout Leadership Experience. The app program curriculum allows Girl Scouts to create and design mobile apps for the Android operating system as a step in their Girl Scout badge-earning experience. The progressive, increasingly complex program is for girls 5-17 with a focus in the pilot stage on girls aged 13-17.

NatureBadges

NatureBadges: Open Source Nature & Science Badge System connects the onsite physical museum experience to digital tools for lifelong learning and engagement. The museum will be a hub for a strong international network of science and nature badges so that the audiences introduced to badging through innovative hands-on digital activities at the museum will have the opportunity to jumpstart their informal learning through badges from dozens of organizations.

National Manufacturing Badge System

The National Manufacturing Badge System recognizes the wide range of skills, competencies, and achievements that students and workers need to be competitive in today's Advanced Manufacturing workplace. The National Manufacturing Badge System will supplement formal learning requirements and pathways, providing individuals with an additional online platform to convey their knowledge and skills to employers.

Partners in Learning

The Partners in Learning Network supports educators and school leaders' active participation by instituting a recognitions-based badge system. The abundance of knowledge, resources, and accessibility to information available today requires a different approach from the generic one-size fits all engagement models of the past. New tools — like the use of badge systems as a means to reward, recognize, and motivate behavior — will fast become an essential change agent in capturing one's skills, competencies, and achievements.

Pathways for Lifelong Learning

The Providence After School Alliance's Pathways for Lifelong Learning badge system recognizes, motivates, validates, and connects learning interests and achievements of youth beginning in 6th grade, creating a seamless system of learning pathways that usher youth through middle school, high school, and onward to college, career and life.

Pathways to Global Competence

Asia Society is creating a badge system that progressively denotes globally competent youth leadership. Global competence is the capacity and disposition to understand and act on issues of global significance. Pathways to Global Competence engages learners in more powerful, relevant, and self-directed ways as they master skills and knowledge enabling them to develop their identity as a global youth leader.

Peer to Peer University (P2PU)

The Peer 2 Peer University is a grassroots open education project that organizes learning outside of institutional walls and gives learners recognition for their achievements. P2PU is an adaptable, customizable, open source, fully documented platform that will allow people to create OBI-compliant badges. It will enable issuers to create and issue badges into the OBI and easily integrate it into their sites.

Planet Stewards

Planet Stewards is a personalized high school competency-based curricular experience. Using NOAA's content and the 3D GameLab learning platform, students earn experience points, levels, and badges through web quests that demonstrate achievements in weather, climate, coastal, ocean, and lake science aligned to National Science Standards. Whether students are in the field, in the classroom, or engaging in a virtual or game-based experience, Planet Stewards will advance environmental literacy and promote a diverse workforce that encourages stewardship.

Preparing Librarians to Meet the Needs of 21st Century Teens

The Young Adult Library Services Association (YALSA) professional development badge system fills a knowledge gap for librarians serving teens. YALSA>s badge program will help librarians develop the skills and knowledge they need in order to meet the needs of 21st century teens.

Robotics and Stem Badges Using NASA Content

The Robotics and Stem Badges Using NASA Content badge system will provide STEM learning opportunities, spread awareness of STEM disciplines, integrate standards, and enable the expansion of new content through the creation of a unique collection of digital badges for lifelong learners.

Supporter to Reporter Medals (S2R)

Supporter to Reporter (S2R) allows young people to take on real-world roles of sports journalists, media producers, and mentors. S2R Medals will recognize and reward the skills and achievements gained by young reporters who learn and demonstrate a rich array of competencies acquired through their participation in the program. Competencies assessed, endorsed, and validated through S2R Medals range from technical skills such as recording, editing, interviewing and social media creation, to transferable skills such as collaboration, meeting deadlines, taking responsibility, and mentoring others.

Sustainable Agriculture & Food Systems (SA&FS)

UC Davis' Agricultural Sustainability Institute (ASI) will develop a model platform for validating experiential learning within formal institutional contexts at the undergraduate level. In creating a learner-driven, content-rich badge system, ASI will establish a new model for bridging learning in and out of the classroom, and enable learners to better communicate their skills and competencies to a broad audience.

Sweet Water Aquapons

Sweet Water Foundation aims to expand and deepen the impact of aquaponics and urban agriculture as a learning method by creating a replicable model for urban agriculture education. An enhanced curriculum and digital learning platform will support the requirements of Common Core Learning, Science Technology Engineering and Math (STEM), IMS Interoperability Standards, and Open Standards. This model will meet the growing needs of lifelong learners to help improve their professional, academic and personal endeavors. Ultimately, this system to encourage learning that will help current and future generations address the growing concerns/implications of food sourcing and healthy food availability around the world.

Who Built America

Who Built America? Badges for History Education is an online professional development learning community where teachers practice and master the skills of effective history teaching, and design materials to help students master Common Core literacy skills. The Who Built America badge system combines proven professional development methods and compelling social history content.

Youth Digital Filmmaker

The Youth Digital Filmmaker Badge system introduces students to the art and science of digital filmmaking. Ninth grade students will explore a combination of five identities: story developer, editor, filmmaker, collaborator, and digital storyteller. Academic skills are English Language Arts standards drawn from the Common Core Standards. Consequently, students are eligible to earn digital badges and core academic credit for the work they produce while creating documentary and narrative short films.

REFERENCES

Antin, J. & Churchill, E. (2011). Badges in social media: A social psychological perspective. In *Proceedings of CHI 2011*, British Columbia, Canada: ACM.

Abramovich, S., Schunn, C., & Higashi, R. (2013). Are badges useful in education?: It depends upon the type of badge and expertise of learner. *Education Tech Research Development*. Retrieved from: http://download.springer.com/static/pdf/503/art%253A10.1007%252Fs11423-013-9289-2.pdf?auth66=1364398853_eaf4db44b712278a1380306b6d651ce6&ext=.pdf

Barata, G., Gama, S., & Jorge, J. (2013). Engaging engineering students with gamification: An empirical study. In *Proceedings of 5th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES)*. Bournemouth University, Bournemouth, England. Sept 11-13, 2013.

Barton, P. (2006). High school reform and work: Facing labor market realities. *Educational Testing Services Policy Information Report*. Retrieved November 2, 2013 from http://files.eric.ed.gov/fulltext/ED492034.pdf

Blair, L. (2012). Congratulations! Selecting the right in-game achievements. Kapp, K. M. (ed). *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education*. John Wiley & Sons.

Boticki, I., Seow, P., Chia, G., Looi, C. K., & Baksa, J. (2014). How can badges be used in seamless mobile learning. In *Proceedings of the Bristol Ideas in Mobile Learning Conference, 2014 conference*.

Bruckman, A. (2004). Co-evolution of technological design and pedagogy in an online learning community. Barab, S. (ed). *Designing for Virtual Communities in the Service of Learning*, pp.239-255. Cambridge University Press.

Bureau of Labor Statistics. (2010). College Enrollment and Work Activity of High School Graduates 2009. Retrieved April 23, 2014. http://www.bls.gov/news.release/archives/ hsgec_04272010.pdf

Capiluppi, A., Serebrenik, A., & Singer, L. (2013). Assessing technical candidates on the Web. *IEEE Software*. January/February, 2013.

Catalano, F., & Doucet, K. (2013). Digital badges emerge as part of credentialing's future. *Professional Examination Service Custom Research Brief*. August 2013, pp. 1-10.

Charleer, S., Klerkx, J., Odriozola, S., Luis, J., & Duval, E. (2013, December). Improving awareness and reflection through collaborative, interactive visualizations of badges. In *ARTEL13: Proceedings of the 3rd Workshop on Awareness and Reflection in Technology-Enhanced Learning*, Vol. 1103, pp. 69-81.

Christensen, C., Horn, M., Johnson, C. (2011). *Disrupting Class*: *How Disruptive Innovation Will Change the Way the World Learns*. McGraw-Hill. New York, NY.

Clinton, W.J. (2013). Clinton Global Initiative (CGI) America. Remarks made by President Clinton at CGI America. *https://www.youtube.com/watch?v=1Qq7emqbzcA*. Retrieved March 29, 2014.

Collins, A., & Halverson, R. (2009). *Rethinking Education in the Age of Technology: The Digital Revolution and Schooling in America*. New York: Teachers College Press.

Davidson, C. (2012). *Now You See It: How the Brain Science of Attention Will Transform the Way We Live, Work, and Learn*. Viking. New York, NY.

Davidson, C. & Goldberg, D. (2009). *The Future of Learning Institutions in a Digital Age*. The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning. MIT Press.

Denny, P. (2013, April). The effect of virtual achievements on student engagement. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ACM,* pp. 763-772.

Duncan, A. (2011). Digital Badges for Learning: Remarks made by Secretary Arne Duncan at the 4th Annual Launch of the Digital Media and Learning Competition. *Ed.gov*. Retrieved September 5, 2013 from: http://www.ed.gov/news/speeches/digital-badges-learning

Ecclestone, K. & Pryor, J. (2003). 'Learning careers' or 'assessment careers'? The impact of assessment systems on learning. *British Educational Research Journal*. 29:4, pp. 471-488.

Fleischman, K. & Wallace, (2011). How values can reduce conflicts in the design process: Results from a multi-site mixed-methods field study. In *Proceedings of the American Society for Information Science and Technology*. Volume 48, Issue 1, pages 1–10.

Friesen, N., & Wihak, C. (2013). From OER to PLAR: Credentialing for open education. *PLA Inside Out: An International Journal on Theory, Research and Practice in Prior Learning Assessment*, 2(1).

Gee, J. (2011). Human action and social groups as the natural home of assessment: Thoughts on 21st century learning and assessment. Valerie J. Shute, Betsy J. Becker (Eds). *Innovative Assessments for the 21st Century: Supporting Educational Needs*. Springer, NY.

Gibson, D., Ostashewski, N., Flintoff, K., Grant, S., & Knight, E. (2013). Digital badges in education. *Education and Information Technologies*, 1-8.

Grant, S. (2013). 5 buckets for badge system design: You are here. *HASTAC*. Retrieved March 29, 2014. http://www.hastac.org/blogs/slgrant/2013/10/23/5-buckets-badge-system-design-you-are-here

Graue, M. (1993). Integrating theory and practice through instructional assessment. *Educational Assessment*, 1:293-301.

Haaranen, L., Ihantola, P., Hakulinen, L., & Korhonen, A. (2014, March). How (not) to introduce badges to online exercises. In *Proceedings of the 45th ACM Technical Symposium on Computer Science Education, ACM,* pp. 33-38).

Hakulinen, L., & Auvinen T. (2014). The effect of gamification on students with different achievement goal orientations. In *Proceedings of the Conference on Learning and Teaching in Computing and Engineering (LaTiCE),* Kuching, Malaysia, 2014.

Halavais, A. (2012). A genealogy of badges: Inherited meaning and monstrous moral hybrids." *Information, Communication, and Society*. 15:3: 354-373.

Halavais, A., Kwon, K., Havener, S., & Striker, J. (2014). Badges of friendship: Social influence and badge acquisition on Stack Overflow. *HICSS 47,* Hawaii, January 6-9.

Hickey, D., Itow, R., Schenke, K., Tran, C., Otto, N., & Chow, C. (2013). *Badges Design Principles Documentation Project Interim Report*. Indiana University. Retrieved from http://iudpd.indiana.edu/InterimReport

Hirscheim, R. & Klein, H. (1989). Four paradigms of information system development. *Communications of the ACM*, Vol. 32, 10, 1199-1216.

Introna, L.D. (2007). Maintaining the reversibility of foldings: Making the ethics (politics) of information technology visible. *Ethics and Information Technology*, 9, 11-25.

Jakobsson, M., 2011. The achievement machine: Understanding Xbox 360 achievements in gaming practices. *Game Studies*, 11(1), pp.1–22.

Kriplean, T., Beschastnikh, I., & McDonald, D. (2008). Articulations of wikiwork: Uncovering valued work in Wikipedia through Barnstars. *In Proceedings of the 2008 ACM Conference on Computer Supported Cooperative Work*, 47-56, San Diego, CA, USA. ACM.

Massum, H., & and Zhang, Y. (2004). Manifesto for the reputation society. *First Monday*. 9:7. Retrieved from http://firstmonday.org/article/view/1158/1078

McDaniel, R., Lindgren, R., & Friskics, J. (2012, October). Using badges for shaping interactions in online learning environments. In *Professional Communication Conference (IPCC), 2012 IEEE International* (pp. 1-4). IEEE.

McDonald, D., Javanmardi, S., & Zachry, M. (2011). Finding patterns in behavioral observations by automatically labeling forms of Wikiwork in Barnstars. *In Proceedings of the 7th International Symposium on Wikis and Open Collaboration*. p15-24. New York, NY. USA. ACM.

Mozilla. (2014). Pearson, edX, Educational Testing Service, Workforce.io, and more to align with the Open Badge standard. *The Mozilla Blog*. Retrieved from https://blog.mozilla.org/blog/2014/02/13/pearson-edx-educational-testing-service-workforce-io-and-more-to-align-with-the-open-badge-standard-2/

Mozilla Foundation and Peer 2 Peer University, in collaboration with The MacArthur Foundation (2011). *Open Badges for Lifelong Learning*. Retrieved from: https://wiki.mozilla.org/images/b/b1/OpenBadges-Working-Paper_092011.pdf

Nah, F., Zeng, Q., Telaprolu, V., Ayyappa, A., & Eschenbrenner, B. (2014). Gamification of education: A review of literature. In *Proceedings of HCI in Business: First International Conference, HCIB 2014*, Heraklion, Crete, Greece, June 22-27, 2014, pp. 401-409. Springer International Publishing.

National Center for Education Statistics. 2011. 2008–09 Baccalaureate and Beyond Longitudinal Study (B&B:08/09): A First Look at Recent College Graduates (NCES 2011-236). National Center for Education Statistics. Retrieved April 23, 2014 from http://nces.ed.gov/fastfacts/display.asp?id=561

National Center for Education Statistics. 2011b. Digest of Education Statistics, 2010 (NCES 2011-015). National Center for Education Statistics. Retrieved April 23, 2014 from http://nces.ed.gov/fastfacts/display.asp?id=76

Nielsen, J. (2006). Participation inequality: Encouraging more users to contribute. *Jakob Nielsen's Alertbox* from October 9, 2006. Retrieved August 12, 2011 from http://www.useit.com/alertbox/participation_inequality.html

Nissenbaum, H. (2009). *Privacy in context: Technology, policy, and the integrity of social life*. Stanford Law Books, Stanford, CA.

O'Connor, E. A., & McQuigge, A. (2013). Exploring badging for peer peview, extended learning and evaluation, and reflective/critical feedback within an online graduate course. *Journal of Educational Technology Systems*, 42(2), 87-105.

O'Donovan, S., Gain, J., Marais, P. (2013). A case study in the gamification of a university level games development course. In *Proceedings of the South African Institute for Computer Scientists and Information Technologists Conference*, pp. 242–251.

Olneck, M. (2012). Insurgent Credentials: A Challenge to Established Institutions of Higher Education. Paper presented to "Education in a New Society: The Growing Interpenetration of Education in Modern Life" at Radcliffe Institute for Advanced Study, Harvard University, Cambridge, Massachusetts, April 26-27, 2012. Retrieved from http://www.hastac.org/documents/insurgent-credentials-challenge-established-institutions-higher-education

Preece, J., & Schneiderman, B. (2009). Reader-to-Leader Framework: Motivating technology-mediated social participation. *AIS Transactions on Human-Computer.* 1(1), 13-32.

Randall, D., Harrison, B., & West, R. (2013). Giving credit where credit is due: Designing open badges for a technology integration course. *TechTrends*. November/December 2013. Vol 57:6. 88-95.

Resnick, P., Kuwabara, K., Zeckhauser, R., & Friedman, E. (2000). Reputation systems. *Communications of the ACM*. 43(12), 45-48.

Schmidt, J., Geith, C., Haklev, S., & Thierstein, J. (2009). Peer-to-peer recognition of learning in open education. *The International Review of Research in Open and Distance Learning.* Vol 10:5. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/641

Schwartz, D., & Arena, D. (2013). *Measuring What Matters Most: Choice-Based Assessments for the Digital Age*. The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning. MIT Press. Cambridge, Massachusetts.

Shepard, L. A. (2000). The role of assessment in a learning culture. *Educational researcher,* 4-14.

Shilton, K., Koepfler, J. & Fleishmann, K. (2014). How to see values in social computing: Methods for studying values dimensions. *Computer Supported Collaborative Work*. February 15–18, 2014, Baltimore, MD, USA.

Shute, V., & Ventura, M. (2013). *Stealth Assessment: Measuring and Supporting Learning in Video Games*. The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning. MIT Press. Cambridge, Massachusetts.

Simpson, J., and Weiner, E. "credential, n." Def. 3b. (1989). *The Oxford English Dictionary.* Oxford University Press. Retrieved October 2013.

Simpson, J., and Weiner, E. "badge, n.". (1989). *The Oxford English Dictionary.* Oxford University Press. Retrieved October 2013.

Simpson, J., and Weiner, E. "relevance, n.". (1989). *The Oxford English Dictionary*. Oxford University Press. Retrieved October 2013.

Suhr, C. (2014). *Evaluation and Credentialing in Digital Music Communities: Benefits and Challenges for Learning and Assessment*. MIT Press.

Thomas, D., & Brown, J.S. (2011). *A New Culture of Learning: Cultivating the Imagination for a World of Constant Change*. Publisher: authors.

Tyack, D., & Cuban, L. (1997). *Tinkering Toward Utopia: A Century of Public School Reform*. Harvard University Press. Boston, MA.

van de Rijt, A. & Restivo, M. (2012). Experimental study of informal rewards in peer production. *PLoS ONE*, 7(3). Retrieved March 29, 2012 from http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0034358

Verbert, K., Govaerts, S., Duval, E., Santos, J. L., Van Assche, F., Parra, G., & Klerkx, J. (2013). Learning dashboards: an overview and future research opportunities. *Personal and Ubiquitous Computing*, 1-16.

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