Badges Design Principles
Documentation Project

Interim Report
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Executive Summary

The Design Principles Documentation (DPD) Project is capturing the design principles for using open digital badges that emerge across the 30 organizations awarded grants to develop badge content in the 2012 Badges for Lifelong Learning Initiative. Because Open Badges contain specific claims about learning paired with detailed evidence supporting those claims, and because they can be easily shared across institutional walls, this new technology has the potential to break open existing economies for recognizing learning. Digital badges should enable learning that occurs in after-school programs, museums, libraries, and virtual organizations to find an appropriate place alongside the learning that occurs within formal school systems. In order to compete with traditional credentials like degrees that boast centuries of credibility, organizations first need to create systems of badges that structure their educational offerings, serve audience needs, motivate learners to participate, and provide appropriate evidence to back up their claims.

The general badge design principles that make up the bulk of this report systematically represent more specific practices that emerged across 30 projects. The DPD Project first documented the intended practices outlined in each of the 30 proposals. The project characterized these in terms of four types of badge design practices: (a) recognizing learning, (b) assessing learning, (c) motivating learning, and (d) studying learning. The project then documented how each badge system enacted those intended practices, modified them, or even abandoned them.

The first chapter of the report is an overview of the DPD Project. This is followed by four chapters, one for each of the four categories of badge design principles and practices. Each of these four chapters highlights the different ways that the general principles were represented by the specific practices in the various project. Particular attention was directed at the contextual factors that impacted how the design principle ended up being enacted. This information is intended to be immediately useful for other organizations who are designing badges systems. In particular this information is expected to help organizations understand how the specifics of their educational context could and/or should impact the design of their badge system.

This draft report also includes the DPD Project’s first two case studies, each of which take a deep dive into a badge system from the DML competition, covering technology workplace skill development in MOUSE Wins! and history teacher training in Who Built America. These case studies include the information obtained from “Lessons Learned” reports submitted by projects to the support team at HASTAC as well as information obtained in the final interviews conducted by the DPD team with each project. These final interviews attempted to capture the formal badge practices that endured at each project after the DML funding for badges was exhausted. These final interviews also attempted to summarize the primary challenges that each project faced in designing its badge system. The final draft of the report will be completed in Summer 2014 and will include case studies from all 30 projects.

The DPD Project is directed by Daniel Hickey of Indiana University. Current project members who contributed to this work and this report include Rebecca Itow, Katerina Schenke, Cathy Tran, Nate Otto and Christine Chow. Andrea Rehak and Elyse Buffenbarger also worked on the project.
Badge Design Principles from the Design Principles Documentation Project

**Design Principles for Recognizing Learning with Digital Badges**
- Use badges to map learning trajectory
- Align badges to standards
- Have experts issue badges
- Seek external backing of credential
- Recognize diverse learning
- Use badges as a means of external communication
- Determine appropriate lifespan of badges
- Recognize educator learning
- Award formal academic credit for badges
- Promote discovery

**Design Principles for Assessing Learning in Digital Badge Systems**
- Use leveled badge systems
- Enhance validity with expert judgment
- Align assessment activities to standards: create measurable learning objectives
- Use performance assessments in relevant contexts
- Use e-portfolios
- Use formative functions of assessment
- Use mastery learning
- Use rubrics
- Promote "hard" and "soft" skill sets
- Involve students at a granular level

**Design Principles for Motivating Learning with Digital Badges**
- Recognize identities
- Engage with the community
- Display badges to the public
- Provide outside value of badges
- Set goals
- Promote collaboration
- Stimulate competition
- Recognize different outcomes
- Utilize different types of assessments
- Provide privileges

**Design Principles for Studying Learning in Digital Badge Systems**

Using traditional evidence:
- Study badge impact: Research OF badges
- Improve badge impact: Research FOR badges
- Improve badge ecosystems: Research FOR ecosystems

Using the evidence contained in badges:
- Study badge impact with badge evidence: Research WITH & OF badges
- Improve badge impact with badge evidence: Research WITH & FOR badges
- Improve badge ecosystems with badge evidence: Research WITH & FOR ecosystems
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Introduction to the Badge Design Principles Documentation Project

Daniel Hickey and Nate Otto

Digital badges are visual symbols of credentials. They make specific claims about learning and can offer detailed evidence in support of those claims. The common structure of this information was formalized in the Open Badge Infrastructure (OBI). The Mozilla Foundation began initial planning of this structure in 2010; the OBI as it currently exists was formalized in 2012. The OBI defined how various types of metadata are embedded in badges and verified by issuers to tie each specific badge image to details on how it was earned. This allows any person or organization to issue, earn, display, and validate compatible digital badges. They are designed to be easily shared wherever learners want to showcase their accomplishments online, including websites, digital resumes, and social media.

Any organization that wishes to use Open Badges to recognize learning in their own context must build a badge system. At a minimum, such a system defines the various skills and achievements to be recognized and builds criteria to match, sets down the assessment methods to be used to decide when that criteria is met. In this set of papers, we argue that a fully considered badge system design will include these recognition and assessment decisions, but also will examine the motivational effects of the design and plan to collect and analyze data relevant to its context. Many decisions in these areas define a badge system for the long term. There are complex relationships between different design elements that should be unpacked and analyzed in advance, but they may also require modifications to the system as the project moves from design into implementation or after running the system in the real world.

As with any open technology, the possibilities for using digital badges are vast, and the range of considerations for effective use are not immediately clear. Digital badges open the possibility to recognize a wider range of learning than is feasible with traditional credentials like diplomas and degrees. This includes badges as micro-credentials for granular achievements as well as badges that cross boundaries to recognize learning that happens inside and outside of traditionally credentialed spaces.

Seeing a need to build a research community around using this technology for learning, Grant and Shawgo (2013) curated an extensive annotated bibliography of the research literature that appears relevant to digital badges. In her post “Badges Now,” Davidson (2013) provided an overview of the function and potential impact of badges, exploring the value provided by badges as alternative forms of assessment and credentialing. When executed well, badges have the potential to recognize diverse forms of learning and powerfully tell the narrative of students’ learning journey. Knight (2010) described a rationale for badges in her post “‘Certification’ Revisited,” raising open questions on the design of badges and how badges might fit into the educational landscape. Learning can happen anytime, anywhere. By providing evidence of
learning, badges can show students’ trajectory as well as their ability. There is potential to provide more detailed information to others and ease the translation of credentials between communities.

To further explore how open badges can be effectively used in learning programs, the MacArthur Foundation, in partnership with Mozilla, HASTAC, and the Bill & Melinda Gates Foundation, sponsored the Digital Media & Learning (DML) competition that funded 30 projects to implement badges in pursuit of recognizing lifelong learning. These projects occupied niches across the spectrum from formal to informal learning environments and served programs in classrooms, museums, libraries, after-school programs, online learning platforms, and more.

The Design Principles Documentation Project

The DML badges competition organizers hoped to capture the experiences of the participating projects and draw conclusions that would be useful for future badge system design and research. This paper, from the Design Principles Documentation Project (DPD Project) came out of this effort. The DPD Project is documenting the practices developed for the DML projects’ badge systems, studying these practices, and distilling them into sets of general and reusable design principles in four categories: (a) recognizing learning, (b) assessing learning, (c) motivating learning, and (d) studying learning.

The project’s overall goal is identifying appropriate practices for using badges in particular learning contexts. This is important because the features that define contexts are what determine whether a particular practice is appropriate. It is complicated for those working with badges, because the practices and contexts are mostly new, they are evolving, and the practices and contexts within a project shape one another. The DPD Project authors believe, and hope to show through this investigation, that badge system design is not a matter of applying “best practices,” but is instead a process that involves tailoring practices to fit project goals and contexts. The DPD Project’s specific goals are to tame this complexity by describing general design principles for badge systems and showing evidence of how they work in particular contexts.

A badge system is unlikely to find the perfectly tailored practices that serve project goals on its first iteration. As Mozilla’s Carla Casilli explained:

Regardless of where you start, it’s more than likely you’ll end up somewhere other than your intended destination. That’s okay. Systems are living things, and your badge system needs to be flexible. You must embrace a bit of chaos in its design. (2012)

While acknowledging some possible chaos, prospective system designers may reach for resources that help give them a roadmap of how the different elements of badge systems work together. For these system designers, the DPD Project hopes to provide resources that will both help get their systems closer to the mark initially and provide examples of how other programs modified their practices to address contextual challenges that they may encounter. In addition,
the project aims to provide a research framework for badge system managers to apply to studying their own systems and for future badge researchers to apply as they study systems externally.

**Methods Used to Capture Badge Design Principles**

The main findings are presented as four sets of design principles for use in digital badge systems, covering the categories of recognizing, assessing, motivating, and studying learning. Each principle is a distillation of related specific practices found among the DML projects. As they represent general versions taken out of their original contexts, it is necessary to recontextualize design principles to form them to the needs of new projects. The DPD Project’s description of principles and contextual practices interact is heavily informed by Design Based Research (DBR), as configured by Cobb, Confrey, diSessa, Lehrer and Schaulble (2003). In the terminology used in this report, general design principles are translated into specific practices through the construction of “local theories” that explain how design features of the intended practices serve project goals and function in context. Often projects’ local theories fit into subdivisions of the general principles, named specific principles.

**Project Phases**

The DPD Project is tracking how specific practices evolve in their contexts, from the initial design phase, through implementation, to becoming formal continuing practices that appropriately serve project goals.

Our project’s process started by identifying and naming intended specific practices for each of the DML competition projects’ badge systems through analyzing written proposals and conducting interviews. After collecting all the practices, team members clustered similar practices together and similar groups of practices together. These formed a two tier hierarchy of design principles with one or more groups of specific principles within each general design principle. The important feature of this structure is that projects’ specific practices are embedded in the local theories that define the function of that particular badge system, while general and specific principles could be represented by practices in a variety of badge systems.

With this structure in place, work began identifying how the projects’ practices changed as they moved from intended practices to the implementation stage, where their ideas became enacted practices. A final round of interviews followed, and as publishing begins on case studies of each of the DML projects, the final stage is to consider how the enacted practices solidified as continuing formal practices and how they relate to the identified design principles.

The lists of principles established in this project are by no means a complete set of the ways projects will use badges for learning, nor are the four categories identified necessarily a complete set of the functions of practices within badge systems as the overall ecosystem and culture around badges develops. There will likely be many interactions between practices that the findings from the DML competition do not anticipate. The authors of the DPD Project hope that
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this research can serve as a platform for future exploration of badge practices and that it can be adapted to meet the needs of future designers and researchers.

**General Findings of the Design Principles Documentation Project**

The DPD Project is beginning to publish research findings, first as this preliminary draft report and its accompanying case study appendices, to be followed by refinements and a more complete set of project profiles of the DML competition badge systems. At this stage, we are hesitant to make many generalizations across all of these project, but there are a few findings that stand out.

**Tensions Between Practices**

One important general finding from the DPD Project concerns the relationships between the four different types of practices. It became clear looking across the projects that the broader ecosystem constrains the learning that badges can be used to recognize. Recognition practices, in turn, constrain assessment practices; recognition & assessment practices together serve to impact motivation. Finally the entire badging ecosystem, including the recognition, assessment, and motivation practices, impact the research designs that might be used to study digital badges. These tensions will be explored in each of the four following category chapters.

**Tensions Between Different Approaches Within Practices**

The second general finding from the DPD Project concerns different approaches to the same practices. The local theories developed in each project’s context can rely on widely varying foundations. Within each of the four categories identified by the project, there are very different (and potentially competing) assumptions about knowing and learning that might be used to inform those practices. Generally speaking, these different approaches reflect the three “grand theories” of knowing and learning.

**Associationist perspectives.** The most traditional grand theory is often labeled *associationist*. It has its roots in behaviorism but is well represented in the work of some cognitive scientists and many instructional systems technologists. This perspective assumes that knowledge consists of numerous small associations, which means the learning involves building and strengthening those associations. These perspective are best exemplified on “competency-based” badging systems like *BuzzMath* the focus on more procedural and factual knowledge that is assessed continuously using multiple-choice formats.

**Rationalist perspectives.** The second grand theory is rooted in modern “constructivist” perspectives that emerged in the 1980s and that a widely embraced among many cognitive scientists and educational and educational psychologists. This perspective assumes that knowledge consists of broader conceptual schema that are constructed when attempting to make sense of new information in the world. These perspectives are best exemplified by “inquiry-
oriented” and “project-based” badge system. *Who Built America* is a good example of these kinds of badging systems, because both the teachers who earn badges in the project generally do so for completing projects that are then assessed by peers using a structured rubric.

**Sociocultural perspectives.** The third grand theory is rooted in contemporary sociocultural perspectives that emerged in the 1990s. These perspectives are less well known, but are strongly embraced by some cognitive scientists and many learning scientists. These perspectives assume that knowledge is fundamentally represented in social and cultural practices of groups of people, and therefore view learning in terms of increasingly successful participation in those social practices. This perspective is best illustrated by badge systems such as *Supporter to Reporter Medals* and *Mouse Wins!* that focus much of their effort on building a digital social network around their learning ecosystem. Within sociocultural perspectives, a strand of theories known as “situative” perspective argue that both associationist practices and rationalist practices can be understood as “special cases” of sociocultural practices.

Each of these three perspectives on knowing and learning has direct implications for supporting, recognizing, assessing, motivating, and studying learning. Particularly in the case of the first two perspective, some of these practices might be quite incompatible with each other. Proponents of the third perspective argue that it offers a way of resolving these tensions. Yet this raises complex issues and is not widely embraced by researchers and is difficult to comprehend for practitioners.

**DPD Project Resources**

In the current report, we offer four chapters, authored by the DPD Project team members who lead the investigation of each category. These chapters will introduce the design principles with selected examples from the DML projects. They will also present some of the relevant research to the function of digital badges in each category and discuss common tensions that affect how the principles can be translated into specific practices. Each chapter contains a table for quick reference of the design principles and lists of the projects that enacted them for further investigation.

We attach several case studies as appendices to this report. Each of these project profiles takes a deep dive into the intended, enacted and continuing practices of a badge system, their relationship to general design principles and a discussion of particularly illuminating challenges faced by the system.

We also include the first draft of an open educational resource (OER) produced by our team to assist with system design or analysis: a printable card deck of the design principles, suitable for remixing into new configurations on the tabletop.
How to Use These Resources in Research and System Design

For those who hope to implement digital badges for learning, the Design Principles Documentation Project describes the goal as identifying appropriate practices that serve project goals and function well in the project context. In addition, it involves determining how practices across different functions of the badge system interact.

To use these resources to design new badge systems, designers should first become familiar with the design principles across all four areas identified by this project and then try out thinking how they could be contextualized to fit the needs of the project at hand. See how various principles feel together, perhaps by rearranging principle cards on a table.

Start with the learning or achievement the system should recognize. Consider the type of evidence necessary to decide when to issue badges that make these learning claims. Move through the categories, and change your perspective to see how your developing system functions. Think about how it serves to motivate learning after deciding on a set of compatible recognizing and assessing principles, for example. Think about the sort of data that would be generated by the operation of the system and what data designers would need to improve it. When the last category is reached, circle back around or jump back and forth between categories and see if additions have introduced complexities that force reconsideration or would strain available resources. Make sure to write down any ideas that seem not to fit within one of the principles identified in this report.

The principles set out in the following chapters aim to help system designers move closer to a complete picture of the interactions in their badge system before issuing any badges. However, they may also be useful to consider as programs evaluate their successes and challenges at any stage.

Acknowledgements

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References
Recognizing Learning with Digital Badges

Christine Chow and Nate Otto

**Abstract:** This chapter on recognizing learning presents the first of of four categories of principles uncovered by the Design Principles Documentation Project; the other three categories are assessing, motivating, and studying learning. This chapter summarizes the principles for recognizing learning that emerged across thirty badge content development projects as the enacted the intentions outlined in their project proposals. This chapter also considers (1) how the broader project factors constrain the ways those projects could recognize learning, (2) how recognition practices in turn impact project assessment, motivation, and research practices, and (3) the tensions that can emerge over different approaches to recognizing learning.

At their core, digital badges, including those that conform to Mozilla’s Open Badges specification, serve as credentials that recognize specific achievements. In light of the considerations around badge system design, this paper describes general design principles for recognizing learning with digital badges. Studying the recognition category means exploring the implications of decisions about what learning claims badges are to represent and how the badges appear to their audience. This includes options like recognizing learning that takes place out-of-school and giving attention to a diverse range of skills that were previously not represented by traditionally established credentials. The recognition design principles take into account a combination of topics and range of skillsets that learners can develop and master.

When we talk about recognizing learning, we focus on decisions about the types of learning and achievement to recognize, the connections with existing credentials for this learning, and how learners interact with badges to unlock their value. New questions appear such as what badges signify, how they should be interpreted, and how they can be used in the emergent ecosystem. For example, design decisions about who issues the badges, whether they are endorsed by outside experts, and even the visual design have implications for their interpretation when learners present them either professionally or socially.

This has led to shifts in models or frameworks for thinking about credentials, contributing to a growing body of literature on alternative credentialing and the comparisons made to traditional transcripts and degrees. For instance, badges allow institutions to recognize learning at a more granular scale. Halavais (2013) explained that “microcredentialing… represent[s] learning and experience at a smaller scale, and offer the possibility of more diverse, detailed, and dynamic records of learning experience.” Credentialing systems, then, can give greater focus to a broader array of skills. Further, Halavais (2013) raised questions for additional research on microcredentials, including how they may be “interpreted by those who see the markers but may not be a part of the cognate communities” and how “they influence gatekeepers for particular
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communities: those charged with recruiting and hiring new employees, and those who admit students in higher education.” Among the concerns for badge system designers is planning how badges will communicate value to these audiences not intimately familiar with the environment in which they were issued.

Badges may represent different things to varied people and contexts. They are a means of communicating value between different communities, and there is the potential for badges to be meaningful outside of closed systems to other groups, such as potential employers, institutions, and organizations. Recognition practices can give greater weight to both formal and informal learning, opening up opportunities to articulate skills to employers and institutions and enabling credible, valued ways of presenting one’s learning.

Designing a badge system, from its claims of learning to its assessments and motivational effects, is not a matter of implementing a list of supposed best practices. Following the thread of Design Based Research, our project argues that design decisions should instead focus on building “local theories” (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003) to describe the value and function of badges, and these decisions should aim to match specific practices to the goals and context of the organization. Questions about what practice is the best fit for the project’s goals and limitations are more important than finding out what is best for all systems. To help support design and research of badge systems in the future, our project assembled general design principles, from which projects may craft new practices and describe those they see in the wild.

Assembling Design Principles

The Design Principles Documentation (DPD) project captured the specific practices of thirty digital badge projects to identify general design principles for recognizing learning with digital badges. We followed the projects as they progressed from intended practices, as outlined in their proposals to the Digital Media and Learning competition, to enacted practices of the projects’ badge system implementation. The principles below illustrate the diverse ways these projects chose to recognize learning in their badge systems. Together with principles for assessing, motivating, and studying learning, these principles aim to help system designers develop a more complete picture of how the components of their system work together to shape and enhance the learning experience.

Badges provide an alternative form of credentialing learning, and design principles for using badges to recognize learning have implications for formal and informal credentialing practices. The principles in this area have an impact on a badge system’s outcomes by informing questions of what types of learning are important to recognize, whether or how badge should be tied to formal academic credit, and how to establish the credibility of an organization’s badges.

It is important to note that the findings do not describe “best practices.” While many projects shared some of the same general principles, they employed different specific practices. The general principles listed here must be translated into specific implementations tailored to the context and goals of an individual badge system. Some principles may not be appropriate to any one project’s context. Furthermore, decisions about how to employ badges to recognize learning
achievement are made in complex relationships with decisions in other categories of badge system design, such as assessing, motivating, and studying learning.

Principles for Recognizing Learning with Digital Badges

The following descriptions of each recognition principle draw on selected examples from the DML competition.

Use Badges to Map Learning Trajectories

Using badges provides an opportunity to organize the achievements recognized by the system into a structure that matches the layout of the underlying subject area or the order students can move through it. Most projects organized learning by determining (a) levels of badges that chart out a progression of learning or by offering (b) routes or pathways, such as through meta-badges, which are awarded upon the completion of a specified set of lower badges. This could represent higher-level mastery of a group of sub-skills for example. While allowing designers to prescribe a specific path through material, badge pathways can also be structured to give students freedom over what they learn and the order in which they earn the badges.

Example: NOAA Planet Stewards aims to teach young people about careers in oceanography. System designers wanted students to be able to pursue their own interests, so they chose to use quest-based learning. Planet Stewards organized its badges (Figure 1) by naming them for careers in the ocean sciences. Students could move along ordered pathways in five categories, earning three career badges in each. When a student attains all three in one category, they also earn a “super badge.” The badges allow Planet Stewards to constrain how learners move through the system, but also to show them the possibilities for what learning they can do and give them options for what to learn first.

Marine Life

![Figure 1. Marine Life Badge Pathway for Planet Stewards Project](image-url)
Align Badges to Standards

In many ways, education standards do the same work as badge system designers deciding what to recognize. Standards like the Common Core State Standards in the US are widely known, and there is an existing audience interested in teaching and assessing the concepts included. Many projects built a badge system around the elements of (a) national or international standards. Because of the credibility and investment in various standards, aligned badges have increased external value to the earners.

Alignment to standards is presumed to improve transparency of the credential and help to facilitate better communication of the knowledge and skills of badge earners. Badges can link to the evidence for each claim that a student has mastered a standard component. Some of these standards were formal or government backed, while others were the less formal such as "21st Century Skills." and some are even (b) internal to the community where learning occurs. Alignment could be complete and direct, or loose. Highlighting the relationship between recognition and assessment, the formality of this alignment was usually defined by the formality of the assessment practices involved. Some projects used (c) both community and national or international standards.

Example: The Providence After School Alliance (PASA) Pathways for Lifelong Learning partners with after school and extra-curricular programs to offer learning opportunities to middle and high school students. Specifically, the badges for high school students are aligned to the nationwide Common Core State Standards. The project employs the Rhode Island Program Quality Assessment (RIPQA) to set consistent standards for quality improvement. The project explained, “All high school program curriculum and standards alignment are reviewed by school district curriculum leaders to ensure quality and rigor” (PASA DML Proposal). By aligning badges to a set of standards, the project can communicate the skills represented by a specific badge.

Have Experts Issue Badges

Integrating experts in the badging process boosts the credibility of the credentials and its value in a knowledge-based economy. This contributes to the validation of the badge and its potential usefulness in professional settings. At some level, an expert is associated with issuing badges. But the nature and role of this expert varied quite a bit, as did the way that the expert was him or herself credentialed. Sometimes the expert held an external credential, while other times the expert was credentialied by the community; some projects include both. Practices that implement this principle vary by how experts are credentialied. Either they are credentialied (a) by an external accredited entity, (b) by community, or (c) by both an accredited entity and community.
Example: Design for America (DFA) is an extracurricular program that guides students in applying human-centered design to foster social change. The organization has expanded into a nationwide network of design studios led by university students, who work together with community partners on local projects. The badge system incorporates experts in the process of validating the credentials, wherein professional mentors called “Design Professionals” review and award badges to users.

Seek External Backing of Credential

External backing is presumed to increase the value or usefulness of the badge as name recognition is a driving force in getting schools or employers to recognize the badge. Projects can gain either (a) formal external endorsement or ensure that badges are at least (b) externally valued.

In the projects that sought external backing, this seemed different than just using badges as a means of external communication. Whether or not the badge is actually externally endorsed, existing formal relationships can increase its external value. In some cases, a badge is formally endorsed and carries the insignia of the endorsing institution. A variation on the practice could be the operation of a badge system on behalf of an organization who would like to recognize certain achievements but does not have an instruction or assessment infrastructure.

Example: BuzzMath is an online program that enables students to practice and develop their math skills. Initially, the project was intending to obtain endorsement from the Common Core State Standards initiative and the state Department of Education. As described in BuzzMath’s proposal, “These endorsements would validate the quality, alignment, and rigor of the curriculum and assessments used by students to acquire each badge” (DML Proposal 2). As with other badge programs we studied, BuzzMath found the pursuit of formal endorsement fruitless. As enacted, the badges are contextually accredited in that they are awarded within an accredited school by a state licensed teacher. The badges are aligned to the Common Core, and teachers award badges based on a rubric.

Recognize Diverse Learning

Credentialing a diverse range of learning experiences can make visible the knowledge and skills that would otherwise only be implicitly noticed or not recognized. While this principle could be uncovered in nearly all of the projects at some level, we highlighted several projects that embraced it explicitly. These projects recognized skills and learning outside of what is traditionally recognized in formal learning environments, giving badges for both "hard" and "soft" skills. For programs within or on the periphery of the formal learning ecosystem, adopting a complementary credential is an opportunity to broaden what is recognized to encompass new categories of learning and accomplishment.
Example: MOUSE Wins! recognizes a broad range of soft and hard skills, awarding credentials at the level of micro-achievements, called Wins!, and macro-achievements, which are represented by badges. Reflecting the spectrum of skills relevant to the workplace, the project issues badges for not only computational or digital skills, but also for collaboration and communication. The badge system also designed Community Wins! in which students can issue micro-achievements to their peers for providing inspiration or demonstrating creativity or technical skills.

Use Badges as a Means of External Communication of Knowledge and/or Skills

As with the previous principle, most projects did this at some level. But some projects really made a concerted effort to increase communication of the learning or accomplishment that the badges represent by providing links to the data or evidence of learning.

Example: Design Exchange is an initiative by Smithsonian’s Cooper Hewitt National Design Museum, together with their partner LearningTimes, to build a badge system for their existing DesignPrep program. The program offers learning experiences for students in underserved high school students in New York City. The program provides the chance for students to develop design thinking skills and learn about fields, such as fashion design, architecture, and 3D design. While portfolios are typically self-curated, “A portfolio doesn’t show you everything. It doesn’t show you how well you learned, how far you progressed, and the period of time. It doesn’t say how open you are to collaboration, or to direction, or to criticism. It doesn’t say anything about your openness to new ideas, being challenged, and trying new things. Those are all important parts of a designer that aren’t necessarily reflected in your portfolio….so I think badges on that front can tell companies how they supplement a portfolio. Badges can lead back to the work” (DPD Interview September 2012). The program uses badges to communicate skills and abilities that portfolios, grades or transcripts cannot fully get across, capturing the process of arriving or creating the final product of the artifact.

Determine Appropriate Lifespan of Badges

The Open Badges specification allows issuers to optionally determine an expiration date for a badge. By default, badges are records of achievement that do not expire, and they remain valid unless the issuing organization stops supporting their badge infrastructure. While many projects did not explicitly discuss whether or not their badges would (a) expire or (b) require renewal or upgrading, a few made strong cases for learners being able to have permanent credentials that will always exist to recognize that specific skill, knowledge, or experience. Conversely, some badges make a claim that by its nature becomes less valid over time. Protecting the validity of the system may require setting an expiration date on these badges, which is an option in the specification.
Recognizing Learning with Digital Badges

Example: BuzzMath designed a badging system with a focus on mathematical achievement. The project integrated the capacity for users to earn badges that exist permanently. To ensure COPPA compliance, BuzzMath intends to make badges viewable in a private backpack to specific people with restricted access, such as the student, the student’s parents, and the school. The project is looking to migrate the badges over to the open backpack when students are thirteen. This practice illustrates the considerations of the lifespan or duration of the badge.

Recognize Educator Learning

Some projects awarded badges specifically to educators in addition to recognizing student achievement. These were sometimes that same as the badges for students and other times they were specific to the educators. Generally speaking, these badges were often used to recognize the educators’ participation in the broader learning ecosystem. The DPD project identified projects using this principle only when they made a distinctive effort to recognize educator learning.

Example: Sweet Water AQUAPONS integrates its aquaponics horticulture science program into participating schools by partnering with a participating teacher or supervisor. That educator must be able to commit to ensuring the provided aquaponics installation stays in good working condition so it is a functional learning tool. To make sure teachers are up to the task, AQUAPONS encourages teachers to learn through the platform and issues them the same badges as they give to students. At first, AQUAPONS staff evaluate student portfolios when students apply for badges, but as teachers gain greater experience, they will gain the ability to recognize their students’ learning through the website themselves.

Example: NOAA Planet Stewards, implemented by 3D GameLab runs its program by partnering with high school teachers, who sign their classes up for the Planet Stewards online quest-based learning platform. In order to maintain the validity of the badges, 3D GameLab requires teachers to complete a pre-training before they can “unlock” the badge system for their students to quest through. As part of this process, teachers are issued a badge recognizing them as a NOAA-certified ocean sciences instructor.

Award Formal Academic Credit for Badges

A few projects used badges to supplement formal grades for the learning that happens in school. For instance, a couple of projects have formed partnerships to grant academic credit tied to badges, increasing the value of the badge for badge earners.

Example: In their badge system design, PASA has built in the possibility for tying formal credit to the badges that students earn. The high school badges for students’
extra-curricular experiences are aligned to the Common Core, with the potential for translating to academic credit in schools and providing a means to communicate those experiences to educators, institutions, and organizations.

**Constraints and Tensions when Recognizing Learning with Badges**

As described in the first part of this report, two important general findings from the DPD project concern (a) the relationship between the four types of practices, and (b) the tensions between different approaches to each practice. Following is an explanation of these two findings as they relate to recognition practices.

**Tensions between Ecosystems, Recognition, and Assessment**

Looking across projects revealed the many ways that existing ecosystems constrained recognition practices. Where these ecosystems already existed, the existing goals, values, and curriculum constrained the kinds and ways that learning could be recognized. A project’s history and goals are the touchstones in decisions about how to implement a general design principle as a specific practice, or when deciding whether it is possible to implement a principle at all. The DPD project has identified a contextual factor arising that has particular influence on the shape of the practices eventually enacted in a badge system:

**Design implication: new or pre-existing learning goals.** A project’s curriculum, including the learning objectives intended for recognition with badges might already be determined, which limits the process of the badge system design to matching practices to this content and structure. Answering these finer-grained questions is not necessarily easier than implementing a fresh curriculum and fresh badges at the same time. A fully considered badge system design does not consist of simply strapping badges to an existing program solely at the existing points of recognition. Design involves consideration of the interaction of practices across categories. For example, badges often function as rewards, and questions about the value of extrinsic motivation appear when they are introduced.

Grant (2013) described five classes, or “buckets” for badge system design that illustrated different approaches of badging projects. The approaches are named as “new,” “integrated,” “layered”, “responsive”, and “badge-first” builds. This analysis combines consideration of whether learning objectives are already defined with a classification of where the project lies in the development of its badge system and its technological platform. Grant selected these classes to reflect the common configurations of being at different stages of development of these three system components and emphasizes that projects will potentially move from one bucket to another as development proceeds. There are challenges at each stage.

One implication here is that if a curriculum already exists for the project, then this presents challenges in figuring out how to build a badge system that matches the project’s well-established requirements. Supporter To Reporter built their badge system on top of a curriculum that already included its bronze, silver, and gold medals across three areas of sports journalism...
skills. The project had previously decided on complex rules for the order in which students could earn these badges. In order to recognize achievement in such a complicated system, complicated assessments were required, including programming new components of the Makewaves online platform that hosted learners’ portfolios, issued badges, and performed automated assessments.

On the other hand, if projects are building the curriculum and badges at the same time, then this introduces a different set of challenges. For example, BuzzMath chose to base their badges on competencies identified by the Common Core standards and had to spend significant time developing new content that would precisely map to the standard. The project team needed to iterate their assessment design several times, adjusting length, problem sources and question types, based on feedback from teachers and a curricular expert.

In both these examples, the contextual factor of which bucket projects started from made them expend extra time and effort developing their system and tools to match the unexpected challenges set down by their starting point and goals.

**Constraints resulting from recognition practices.** As elaborated in the introductory chapter and in the other three chapters, recognition practices serve to constrain assessment, motivation, and research practices. In a less obvious way, this means that these other three practices can serve to constrain recognition practices. This was most pronounced in the case of assessment, where projects appreciated that any learning that they wished to recognized was going to need some sort of assessment practice to provide evidence to support that recognition claim. Put differently, one of the most basic challenges involved with recognizing learning is ensuring that the learning claims embedded in badges are backed up by valid assessments that truly indicate whether the earner’s accomplishments match the criteria of the badge. In her article “Badge System Design: What We Talk About When We Talk About Validity,” Casilli (2012) addressed questions and assumptions of the validity of digital badge systems, including the authority of the badge issuer, the skills or knowledge represented by a badge, and the indications that can be made from badges about learning. It explored questions regarding the validity of the learning claim represented by a badge, the credibility with which the badge is perceived, and consistency of the measurement of learning as it adheres to a set standard. In order to create a system where the claims of learning contained in the badges are valid, those claims must be appropriately tailored to the learning objectives, the assessments used must be appropriate, and evidence attached should back up the assessments.

As will be more thoroughly explored in the chapter on motivation, recognition decisions have major consequences for how learners are motivated to participate in the badge system. The decisions about what learning will be recognized and the content of the badges, including their branding and visual design, have direct consequences on the possibilities for which motivational principles are available. Often, the practices developed in the recognition category directly exemplify one or several motivation principles. As shown by the project profiles that constitute the appendices to this report, there is often overlap between the practices as seen from the lens of each different category. For example, in Sweet Water Foundation’s AQUAPONS badge system,
the program found that badges essentially issued by learners themselves after self-assessment motivated far deeper self-reflection and engagement with the complex interrelated principles of aquaponics than expected. We have described this practice in each of the recognition, assessment and motivation sections.

**Tensions Between Different Approaches to Recognition**

As elaborated in the introduction and in each of the four chapters, another challenge projects faced concerned different approaches to recognizing, assessing, motivating, and studying learning. Generally speaking, these challenges are rooted in the tensions between traditional associationist perspectives, modern constructivist perspectives, and contemporary sociocultural perspectives.

**Associationist recognition practices.** Associationist perspectives are embodied in learning recognition practices that focus on relatively small and specific associations. Associationist recognition practices are embodied by the use of “selected-response” assessment formats like matching and multiple-choice items. This is because selected response assessment items involve recognizing the correct (or the most correct) association correct. This is a rather different way of recognizing learning, as compared to the recall processes recognized with short-answer formats or the constructive processes associated with essay items and performance assessments.

Associationist recognition practices are perhaps best exemplified by BuzzMath, where the learning pathway is represented by a more formative *Practice Document* and a more summative *Challenge Document*; both recognize learning in terms of very specific mathematical procedures. While some of the practice documents include short answer “fill in the blank” items, students progress through the system by completing the multiple choice items on the challenge documents in order to eventually earn badges.

One advantage of recognizing associationist learning is that the distinction between recognition and assessment practices is typically quite small. In some cases they are actually the same. Another advantage of recognizing associationist learning is that it can be quite readily and objectively assessed.

**Constructivist recognition practices.** Constructivist perspectives are embodied in learning recognition practices that focus on “higher-order” kinds of knowledge. In contrast to the more procedural and factual knowledge of associationist recognition, constructivist recognition practices focus on more conceptual and contextual knowledge. This is why constructivist learning is often referred to as “understanding.”

For example, in Who Built America projects, learning is recognized in terms of teachers’ creation of sample lessons that are then evaluated by experts against a rubric. While the rubric refers to specific elements of the lesson, the implicit conclusion that can be drawn from that evidence is the teacher “understands” how to make a lesson that embodies the broader goals of the project. While there is social interaction involved in the peer assessment process, the
learning that is recognized and assessed is defined in terms of individual conceptual understanding.

One of the challenges of recognizing constructivist learning is that it often requires the development of a specific and different assessment practice (such as a rubric or a quiz) to generate evidence. This often introduces the need for human involvement for the purposes of scoring essays or projects. In some cases, it may be possible to use machine-scorable multiple-choice items to assess constructivist learning. But in other cases, doing so will prove problematic.

Sociocultural recognition practices. Sociocultural perspectives are embodied learning recognition practices that focus more on social knowledge. In contrast to associationist and constructivist practices the recognition of social learning will involve consensual judgements across entire communities of learners. The most obvious examples of sociocultural recognition occur in social networks where recognition can be “crowdsourced.”

One of the best examples of recognizing sociocultural learning is found in the badges associated Stack Exchange. This is a “question & answer” site that is widely used among programmers. Users enter questions at the site and are directed to answers that have already been provided to that question, or new answers that are provided by users. All of the users vote answers up or down. Badges are earned based on the overall judgement of the community, rather than the judgement of an individual. While some of the DPD projects indicated that they hoped to recognize crowdsourced knowledge, none of them had enacted practices for doing so at the time of the first interviews.

There are many challenges in recognizing sociocultural learning. The obvious challenge is that the very notion of “social learning” violates many peoples’ assumptions about the nature of learning. Stack Exchange is one of very few “high-stakes” badges associated with crowdsourced learning. But thanks to the sophisticated system and the well defined nature of the content, potential employers are willing to pay handsomely to be put in touch with the rare individuals who have earned the highest level badges around particularly difficult questions. Nonetheless, one of the advantages of recognizing sociocultural learning is that doing so can create sophisticated learning ecosystems.

Recognizing informal versus formal learning. A related set of tensions exist over different recognition principles when they constitute different types of recognition, such as a distinction between formal, informal, and crowd-sourced recognition. These types have vastly different requirements and affordances. Formal recognition involves traditionally established forms of credentialing, whereas informal recognition provides new ways of recognizing skills and learning. Crowd-sourced recognition includes socially defined peer recognition and the value that peers ascribe to badges. In this process, the value and credibility of the claims are constructed by everyone, and in this process individuals are coming to a collective judgment of what is valued. Among the DML projects, practices that awarded high-stakes formal academic credit for badges were rare. Even projects that aligned their badge systems to standards from the formal education system were not able to directly translate their badges into formal
recognition. In order to gain formal credentials for this learning, students typically still had to pass through traditional assessment channels.

The digital nature of Open Badges also raises fresh possibilities for secondary recognition that comes from peers, with the capacity of sharing badges to an audience of peers via social media. This audience may ascribe greater value to certain badges, communicating or cultivating aspects of identity or expertise on particular subjects or topics. It dives into the effects of recognition that are not as apparent, such as peers recognizing the value of the badge or how the badge may be accepted. Since badges can be pushed out and shared with one’s network of peers, then the value of the badge can increase with peers’ acknowledgment. There are challenges intermingled with the perceptions of learners and the image of the badge. Practices aligned to principles such as “Use badges as a means of external communication of knowledge and/or skills” attempt to harness the sharability of Open Badges to give them value for the earners.

**Platform-related constraints on recognition.** In addition, the platform and infrastructure constrained the design and recognition practices of digital badge systems. Many projects addressed these challenges by adapting their approach and workflow or concentrating more of a specific aspect of the project. Often, adapting to the capabilities of the platform required simplifying elements of the badge system or rules for how students could move through learning pathways. Or conversely, as seen in the S2R Medals badge system, requirements of the learning pathways forced upgrades to the platform to mold it to the goals of the program.

<table>
<thead>
<tr>
<th>General Design Principle</th>
<th>Description</th>
<th>Specific Design Principles</th>
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<tbody>
<tr>
<td><strong>Use badges to map learning trajectories</strong></td>
<td>Guide learners to objectives by recognizing steps along the way. Use paths, levels, or metabades.</td>
<td>Level badges (LevelUp, Global Pathways, Who Built America, Story Corps U, Roadtrip Nation, News Hour, BuzzMath, Design for America, Intel, Manufacturing Badges, AQUAPONS) Provide routes or pathways (4H, BuzzMath, MOUSE Wins, Planet Stewards, S2R Medals, SA&amp;FS)</td>
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<tr>
<td><strong>Align badges to standards</strong></td>
<td>Choose which learning to recognize by following public or internal standards. The incorporation of formal and informal standards increased external value.</td>
<td>Use standards internal to community (Global Kids-Hive, Pixar) Use national or international standards (LevelUp, Youth Filmmaker, Story Corps U, Roadtrip Nation, News Hour, BuzzMath, Intel, Manufacturing Badges, Partners In Learning, PASA, NASA Robotics)</td>
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<td>Recognizing Learning with Digital Badges</td>
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<td><strong>Have experts issue badges</strong></td>
<td>When experts recognize learning, the badges may gain greater credibility and carry more weight in the market.</td>
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<td></td>
<td>Credentialed via external accredited entity (LevelUp, Global Pathways, Youth Filmmaker, BuzzMath, Design Exchange, Intel, Digital On-Ramps, Planet Stewards, SA&amp;FS)</td>
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<td>Credentialed via community (Design for America, MOUSE Wins)</td>
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<td>Credentialed via accredited entity and community (Who Built America, PASA, NASA Robotics, S2R Medals)</td>
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<td><strong>Seek external backing</strong></td>
<td>Gaining external endorsement of a badge increases the value with name recognition.</td>
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<td></td>
<td>Externally endorsed (Youth Filmmaker, 4H, Intel, Nature Badges, Planet Stewards)</td>
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<td></td>
<td>Externally valued (CSSN, Manufacturing Badges, NASA Robotics, S2R Medals, AQUAPONS)</td>
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<tr>
<td><strong>Recognize diverse learning</strong></td>
<td>Badges allow educators to recognize other types of learning that don't fit in their traditional credential systems.</td>
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<tr>
<td></td>
<td>Recognize diverse learning (Global Leadership, Roadtrip Nation, Intel, Digital On-Ramps, MOUSE Wins, Manufacturing Badges, PASA, Planet Stewards, YALSA, AQUAPONS)</td>
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<tr>
<td><strong>Use badges as a means of external communication of knowledge and/or skills</strong></td>
<td>Consider the audience for the information the badge carries, and recognize learning that this audience needs while presenting data and evidence of learning.</td>
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<td></td>
<td>Use badges as a means of external communication of learning (Who Built America, Global Leadership, Badges For Vets, BuzzMath, Design Exchange, Intel, Digital On-Ramps, YALSA, S2R Medals, SA&amp;FS)</td>
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<tr>
<td><strong>Determine the appropriate lifespan of the badge</strong></td>
<td>Provide credentials with lasting impact for an appropriate duration, maintaining accessible evidence.</td>
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<td></td>
<td>Never expires (Who Built America, 4H, BuzzMath, Digital On-Ramps, Planet Stewards, NASA Robotics, S2R Medals)</td>
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<td></td>
<td>Requires renewal or upgrading</td>
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Recognize educator learning

Badge systems can recognize participating educators for their achievements.

Recognize educator learning as well (Global Pathways, CSSN, Partners In Learning, PASA, NASA Robotics, S2R Medals, AQUAPONS)

Award formal academic credit for badges

Granting credit either internally or through partnerships is one way to ensure a badge has value in the existing education marketplace.

Award formal academic credit for badges (Youth Filmmaker, PASA)

References


Design Exchange, interview with the DPD Project, September 2012.


Assessing Learning in Digital Badge Systems

Rebecca Itow

Abstract: The Design Principles Documentation Project has followed the development of thirty digital badging projects as they moved from their intended practices outlined in their initial proposals to their enacted practices constrained by their audience and the badging platform. The DPD Project aimed to capture the knowledge that emerged in this progression. The result was the derivation of ten design principles for designing assessments in digital badge systems that is relevant beyond badging systems. A scholarly review of the literature related to the design principles revealed aspects of assessment functions that badging projects – or anyone designing assessments for a learning system – should consider as they make decisions about the kind of learning they wish to foster.

Digital badges are web-enabled tokens of accomplishment. They contain specific claims and detailed evidence about learning. Because they contain this information and can be readily accumulated and shared, they can work quite differently than traditional grades, certificates, and transcripts. Digital badges are becoming widely used to recognize learning in a variety of formal and informal educational settings. When the Badges for Lifelong Learning competition was launched, we were charged with the task of following the thirty projects awarded funds to build digital badge systems that encourage learning in a variety of formal and informal settings. In order to carefully analyze the different aspects of the badging systems and their development over time, we developed the Design Principles Documentation (DPD) Project and focused our questions and research around emerging practices in four categories of badging practices: recognizing, assessing, motivating, and researching learning with digital badges. We were concerned with the emerging informal knowledge that developed as projects moved from intended practices outlined in their initial proposals to enacted practices that developed as the projects matured and systems were implemented with learners. This paper focuses on the assessment strand of this research.

When designing a learning system, the choices of assessment types, functions, and practices directly impact the ways in which learners engage with content. Learning system developers must be acutely aware of how their choices impact learning if they are going to make claims about what learners can and cannot do as a result of engaging with their content and activities. This is especially relevant as digital badges enter the educational sphere and badge system developers design badges that act as credentials for learning.

At their core, badges recognize some kind of learning. However, if one wants to recognize learning and make claims that something has been learned, some form of assessment is needed. This research (a) traced intended and enacted assessment practices across the thirty
projects, (b) derived ten more general principles for assessing learning with digital badges, (c) connected these principles to relevant aspects of project contexts, and (d) connected these principles to relevant external research and resources to help projects be more systematic. This paper summarizes these badge assessment design practices, principles, and resources across projects, and examines one of these principles and its enactment in two of the projects.

**Theoretical Framework**

Our derivation of badge design principles and reflexive identification of outside literature focus directly on the ideas and insights most relevant to the badges initiative. Rather than summarizing the vast literature on assessment, the literature was reviewed and the design principles were derived in the same way evidence in a trial must be directly relevant to the case and the question at hand (Maxwell, 2006). Both the literature review and the design principles relate to the enacted practices that emerged as badge systems were implemented.

This “conceptual” (rather than “foundational”) approach is called for by the groundbreaking nature of this initiative. Teasing apart the areas of recognizing, assessing, motivating, and studying learning and addressing the tensions within and between these four areas serves to highlight the incredibly complex problems in educational reform and begin rectifying some of them. The review and design principles pragmatically review prior research and explore the value of newer paradigms based on new newer “social” theories of learning. These new theories are infused throughout the DML initiative and are embodied in the writings DML scholars and leaders like John Seely Brown (e.g. Brown et al. 1989; 2002; 2008;), Mimi Ito (Ito, et al. 2005; 2009), and Connie Yowell (Yowell & Smylie, 1999).

These social theories are being widely adopted, but many educational innovators embrace social theories of learning while using traditional practices to assess learning. This research aims to highlight the impact assessment choices have on learning so that educational innovators have a better understanding of the kinds of claims that can be made with those choices.

**Methods**

While carried out as design ethnography, this research was inspired by current design-based research (DBR) methods. DBR builds “local theories” through systematic iterative design in the context of implementations (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003) with particular attention to relevant aspects of particular educational contexts. To help capture the emergence of local theories and relevant aspects of context, this research reflexively documented more general and more specific ways of assessing learning in the context of digital badges. Meta-principles are very general theoretical statements that reflect how different “grand theories” of knowing and learning (i.e., behavioral, cognitive, or sociocultural) lead to different conceptualizations of the role of digital badges. General principles are the guiding principles behind badge system developers’ designs. These general principles are broad, and address the projects’ general practices for recognizing, assessing, motivating, and studying learning. Specific
practices — labeled appropriate practices, explained below — reflect how the general design principles were enacted in light of specific constraints of the individual content development efforts. These practices, along with the specific features that emerged in that context are invaluable for helping similar projects appreciate how the general principles might be enacted and further refined in their own contexts.

Evidence

Analyses of proposals and subsequent interviews with project stakeholders identified over 100 enacted assessment practices across the thirty projects. The thirty interviews revealed that projects needed to make substantial changes to their initial designs when they began working within the badging platforms in their particular settings. Doing so uncovered aspects of platforms and settings that impact how (and if) initial designs were enacted. These practices were organized into ten assessment design principles, which remained usefully linked back to the specific practices and features. This process was followed by a half-day workshop where stakeholders could review our characterizations of the projects’ assessment practices, refinement of the general assessment principles, as well as a recategorization of projects’ practices. These practices are documented in the DPD project database, to which all of the projects have access. These practices have been labeled appropriate practices rather than best practices, as the appropriateness of a specific practice depends on the context in which it is used. The appropriate practices contained in the ten principles for badging practice are open to the public so that new badging systems can use them to inform their decisions around assessment. This information is now being disseminated back to projects and to the broader badging community via blogs and at www.workingexamples.org where it will continue to evolve.

Because there is almost no literature on assessment for badges and a vast literature on assessment, a reflexive and recursive review of the relevant literature and other resources was needed to inform these efforts. For example, projects considering “leveled” versus “flat” badge assessment systems (described below) might consider how benchmark assessments in Philadelphia schools’ impacted reteaching of content (Bulkley, Christman, Goertz, & Lawrence, 2010; Oláh, Lawrence, & Riggan, 2010). These studies found that while the benchmark assessments gave teachers a general sense of what needed to be retaught, the incorrect answers did not provide guidance as to the error in students’ thinking. Badge systems may want to consider how their assessments will impact the formative feedback and reteaching methods that can be used when students take an assessment. The online database that houses the principles and the related literature outlines many such considerations badge system developers ought to be aware of.

Some of the most exciting evidence that emerged as part of this research was the impact that different decisions about assessment practices had on learning and how this in turn connected with the research literature. For example, S2R Medals trains youth to become sports journalists. Earners’ badges were associated with a portfolio of their work and encouraged not only the immediate learning community, but the community at large to comment on these
portfolios and provide feedback. This meant that coaches, parents, and general community members were interacting with the learners and their projects, so learners received a variety of feedback from many different perspectives on their work. In contrast, the Sustainable Agriculture & Food Safety program at UC Davis kept portfolios closed to the immediate learning community. These portfolios were assembled by students and presented to a board of judges for evaluation. This closed system was in place partly for the privacy and protection of students, but it also facilitated more formal interaction around the portfolios. It turns out that the advantages and disadvantages of public vs. private portfolios is an enduring strand of research in portfolio assessment (Gillespie, et al., 1996; Stiver, et al., 2011). By connecting this literature with badging practices, this research will help inform other projects while helping those projects inform broader audiences.

One approach to portfolio assessment is not inherently better than the other, but the impact system developers’ choices had on the kind of learning and revision in which the learners engaged is significant. These two projects did not know about each other’s practices. Part of the goal of this research is to connect projects and start a dialogue. When these two projects began conversing with one another, a very productive dialogue occurred, resulting in a better understanding of the kind of learning their assessments were fostering.

Resulting Design Principles and Conclusions

The general design principles for assessing learning in digital badge systems are a result of this process. They are ordered by prevalence among the thirty projects. The first principles are employed by almost all of the projects, while the last principle is used by only three. Badge system developers must consider what kind of learning they want to recognize, and how the assessment principles they use will impact the learning ecosystem.

The development of these principles has led to the need to attach them to the scholarly assessment literature. By bringing in the relevant research literature, both existing and new projects can make informed decisions about their assessment practices, and the DPD project can make recommendations of aspects to consider when employing particular principles. What follows are (a) the ten general design principles and the number of projects who use each principle, (b) the more specific principles under each design principle, (c) one example of relevant research associated with the principle, and (d) an example of a specific practice (also see Table 1).

Use Leveled Badge Systems

Nearly all (twenty-nine) of the thirty projects included some kind of “leveling” system that students would move through as they practiced new skills, as opposed to a “flat” system where all badges have equal value. Sixteen projects created what we deemed “competency levels”, ten used “meta-badges”, and three formed hierarchical categories of badges. Projects using benchmark assessments to promote mastery of a specific skill would do well to learn from Bulkley et al.'s (2010) research on Philadelphia schools, finding that while the benchmark
assessments revealed general categories that needed to be retaught, the assessments were not designed in such a way that a teacher could learn the mistakes in student thinking from the incorrect answers. For example, in the mastery-learning orientation of the BuzzMath project, this leveling meant that small badges for activities marked achievements that add up to larger mastery badges.

**Align Assessment Activities to Standards**

Twenty-six of the projects aligned their projects to existing standards. These standards varied from national and state standards to internal standards set by the parent organizations of the projects. Ten projects used internal standards, seven used national/state, and nine used the Common Core State Standards. Darling-Hammond (1997) discussed the need to raise standards and the system in which they are employed to support teaching and learning. This is relevant, for example, to the Make Waves project because there is already a large community of teachers within the Make Waves community who are mapping the S2R curriculum to their own objectives and standards.

**Use Rubrics**

Sixteen projects used rubrics as an aid to score learner artifacts. Twelve projects developed rubrics for the assessment of specific artifacts, while four used general rubrics. Popham (1997) provided a succinct list of guidelines one should consider when creating and using rubrics. This relates to LevelUp’s practices with rubrics, which are competency based and generated ad hoc by individual teachers. However, the project is looking to standardize the process and pull the rubrics into a system. Their reforming of their practice could be well informed by this literature.

**Use Formative Functions of Assessment**

Fifteen projects provided varying types and amounts of formative feedback to learners. Five projects used peer feedback, three used expert feedback, and seven used a combination of the two. Schwartz & Arena (2009) make the case for choice-based assessments. Many researchers have argued that giving formative feedback enhances the learning experience (e.g. Black & Wiliam, 2009; Shepard, 2007), but Schwartz and Arena argue that the skill of knowing how to ask for formative feedback is a skill not being taught. Some projects encourage students to ask for, give, and use feedback to each other, which may help in building this skill. For example, in the Pathways for Lifelong Learning project, high school peers are also expected to provide formative assessment on blog entries online, as well as participate as panel judges for the final demonstrations and review the student demonstration with a rubric.

**Enhance Validity with Expert Judgment**

Twelve projects used expert judges to evaluate learner artifacts. Nine used experts who were teachers or practitioners, two used computer scoring systems, and one project used an AI
tutor. Popham's (2007) chapter on validity highlights the information and practices teachers should consider to enhance the validity of the claims they make about learning. In the Design for America project, badges are validated by community mentors, so understanding validity of learning claims is particularly important. Peer feedback is given and used for refinement purposes. Badges are not awarded because of feedback given by peers, but artifacts that earn badges may be influenced by that feedback.

**Promote "Hard" and "Soft" Skill Sets**

Eleven projects promote “soft skills” like leadership and collaboration in addition to the “hard skills” they promote. Schulz (2008) discussed the need for students to develop “soft skills” beyond academic knowledge. This is relevant to MOUSE Wins!, a project that wants "the assessment process to be as social as the learning is." There is a feedback loop in the workplace; they want learning to mirror that organic process.

**Use E-portfolios**

Eight projects required learners to collect artifacts in a digital portfolio. One of these e-portfolio systems was open to the public, while seven were “closed,” meaning only the immediate learning community could see and comment on them. Gillespie et al. (1996) provide a review of the recent literature on portfolio assessment and address the topic of private and public portfolios. This is important to S2R Medals because “every S2R participant has their personal Reporter Page on [www.makewav.es/s2r](http://www.makewav.es/s2r).” This serves as an e-portfolio and permits their educators, supporters, friends, family and peers to see and evaluate their work” (S2R Medals Proposal).

**Use Performance Assessments in Relevant Contexts**

Seven projects used performance assessments to evaluate learners. Mehrens, Popham, & Ryan, (1998) provided six guidelines for using performance assessment, and suggested that instructors should be careful in how they prepare students for such assessments lest they compromise the assessment. Sweetwater AQUAPONS faced some of these considerations, as “the badges for each curricular area will be earned through written assessments, photo and video projects, and in-person demonstrations of proficiency” (Sweetwater AQUAPONS Proposal).

**Use Mastery Learning**

In this context we use the term “mastery learning” to mean that learners are given practice until they have mastered a single skill set, and then move to the next skill set. Six projects did this, two of whom used humans to judge “mastery” and one used only a computer. Three projects used a combination of human and computer experts to judge mastery. Duncan & Hmelo-Silver (2009) define and discuss learning progressions, and advocate focusing on a smaller set of focused skills rather than a large set of skills in a perfunctory manner. In the CS2N project, badges in activities supported by AI tutors are validated through the AI tutor and through
automated online testing (through Moodle), or automated detection of in-game events (through Unity) in simulator environments. Instructor approval is used where appropriate in addition to automated tools.

**Involve Students at a Granular Level**

Three projects involved students in the design of the physical badges, as well as in the design of the pathways it takes to earn a badge. Stefani (1994) studies student marks and grades, and their effectiveness in comparison to teacher marks. This is relevant to the Badge Constellation Design Process in Cooper-Hewitt’s Design Exchange, as they are realizing that the badges should have "personality" and personal touched added by students. The process of designing a badge reflects the process that goes into receiving a badge.

**Conclusions and Implications**

By showing projects the practices they have in common with each other, productive dialogues emerge and refinement of practices are suggested. This dialogue also makes projects explicitly aware of the impact their assessment choices have on learning, which they can then evaluate and refine as necessary. The design principles are instrumental in this dialogue, as existing projects can use them to find projects with whom they can engage, and new projects can review and ask questions to those already enacting these principles.

As education evolves more toward open and networked learning, innovations such as digital badges are becoming increasingly significant. For if one is going to use digital badges responsibly in education, they must consider the implications of their assessment practices on the learning process. By making the assessment design principles that emerged from the DML projects open to the public for use and discussion, this work is fostering important conversations about assessment design in digital credentialing and beyond.

By connecting these design principles to the scholarly literature and recommending assessment functions to consider when designing assessments, this work becomes relevant beyond creating a digital badge system; it is relevant to anyone designing assessments for educational programs. These assessment design principles offer a unique perspective on the implications of assessment design for learning, and can serve the larger audience as they design assessments within badging systems or in other contexts.
## Table 1 Design Principles for Assessing Learning in Digital Badge Systems

<table>
<thead>
<tr>
<th>General Design Principle (# of projects)</th>
<th>Description of Principle</th>
<th>Specific Principles (# of projects)</th>
<th>Relevant Research Example</th>
<th>Example of a Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use leveled badge systems (29)</td>
<td>29 of the 30 projects included some kind of “leveling” system that students would move through as they practiced new skills, as opposed to a “flat” system where all badges have equal value.</td>
<td>Competency Levels (16) MetaBadges (10) Hierarchical Categories (3)</td>
<td>Bulkley et al. (2010) found that answers marked incorrectly did not help teachers in designing specific reteaching strategies.</td>
<td>Small badges for activities will add up to larger mastery badges (BuzzMath).</td>
</tr>
<tr>
<td>Align assessment activities to standards: Create measurable learning objectives (26)</td>
<td>Standards varied from national and state standards to internal standards set by the parent organizations of the projects.</td>
<td>Internal (10) National/State (7) Common Core (9)</td>
<td>Darling-Hammond (1997) discusses the need to raise standards and the system in which they are employed to support teaching and learning.</td>
<td>There is already a large community of teachers within the Make Waves community who are mapping the S2R curriculum to their own objectives and standards (S2R Medals).</td>
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</tr>
<tr>
<td>Use rubrics (16)</td>
<td>Projects used rubrics as an aid to score learner artifacts.</td>
<td>Rubrics Developed for Assessment of Specific Artifacts (12) General Rubrics (4)</td>
<td>Popham (1997) provides a succinct list of guidelines one should consider when creating and using rubrics.</td>
<td>Rubrics are competency based and generated ad hoc by individual teachers. However, the project is looking to standardize the process and pull the rubrics into a system (LevelUp).</td>
</tr>
<tr>
<td>Use formative functions of assessment (15)</td>
<td>Projects provided varying types and amounts of formative feedback to learners.</td>
<td>Peer Feedback (5) Expert Feedback (3) Combination of Peer/Expert Feedback (7)</td>
<td>Schwartz &amp; Arena (2009) make the case for choice-based assessments. Many researchers have argued that giving formative feedback enhances the learning experience (e.g. Black &amp; Wiliam, 2009; Shepard, 2007) but Schwartz and Arena argue that the skill of knowing how to ask for formative feedback is a skill not being taught.</td>
<td>At high school level peers participate as panel judges for the final demonstrations and review the student demonstration with a rubric. Peers are also expected to provide formative assessment on peer blog entries online (Pathways for Lifelong Learning).</td>
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<td>Enhance validity with expert judgment (12)</td>
<td>Projects used expert judges to evaluate learner artifacts.</td>
<td>Teacher/Practitioner Experts (9) Computer Scoring System (2) AI Tutors (1)</td>
<td>Popham's (2007) chapter on validity highlights the information and practices teachers should consider to enhance the validity of the claims they make about learning.</td>
<td>Badges are validated by community mentors. Peer feedback is given and used for refinement purposes. Badges are not awarded specifically because of feedback given by peers, but the artifacts that earn badges may be influenced by that feedback (Design for America).</td>
</tr>
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<td>Promote &quot;hard&quot; and &quot;soft&quot; skill sets (11)</td>
<td>Projects promote “soft skills” like leadership and collaboration in addition to the “hard skills” they promote.</td>
<td>N/A</td>
<td>Schulz (2008) discusses the outcry for students to develop “soft skills” beyond academic knowledge.</td>
<td>The project wants &quot;the assessment process to be as social as the learning is.&quot; There is a feedback loop in the workplace, and they want learning to mirror that organic process (MOUSE Wins!).</td>
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<td>Use e-portfolios (8)</td>
<td>Projects required learners to collect artifacts in a digital portfolio.</td>
<td>Open to Public (1) Local to Community (7)</td>
<td>Gillespie et al. (1996) provide a review of the recent literature on portfolio assessment and address the topic of private and public portfolios.</td>
<td>“Every S2R participant has their personal Reporter Page on <a href="http://www.makewav.es/s2r">www.makewav.es/s2r</a> This serves as an e-portfolio and permits their educators, supporters, friends, family and peers to see and evaluate their work” (S2R Medals).</td>
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<td>Use performance assessments in relevant contexts (7)</td>
<td>Projects used performance assessments to evaluate learners.</td>
<td>N/A</td>
<td>Mehrens, Popham, &amp; Ryan, (1998) provide six guidelines for using performance assessment, and suggest that instructors should be careful in how they prepare students for such assessments lest they compromise the assessment.</td>
<td>“The badges for each curricular area will be earned through written assessments, photo and video projects, and in-person demonstrations of proficiency” (Sweetwater AQUAPONS).</td>
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<td>Use mastery learning (6)</td>
<td>In this context we use the term “mastery learning” to mean that learners are given practice until they have mastered a single skill set, and then move to the next skill set.</td>
<td>Judged by Human Experts (2) Judged by Computer Experts (1) Combination of Human and Computer Experts (3)</td>
<td>Duncan &amp; Hmelo-Silver (2009) define and discuss learning progressions, and advocate focusing on a smaller set of focused skills rather than a large set of skills in a perfunctory manner.</td>
<td>Badges in activities supported by AI tutors are validated through the AI tutor and through automated online testing (through Moodle), or automated detection of in-game events (through Unity) in simulation environments. Instructor approval is used where appropriate in addition to automated tools (CS2N).</td>
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<td>Involve students at a granular level (3)</td>
<td>Projects involved students in the design of the physical badges, as well as in the design of the pathways one must take to earn a badge.</td>
<td>N/A</td>
<td>Stefani (1994) studies student marks and grades, and their effectiveness in comparison to teacher marks.</td>
<td>In the Badge Constellation Design Process, Cooper-Hewitt is realizing that the badges should have &quot;personality&quot; and personal touched added by students. The process of designing a badge reflects the process that goes into receiving a badge (Design Exchange).</td>
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Motivating Learning with Digital Badges

Katerina Schenke and Cathy Tran

Abstract: This chapter on motivating learning presents one of four categories of principles uncovered by the Design Principles Documentation Project on recognizing, assessing, motivating, and studying learning in digital badge systems. The Design Principles Documentation Project has followed the development of thirty digital badging projects as they adjusted their intended practices from the initial designs outlined in their proposals to accommodate the realities of their audience and the badging platform. The DPD project aimed to capture the knowledge that emerged in this shift from intended and formalized practices concerning badge system development and transform it into resources that could be used to design or study future badge systems. This chapter also describes how the broader ecosystem, recognition practices, and assessment practices impact motivation, and the tensions between competing conceptualizations of motivation as they relate to digital badges.

Motivating learning with digital badges focuses on how the design of badge systems affects learners’ participation within the badge ecosystem. Researchers and developers appear divided on the role of digital badges in motivating learners. Skeptics of badges “worry that students will focus on accumulating badges rather than making connections with the ideas and material associated with the badges – the same way that students too often focus on grades in a class rather than the material in the class, or the points in an educational game rather than the ideas in the game” (Resnick, 2012). Badge evangelists find promise in having a new way to assess learners apart from the “current multiple-choice form of testing doesn’t measure all that is being learned and de-motivates true curiosity” (Davidson, 2012).

A crucial step in reconciling these two views on badges is the consideration of the ways that their design and function differentially affect learner motivation. Learner motivation in badges projects can mean a variety of things such as motivation to continue in the project (for example, learners attending an after school program), motivation to use the badge system implemented in the project (learners valuing the badges they receive), and motivation to learn (encouraging learners to develop new skills and knowledge forms). In addition, the context under which those motivation practices operate, such as the corresponding assessment and recognition practices within the badge ecosystem, also matter (Goodenow, 1992; Hickey, 1997, 2003). We derived a set of motivation principles from practices that badge developers intended to implement as well as those that were enacted in programs and analyzed how those principles may impact learner motivation. In order to do this, we drew on well-known psychological theories of motivation and consider the effect that context has on the implications that can be drawn using current theories. These principles aren't meant to be prescriptive—the process of
designing a learning environment is not an exact science. Additionally, the process of
categorizing and labeling the motivation principles is one way to conceptualize the hypothesized
effects of using badges on learner motivation. Our goal is to provide perspectives and resources
for educators and badge system developers to consider as they design badge ecosystems and
figure out which badge design elements work best in within their context to motivate learners.

**Assembling Design Principles for Motivating Learning**

To identify the motivational practices in badge ecosystems, we analyzed the 30 projects
funded by the MacArthur Foundation to develop digital badge systems. Our team asked each
project’s staff, through phone and in-person interviews, about design decisions they made to
motivate learners to generate a list of intended practices. In addition, based on their grant
proposals, we flagged other practices that may have unintended motivational consequences based
on motivation research, and that, too, constituted the list of practices.

Below, we present a series of practices (what projects award badges for and how these
badges are awarded) categorized under specific principles (clusters of practices related to a
similar idea), which were then categorized under general principles (a collection of specific
principles that draw on the same motivation construct) for motivating learning with digital
badges. For example, specific principles of “provide privileges” are: “tangible prizes unrelated to
the subject domain” and “peer mentorship positions”. The enactment of the specific principle is
done differently by each project.

In order to come up with our list of principles, we first identified the intended practices
that each project had planned to implement, categorized these practices into design specific
principles by dynamically sorting and re-sorting the practices into different groups of specific
principles. We subsequently grouped specific principles into more general principles that
encompass an overarching theme such as “recognizing identities” or “providing privileges” from
which we could draw on extant literature and motivation research.

It is important to note that practices were grouped into specific principles and principles
based on our reading of motivation in the research literature. We draw on prominent theories (e.g.
Expectancy-value theory; Wigfield & Eccles, 2000) and meta theories (Self Determination
Theory; Ryan & Deci, 2000), of motivation as well as on different traditions (e.g. sociocultural
approaches; Hickey, 2003) in order to derive the complete set of general principles. Drawing
from different theories allows us to gain a more comprehensive view on how motivation may
play out in badge ecosystems since deep and continuous learning does not depend only on the
level of motivation (i.e., amount of engagement) but also on its type (i.e., reason for engagement).
Principles and specific principles were based on both the actual practices of the thirty projects, as
well as areas in motivation that we felt were important to consider based on current discussions
in the field. The eleven general principles that emerged were vetted for feedback and revised
both by representatives from the badge projects as well as attendees at several conferences and
workshops this past year.
An important note is that practices were concrete activities that were extracted from resources and interviews provided by the badge projects, whereas the organization of these practices into principles is more interpretative; these principles are one way to categorize the practices.

**Principles for Motivating Learning with Digital Badges**

The following descriptions of each motivation principle draw on selected examples from the DML competition.

**Recognize Identities**

The development of identity in educational contexts plays a vital role in the choices that learners make. The concept of identity can take a perspective that is focused on the individual and the collective. As such, we present our specific principles considering the two perspectives. Badges can recognize a learner’s role (1) within the badging system and the real-world ecosystems it may represent, such as recognizing their specialization in journalism, engineering, or peer mentoring and (2) a learner’s collective identity by being incorporated into badge projects that themselves target specific groups. Ten projects have developed badges that focus on identity of the individual whereas only four have focused on recognizing roles within the collective (such is the case in Girl Scouts and EarthWorks where the projects themselves target specific groups such as girls and students of Native American background). Tapping into learner’s identity is one way that badge projects can motivate learning and participation.

**Example.** Supporter To Reporter (S2R) Medals intends that badges will motivate learners by recognizing key roles played in a community. S2R Medals recognize the three main S2R roles - journalist, live reporter and peer mentor. Students can pursue their strengths and interest in one of these roles or develop skills in an unfamiliar or new role. For example, a student may achieve a Gold in journalism while remaining at Bronze in coaching. Alternatively, they may aim for Silver in each set.

**Engage with the Community**

Some learners are able to earn badges for their involvement in their communities both at the (1) physical and (2) digital level signifying two specific principles under this general principle. For example, earners can be awarded badges by engaging with members of their immediate community while other projects have designed badges that value interactions with members of the digital community via blog posts and discussion forums. Strengthening relationships with the community can help learners feel more connected and therefore persist within that learning environment (for an example in undergraduate education see Summers, Svinicki, Gorin, & Sullivan, 2002). Nine projects in total have designed badges for engaging with the community.
**Example.** *Planet Stewards* awards learners badges for engaging with their online community and acting as science communicator and collaborator.

**Display Badges to the Public**

Badges are web-enable tokens of accomplished that contain specific claims and detailed evidence about learning. Allowing for the capability to display badges to the public is a feature that badge systems may consider enabling in order for others to recognize that learning. Some projects give learners the option of displaying badges themselves, while other projects automatically display badges for learners suggesting two specific principles of the general principle. Who chooses to display badges has implications for learner motivation and it is thought that giving badge earners a choice of whether or not to display the badges they’ve earned is related to motivation (for readings on choice see Malone & Lepper, 1987). Few projects (nine in total) have practices aligned with this general principle.

**Example.** *MOUSE Wins!* automatically displays learner's badges on their website so that users of the website can see which badges their participants have earned.

**Build Outside Value of Badges**

Some projects integrate practices to give badges value outside of the badge system. These include: (1) having badges count as academic or course credit, (2) showing badges to outside agencies thereby giving badge opportunities outside of the project, and/or (3) documenting the link between the badges and real life applications of knowledge, causing badge earners to value the activities that lead to the badge more (for review see Wigfield & Eccles, 2000). Nine projects in total have made an effort to link badges and their badge ecosystem to outside forms of knowledge.

**Example.** Earners of *4H* badges have the opportunity to earn internships with partner institutions such as NASA because NASA values the badges that *4H* participants have earned.

**Set Goals**

Badges allow for learners to set goals and visualize the previous goals that they’ve accomplished through the accumulation of badges. Specific principles include: (1) displaying the trajectory of badges earned for the learner, (2) allowing the learner to determine this trajectory, and (3) allowing for user-created badges in which learners decide for what and how a badge is awarded (4) allow the provider to determine the learning trajectory and (5) allow the provider to give a personalized recommendation of subsequent goals to the learner. Encouraging learners to set goals and visualize those goals is an important strategy for self-regulated learning in which learners plan and monitor their learning (Zimmerman, 2000). This specific principle is similar to the “Provide routes or pathways” specific principle under the “Use badges to map learning
trajectories” general principle in the recognition strand and a total of eleven projects have implemented badges around setting goals.

**Example.** *BuzzMath* provides learners with clear learning pathways of the badges they have earned. For example, badges are awarded in a progressive manner and displayed in a clear manner to guide learners to the next mathematics activities.

**Promote Collaboration**

Though several projects allow for collaborative efforts, some make a concerted effort to encourage this through awarding group badges for (1) group accomplishments and (2) personal badges for having a role in a group collaboration. Only three projects in total have practices around recognizing collaboration. Research has shown that individuals can learn more in a group than individually, therefore designing badges to encourage collaboration can have an effect on motivation (Yager, Johnson, & Johnson, 1985).

**Example.** *Robotics and STEM Badges using NASA Content* awards badges to groups of learners such that each individual in the group receives the badge for a group accomplishment.

**Stimulate Competition**

Some badge projects have created competition by (1) making badges scarce and therefore more difficult to earn, or (2) use a point system to award badges to earners. The use of competition in badge systems has not been thoroughly investigated within the context of badges. In classroom research, the outcomes related to competition are mixed: when competition is paired with collaboration, we would expect to see beneficial outcomes for learners in those environments allowing all learners to participate in competition (see Hickey, 2003).

**Example.** *Supporter to Reporter Medals* uses limited access to special opportunities as a motivator. The program provides prestigious live reporting opportunities for students who have completed training and performed well. This is reflective of the limited number of live reporting opportunities that are available to students and is a result of a real world constraint. Badges give program coordinators a clear system for allocating these opportunities.

The type of learning that projects recognize as worth earning a badge for has implications for motivation. For example, projects can award badges for (1) the effort that learners make or (2) for the learner’s performance. Learners who think they can grow their intelligence and are rewarded for their effort or improvement instead of their performance are associated with being more persistent on tasks and more orientated towards learning and improving (Dweck & Leggett, 1988; Henderson & Dweck, 1990). Therefore, how learners interpret the feedback they receive,
whether for their improvement or for their performance, has implications for motivation. Two projects have designed badges that are awarded based on performance and none have designed badges around learner improvement. Even though we did not see the enactment of the improvement specific principle, motivation research suggests that recognizing improvement can be beneficial for learners.

**Example.** *MOUSE Wins!* has designed a badge that is awarded depending on the number of blog posts learners write. This is indicative of how learners perform. None of the projects in our study have designed badges based on the amount of effort learners put in, but one can imagine awarding learners badges based on improvement or effort.

**Utilize Different Types of Assessments**

Projects utilize different types of assessments for learning such as (1) computer, (2) peer, (3) expert, or (4) self assessment. While computer assessment may benefit from being more efficient and free from social judgment, peer or expert assessment may be more meaningful and therefore increase the quality of work put into earning the badge. This general principle is an example of assessment having implications for motivation. Interestingly, most projects who utilized different types of assessment used peers (seven projects). Learners who are asked to assess themselves on a task may reflect more deeply on their own learning than learners who are assessed using a computer.

**Example: Sweet Water AQUAPONS** intends to implement a variety of assessments. The program structure includes staff approving requests for badges and peer assessment. Students are also required to self-assess their accomplishments, as they upload evidence to apply for badges. Badges are also earned through formal scoring of written assessments, photo and video projects, and in-person demonstrations of proficiency.

**Provide Privileges**

Learners are awarded a variety of privileges in response to earning a badge such as (1) prizes, (2) the opportunity to take part in new activities, (3) access to internships, and (4) becoming a peer mentor. The prize or privilege that is awarded to learners as a result of earning a badge has implications for whether or not earners choose to earn the badge or not. Giving learners access to internships or to new activities within the badge project are thought to be more valued by learners than simply awarding physical prizes to learners (see Malone & Lepper, 1987). Additionally if becoming a peer mentor is of value to the learner, designing a badge around peer mentorship can be very effective for learner motivation. A total of fourteen projects have designed badges under the principle providing privileges.

**Example.** *Sweet Water AQUAPONS* aims to motivate students to learn about aquaponics by helping ensure the credential will have value to external employers. The program
reaches out to partner organizations in education and business and publicizing the portability of students' acquired skills to related disciplines.

Constraints and Tensions when Motivating Learning with Badges

Motivation plays an integral part in the discussion around implementing badge systems. Whether motivation is purposefully integrated into the design of a badge or occurs as a byproduct of designing a badge for another purpose, understanding the implications of using a particular badge on learner motivation is vital for the research and interest on badges to continue. Badges can be designed to promote motivation that is adaptive in learners. In order to understand these implications more thoroughly, we discuss tensions that occur within the category of motivation, as well as between recognition and assessment.

Tensions Within this Category

It is difficult to make assumptions about the outcomes of the motivation principles that we have derived without understanding the context in which these principles are used. For the principle of “Providing privileges,” for example, there is not a clear yes or no answer to whether that principle should be enacted in badge systems and the exact effect that the practice will have on learner outcomes. Using established research from the motivation literature can provide badge issuers with ideas of the effects of the design of a particular badge system on learner motivation, however, it is important to note that this literature was developed within very specific contexts such as lab-based studies or in the context of classrooms. Incentives in themselves do not necessarily have positive or negative motivational influences. Rather, it is studying them in the contexts in which they operate that provide valuable insight about their impact.

There are many ways to provide privileges to badge earners. The privilege of allowing learners to be peer mentors may be motivating for learners because students feel in charge and are eager to help their tutees improve and as a byproduct put forth more effort and learn more themselves (Chase, Chin, Oppezzo, & Schwartz, 2009). Providing prizes unrelated to the subject domain can undermine motivation and learning for complex activities such as problem solving but have no effect on rote memorization (Dweck & Leggett, 1988). Giving learners access to new activities may be appealing to some students but others may be motivated to stay with easier tasks rather than choose harder tasks (Ames & Archer, 1988). As such, badges for privileges will be differentially pursued depending on individual differences and the context at hand.

Tensions Between Categories of Practice

Though this project focuses on principles for motivating learning, it is crucial to acknowledge the interactivity of our strands and how assessment and recognition principles, together, influence learner motivation. This is illustrated in the program Supporter to Reporter (S2R) Medals. S2R Medals gives youths a glimpse at what it is like to be a journalist in the sports reporting world. More than 2,000 individuals have developed their reporting skills through S2R and reported at more than 1,000 events including the 2012 Olympic Games. In this program,
badges are intended to guide students along the path from novice to mentor, enabling advanced students to become a source of peer assessment for newer students.

In considering how recognition and assessment practices work together to influence learner motivation, what learning is recognized has implications for how that learning is assessed and how that learning can be motivating. For example in S2R Medals, recognition practices include having badges credentialed by the community by allowing experts to issue badges, having those badges be valued by an external community, and using badges as a means of external communication of learning. Participants of the S2R Medals program are recognized by the journalism and sports reporting community and consequences of earning particular badges give learners the privilege to report at sports events that are meaningful to the learner thereby influencing the learner’s motivation by increasing their value for the task. Assessment practices used by S2R Medals include leveled badges from bronze to gold that are indirectly aligned to standards that teachers are using in school and are awarded by computer scoring systems, peers, and experts (different types of assessment). These various assessment practices have implications for motivating students. For example, using leveled badges allows learners to set goals for themselves and being assessed by peers has different implications for motivation than being assessed by a computer scoring system.

Considering how motivation works in the context of recognition and assessment principles is vital to understanding the implications of these practices on learner motivation. The current literature around motivation was not developed with this context in mind, and before conclusions can be drawn about how to motivate learners in these environments, a complete understanding of the entire context (not just recognition and assessment, but also the context of the project such as after school or digital) is necessary.
## Table 1: Design Principles for Motivating Learning in Digital Badge Systems

<table>
<thead>
<tr>
<th>General Design Principle</th>
<th>Description</th>
<th>Specific Design Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recognize identities</strong></td>
<td>Motivate achievement by creating badges named for the careers or roles that learners wish to fill or by acknowledging the groups that learners are a part of.</td>
<td>Roles within a System (Youth Filmmaker, Who Built America, Design Exchange, Design for America, Pixar, EarthWorks, MOUSE Wins, Girl Scouts, NASA Robotics, S2R Medals) Targets a Specific Group (4H, EarthWorks, Girl Scouts, Manufacturing Badges)</td>
</tr>
<tr>
<td><strong>Engage with the community</strong></td>
<td>Badges awarded for interacting with communities can increase motivation through building social relationships and shared goals.</td>
<td>Involvement in Local Community (Pixar, EarthWorks, Manufacturing Badges, S2R Medals) Involvement in Digital Community (Global Pathways, Design for America, Intel, MOUSE Wins, Planet Stewards)</td>
</tr>
<tr>
<td><strong>Display badges to the public</strong></td>
<td>Showing off learners’ achievements to the public as part of regular operation could motivate them to achieve.</td>
<td>Learners can choose to share their badges with others (Global Pathways, Girl Scouts, Nature Badges, SA&amp;FS) Learners do not choose which badges to share with others (Youth Filmmaker, MOUSE Wins)</td>
</tr>
<tr>
<td><strong>Build outside value of badges</strong></td>
<td>Through partnerships or simply recognizing necessary skills, ensuring that stakeholders in public value a set of badges will motivate learners to earn them.</td>
<td>Badges as Academic Credit (Global Pathways, 4H) Evidence for Outside Opportunities (News Hour, Manufacturing Badges) Real-life Application of Knowledge (CSSN, YALSA, S2R Medals, SA&amp;FS, AQUAPONS)</td>
</tr>
<tr>
<td><strong>Set goals</strong></td>
<td>Badges allow for learners to set goals and visualize the previous goals that they’ve accomplished.</td>
<td>User-created Badges (Design Exchange, Design for America, Pixar, PASA, SA&amp;FS) Display of Goal Trajectory (BuzzMath, CSSN, Pixar, PASA, NASA Robotics) User-determined Learning Trajectory (LevelUp)</td>
</tr>
<tr>
<td>Motivating Learning with Digital Badges</td>
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<td>----------------------------------------</td>
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<tr>
<td>Recognize collaboration</td>
<td>Specifically recognizing collaborative achievements can help motivate students, because they see the tasks differently.</td>
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<td></td>
<td>Badge for Group Accomplishment (LevelUp)</td>
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<tr>
<td></td>
<td>Personal Badge that is Earned Through Collaboration (News Hour, Digital On-Ramps)</td>
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<tr>
<td>Stimulate competition</td>
<td>Scarcity, point systems, and leaderboards help create competition between learners, which can motivate some to try harder.</td>
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<tr>
<td></td>
<td>Use of Points System (Youth Filmmaker, Who Built America)</td>
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<tr>
<td></td>
<td>Scarcity of Badges (LevelUp, S2R Medals)</td>
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<tr>
<td>Recognize different outcomes</td>
<td>Recognizing both performance-based and improvement-based achievements can have complex effects on learner motivation.</td>
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<tr>
<td></td>
<td>Performance-based (Intel, MOUSE Wins)</td>
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<tr>
<td></td>
<td>Improvement-based</td>
<td></td>
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<tr>
<td>Utilize different types of assessment</td>
<td>Encountering different assessment methods has complex consequences for motivation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peer (Youth Filmmaker, Who Built America, Design for America, EarthWorks, MOUSE Wins, PASA, SA&amp;FS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expert (Digital On-Ramps, NASA Robotics)</td>
<td></td>
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<tr>
<td></td>
<td>Self (SA&amp;FS, AQUAPONS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer (CSSN)</td>
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<tr>
<td>Provide privileges</td>
<td>Encourage earning badges by granting privileges to those who do.</td>
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</tr>
<tr>
<td></td>
<td>Prizes (Who Built America, NASA Robotics)</td>
<td></td>
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<tr>
<td></td>
<td>Peer Mentorship (Who Built America, Pixar, Nature Badges, S2R Medals)</td>
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<tr>
<td></td>
<td>Peer Mentorship (LevelUp, Who Built America, News Hour, BuzzMath, Design Exchange, Pixar, Nature Badges, S2R Medals)</td>
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</tr>
<tr>
<td></td>
<td>New Activities (Youth Filmmaker, News Hour, BuzzMath, Design Exchange, Planet Stewards)</td>
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</tr>
<tr>
<td></td>
<td>Internships (PASA, S2R Medals, SA&amp;FS)</td>
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</tr>
</tbody>
</table>
Motivating Learning with Digital Badges

References


Studying Learning with Digital Badges

Daniel Hickey

Research and evaluation are contentious topics in education. This is because people disagree on what counts as “evidence” and what methods count as “scientific.” A 2001 report by the National Research Council argued that the “gold standard” of scientific educational research is randomized experimental trials. But the NRC also recognized that many of the most important ideas that might be tested in experimental research are unlikely to be discovered in experimental studies. This seems certain to be the case with digital badges in education.

The research designs introduced here are tentative and are intended to begin shaping conversation about where the systematic knowledge associated with digital badges is going to come from. The other three sets of badge design principles are more general characterizations of the specific practices that emerged across the thirty projects as they figured out how to use digital badges in their contexts. These principles should be quite useful for others who wish to use badges—particularly when the badges are linked to examples in projects and to relevant research resources. But these other badges design principles are not offered as “hypotheses” to be tested in experimental studies. Even if they did present testable hypotheses, the results would probably not generalize from the context where the experiment was conducted to other badging contexts where those findings might be applied. Rather these badges design principles are intended to be useful guidelines to help build systematic knowledge within the nascent badging community and to help newcomers to digital badges find and use the most relevant insights.

Research and Evaluation of Digital Badges

Thanks to the DML competition and extensive media coverage, many schools and programs are considering using digital badges. This means that many are also beginning to ask about the research evidence concerning the effectiveness of digital badges. Digital badges are so new that there are very few published studies because just a handful of studies have yet to make it through the peer review process. Grant and Shawgo’s (2013) annotated bibliography provides a nice summary of current badges research and provides additional relevant resources from other contexts. After the initial badges competition, HASTAC announced a separate research competition to study digital badges and made awards to five badges research projects. Some of these will be discussed below.

Few of the awardees included any formal research or evaluation studies in their original proposals. Notably, the DML 2012 competition did not require that proposals include detailed evaluation plans. This was probably a wise decision because requiring detailed evaluation plans may have led projects to prematurely search for “summative” evidence that badges “worked” before they had a chance to maximize the formative potential of digital badges to support
learning. However, interviews with project leaders whose badge systems are now in place revealed that many were starting to think quite seriously about the sorts of studies they might conduct.

The issue that this paper addresses is that most of the project leaders were unclear as to where they might start in studying learning with digital badges. And only a few of them had even begun to grapple with the far-reaching idea of using the evidence contained in the digital badges in their research. Compare to the other three categories of principles uncovered in the DPD project, the principles proposed here are quite tentative, and draw on a broader set of ideas about educational research.

Three Important Distinctions for Studying Digital Badges

Attempting to make sense of the possible kinds of studies that might be carried out with digital badges revealed three dimensions for thinking about research: systematicity, purpose, and evidence.

Systematicity. Arguably, the distinguishing feature of “research” is that it is systematic. Research involves systematically gathering some sort of evidence and attempting to document things in a way that could inform others. The design principles that the DPD project is identifying for recognizing, assessing, and motivating learning are mostly not coming out of systematic studies. In other words, the thirty projects are systematically developing badging practices, rather than more general principles. The DPD project is attempting to capture this more informal knowledge as it emerges as teams get their badge systems up and running.

Purpose. Building on the existing assessment literature, one can distinguish between summative studies “of badges” and formative studies “for badges.” Summative studies aim for a more naturalistic examination of the way the world is, while formative studies are designed as more interventionist efforts to change things. While most summative studies are intended to be formative, they do so less directly. One can also distinguish transformative research that examines how entire learning ecosystems are changed or created around badges.

Evidence. There is a distinction between studies that do not use the evidence of learning contained in digital badges and studies that do use this evidence. What makes digital badges unique is that they contain the actual evidence (or links to evidence such as artifacts produced by learners) to support particular claims of proficiency or accomplishment. There is usually a lot of negotiation involved in deciding what learning should be recognized with badges and how that learning will be assessed. As such, the evidence contained in badges will embody the values of the program or organization that issued them. As the DPD project is learning, 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. This seems to bolster the credibility of the information of the information in the other projects that were able to negotiate these issues. Taken together, these observations suggest that information contained in digital badges has enormous potential for summative, formative, and transformative research on learning.
Focusing on systematic studies and crossing purposes and evidence yields six research designs shown in Table 1.

Table 1: Six badge research designs.

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Using Conventional Evidence</th>
<th>Using Evidence in Badges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summative</td>
<td>1. Research OF Badges</td>
<td>4. Research WITH Badges and OF Badges</td>
</tr>
<tr>
<td>Formative</td>
<td>2. Research FOR Badges</td>
<td>5. Research WITH Badges and FOR Badges</td>
</tr>
<tr>
<td>Transformative</td>
<td>3. Research FOR Ecosystems</td>
<td>6. Research WITH Badges and FOR Ecosystems</td>
</tr>
</tbody>
</table>

**Principles Within This Category**

The following descriptions of each research design draw on selected examples from the DML competition as well as the studies being conducted by the awardees in the 2013 HASTAC Badges Research Competition.

**Study Badge Impact: Research OF Badges**

Summative studies of digital badges are likely to be the largest category of badges research. Some will rely more on interpretive methods and qualitative evidence. For example, HASTAC Badges Research awardee Katie Davis (University of Washington) is studying how students and teachers in the Providence After School Alliance experience the badges used to give high school credit for expanded learning opportunities. Davis and her team will use interviews, questionnaires, and observations to explore (a) how badges fit in the academic and peer culture, (b) the role that badges play in motivation and achievement, and (c) whether badges connect in-school and after-school experience. Likewise, one of the studies being carried out by HASTAC Badges awardee Jan Plass (New York University) falls in this category. Plass and colleagues will video record game play in publicly available games with and without digital badges. They will then analyze those recordings for trends and insights into participants’ perceptions and valuations of badges, and for changes in gameplay patterns due to badges. Other summative studies of badges might rely more on correlational methods and focus on individual differences and variables. In one of the first published peer-reviewed studies of digital badges, Abramovich, Schunn, and Higashi (2013) explored mastery-based and participation-based badges in an intelligent tutoring system for teaching proportional reasoning in mathematics.
They measured self-reported motivation toward mathematics before and after the game, pre-achievement of proportional reasoning, and opinion toward badges. Correlational analyses revealed both positive and negative effects of badges on learner motivation, and that these finding interacted in turn with student ability and types of badges. The Badge Impact Survey (BIS) that Jan Plass will develop based on the results his initial observational study promises to be quite useful in this class of studies.

Other studies of the impact of digital badges will use experimental methods, such as creating different versions of the same types of badges issued. For example, the final study that Plass has proposed will modify a geometry game to examine the impact of two different types of badges. They will compare mastery badges (based on players’ own progress mastering learning goals) and performance badges (based on players’ performance relative to others). They will examine impact of the different badges on a range of individual outcomes, including motivation and learning. This study promises to provide generalizable principles about the impact of these two common types of badges in game-based learning environments. Other summative studies will be more consistent with typical program evaluations. While DML awardees were not required to include formal evaluations of their badging programs, many of them are now planning to evaluate the impact of badges as part of their larger organizational mission.

**Improve Badge Impact: Research FOR Badges**

Other studies will formatively intervene more directly in badge system design. One distinctly formative effort is the study proposed by HASTAC Badges Research Awardee Jim Diamond of the Educational Development Center. Diamond has already been working intensively with the DML/Gates 2012 Awardees Who Built America? (WBA) teacher mastery badge system. Diamond’s study is asking some of the same questions as Davis’ study of PASA. For example Diamond is asking about the role that WBA badges play in teacher professional development, and examining the ways that badge-related activities influence the development of an online teacher professional development community.

What pushes this research into the formative category is that Diamond is asking these questions while directly participating in efforts to build the badging system and the online professional development network. Studying things as they are changing quickly becomes complicated. And studying one’s own practice makes it hard to be “objective.” Diamond certainly recognized this in his proposal. This is why he is using design-based research (DBR) methods. As articulated by Paul Cobb and colleagues in 2003, DBR builds “local” theories in the context of iterative refinements of practice. Generally speaking, DBR studies start with some relatively general design principles for getting from the current state of affairs to the desired state of affairs. The back and forth process of translating the general principles into specific features yields specific design principles. Importantly, this process also reveals the key aspects of the learning context that support the specific design principles. It is this “embodiment” of the design principles in learning contexts that is presumed to generate useful insights that others can readily build on (Sandoval, 2004).
Two ongoing expansions of badging efforts should offer numerous opportunities for systematic formative research of digital badges. A number of researchers and graduate students were involved in efforts to design badge systems for the 2013 Summer of Learning in Chicago, and many will be involved in perhaps as many as a dozen similar citywide efforts in Summer 2014. Another context in which extensive formative research for badges is being carried out is a collective of informal learning organizations in New York City known as HiveNYC. While it is beyond the scope or timeframe of the DPD project to track all of these efforts, it appears certain that new models of practice for formative studies of digital badge systems will emerge from them.

**Improve Badge Ecosystems: Research FOR Ecosystems**

Many projects are using digital badges to create new learning ecosystems or transform existing ones. Some of the projects are beginning to study this process systematically. Consider the pilot study carried out by Global Kids of a new badging system for their youth programs. A DML award paired them with DML Badge System awardee Learning Times to implement BadgeStack in Global Kids’ Race to the White House and Virtual Video Project programs. The report of the pilot study provides some examples of what this might look like. The report of the pilot study describes how badges impacted the educational programs that Global Kids had already developed. For example, they found that:

Global Kids youth leaders received confirmation 48 times that evidence submitted of their work met the requirement of one of thirteen different educational objectives in their programs. At the same time, youth leaders received confirmation ten times that their evidence did not meet the requirements. Both took extra time—for the youth to submit the evidence and the GK staff to review and evaluate—but the goal of providing formative assessment was significantly advanced (2012, p. 6).

The report explained that this sort of assessment had never been carried out in the educational programs that Global Kids offer. Other systematic studies of the transformational effects of badges on ecosystems are likely to emerge in the Summer of Learning and various Hive projects. Another example is the dissertation study being conducted by Rafi Santo. A grant from the New York Community Trust is supporting his extended study of the diffusion of innovations in the Hive NYC. This study is not focusing specifically on digital badges. But a DML award to Global Kids is ensuring that badges are systematically implemented across the Hive NYC community. This and other such efforts promise to provide more specific research design principles for studying the creation and transformation of learning ecosystems via badges and other specific innovations.

Formative studies of entire learning ecosystems are incredibly complex. There are many variables to consider, numerous principles and features to be refined, and many methods that might be used. There are also complex issues that arise when attempting to link the learning of students/mentees with the learning of teachers/mentors. While Jim Diamond’s study certainly has some of these characteristics, it seems like he made a wise decision to tame some of that
complexity by staying within the DBR framework. However, as the badges community matures, it is certainly going to need to tackle this complexity. Fortunately, a new strand of DBR known as Design-Based Implementation Research (DBIR, Penuel et al., 2011) aims to address these additional challenges. In particular, DBIR explicitly addresses (a) the existence of multiple stakeholders with different perspectives, (b) the crucial and unique role of educators and mentors in DBR, and (c) a concern with developing capacity for sustaining change in systems.

**Study Badge Impact with Badge Evidence: Research WITH and OF Badges**

Using the evidence contained in badges offers new opportunities for summative research of badges. This includes studies of the credibility of claims made in badges. This question naturally has come up a lot around digital badges. Jacobs, in a 2012 article in US News & World Report suggested badges might someday overturn the monopoly that colleges currently hold on formal credentials—but only if badges are proven credible. As badges begin to function as more formal credentials, employers and college admissions officers are wondering about the reliability of the assessments behind the badges and validity of the claims made in badges. Some have noted that the credibility of conventional credentials (grades and transcripts) is seldom systematically scrutinized. Nonetheless, more formal badges are likely to trigger studies using conventional criteria from educational and psychological testing (e.g., internal reliability, construct validity, generalizability, etc.). Mozilla’s Carla Casilli (2012) argues that being web-enabled means that the validity of the claims made in any badges will ultimately be crowdsourced. This means that evidence from formal reliability and validity studies might be meaningless if relevant personal or professional networks collectively ignore or dismiss that evidence. Casilli points out that if this turns out to be true efforts to understand the credibility of badges will have to look beyond the validity literature to consider research about the credibility of information on the Internet. One promising example is Fogg’s (2003) taxonomy of credibility, which includes presumed, surface, reputed, and earned credibility.

The evidence contained in digital badges has many other potential uses. The aforementioned pilot study of badges at Global Kids provides initial examples of the how programs can use the evidence to study how learning occurs in their programs. Before Global Kids introduced badges, their primary evidence of learning in program evaluations were summaries of blog entries that students were asked (but not required) to make. With digital badges it was simple to link to a detailed description of the badges that were offered to program participants. Additionally, the details of who earned what badges provide a surprisingly comprehensive picture of the learning that was supported by the program. Examining the order in which badges were earned also allowed Global Kids to begin studying the paths that learners took through their programs. Given the challenges that many schools and programs face in evaluating and studying learning, the introduction of digital badges seems poised to unlock enormous potential in this regard.
Improve Badge Impact with Badge Evidence: Research WITH and FOR Badges

The evidence contained in digital badges also has the potential for systemic efforts to formatively improve badge systems. Consider for example, the work of Stacy Kruse, Creative Director of DML 2012 awardee Pragmatic Solutions. Kruse is collaborating with the Digital On-Ramps project in Philadelphia and several educational initiatives at the Corporation for Public Broadcasting. As Kruse put it in response to an interview questions about badges research, “before I started working with digital badges, I was working on learning analytics.” This kind of experience has left Kruse and colleagues quite enthusiastic about building learning analytics directly into the badging systems they are building, and using those results to dynamically refine what badges are available, how they are displayed, etc.

Interviews with other DML awardees uncovered some other promising efforts to use the evidence in badges to transform badging systems. GoGoLabs CEO Lisa Dawley and the Planet Stewards project are using badges to connect educational content from the National Oceanic and Atmospheric Administration to the Next Generation Science Standards. One of their challenges is mapping the game-like curricular “quests” to the standards. Such mapping is notoriously difficult and a major obstacle to standards-based reform. Curricular activities naturally touch on multiple standards, and systems need redundancy so that students and teachers can select from multiple activities. Because badges can be more specific and because they contain actual evidence of learning, they open up entirely new formative possibilities for mapping. This same evidence can then be used summatively to examine the learning trajectories that students take.

Improve Badge Ecosystems with Badge Evidence: Research WITH Badges and FOR Ecosystems

Eventually researchers are likely to begin using the evidence in digital badges to systematically study and improve entire learning ecosystems. In this way it seems possible that digital badges might ultimately transform the entire learning analytics movement. But this seems unlikely to even get started until clear research design principles for summative and formative studies using the evidence in badges emerges.

Table 2. General Design Principles for Studying Learning in Digital Badge Systems

<table>
<thead>
<tr>
<th>General Design Principle</th>
<th>Description</th>
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<tbody>
<tr>
<td>Research OF badges</td>
<td>Often using interviews and surveys, this research aims to study the badge system's impact and integration into learners' lives.</td>
</tr>
<tr>
<td>Research FOR badges</td>
<td>Research is explicitly intended to feed back into the badge system to iterate its design and better achieve its goals.</td>
</tr>
<tr>
<td>Research FOR ecosystems</td>
<td>Transformative research examines how entire learning ecosystems are changed or created</td>
</tr>
</tbody>
</table>

Research WITH badges & OF badges
Research uses the evidence in badges to study the system, including the validity of its assessments and how learners moved through it.

Research WITH badges & FOR badges
Implement systematic research to improve badge systems, by analyzing the badges that were issued.

Research WITH badges & FOR ecosystems
Eventually studies may analyze badges across wide badge ecosystems to find ways of improving the function of entire learning networks and culture.

References
Appendix: MOUSE Wins!

Timeline

MOUSE had started working on digital badges for internal use before the MacArthur/HASTAC Badges for Lifelong Learning competition, beginning the design process in 2009 and deploying their first set of badges in 2010. They became a beta partner for Mozilla’s Open Badge Infrastructure (OBI) in the spring of 2011 “to connect participants’ profile data to external social and professional network sites online with the goal of releasing public-facing badges for a pilot group of advanced leadership high school students from the MOUSE Corps program” (DML Proposal). In 2011, the program developed two features: the Wins!Tracker, a tool to aggregate micro-achievements into one place, and Microprojects, posted as monthly creative challenges in which users can earn achievements for successfully completing the task. Relative to Microprojects, MOUSE designed a peer to peer issuing system in February 2013 called Peer2Peer Awards, which enabled youth to issue Wins! to one another for demonstrating inspiration, creativity, and technical savvy on projects. In October 2013, MOUSE launched new features for their certification badges, which included a visual redesign of the graphics and increased flexibility in the sequence with which learners complete the learning modules.

Summary

MOUSE offers opportunities for youth to develop skills and dispositions that can translate into the workplace and apply across professional settings. The program trains youth to join teams of help desk experts who provide technology support during the school day. This offers an environment that mirrors the workplace and enables students to gain practical experience. In school, youth receive the opportunity to lead in the field of technology, cultivating skills, and strengthening identities as valued contributors in technology-driven environments, in preparation for the careers and workplace that they would eventually enter. MOUSE explains that their “goal has always been to capture the milestones that emerge along the way as points of reflection (and as wayfinding devices) that empower the user to pursue pathways forward and demonstrate their expertise in learning and professional contexts where not enough of their experiences are being counted” (HASTAC MOUSE Q&A). By introducing youth to communities of practice, MOUSE enables them to gain exposure and develop their skills and teamwork in an age-appropriate professional work setting. The program extends students’ experience after school by connecting them with a peer community with shared interests.

In 2011, MOUSE won a grant from the MacArthur Foundation through the Digital Media & Learning competition to implement a digital badge system to support lifelong learning. Through the grant, MOUSE integrated badge-based credentialing into its pre-existing network of
students, educators, and institutions. This network forms a system of support for youth, focusing on developing their digital, computational, technical, and interpersonal skills. The badges were designed to recognize students for skills and community-building across this spectrum. The program is partnering with schools and organizations in New York, California, Chicago and 15 other regions.

The “MOUSE Wins!” badging system is partly designed to grow interaction between its established sub-networks to form a stronger online community at the national level. Youth can extend their experiences at the local sites to the broader community online by interacting with other individuals with shared interests. To this end, MOUSE has rolled out two kinds of badge types, called “Community Wins!” and “Certification Wins!”, recognizing learners for interaction and engagement with the community as well as for mastering a set of digital skills.

For Certification Wins!, the project essentially designed a system to recognize learners’ successful completion of learning modules, through which youth develop digital skills and literacies. The badge system charts the learning pathways of students as they develop the technical skills needed to help their local school communities. Students can earn micro-credentials for completing activities in a specific learning module, aggregating micro-credentials to ultimately earn the certification badge. By building an online credentialing system, MOUSE creates the ability for students to connect their achievements and pathways of learning. The badges also give focus to skills and accomplishments that do not receive much attention but are critical to the function of school communities and recognize students whose talents may otherwise escape notice.

Community Wins! aim to recognize students for fulfilling their duties on local MOUSE squads and build positive interactions between squads online. Students are recognized for closing tickets, posting blogs, and commenting on others’ work.

Learners are incorporated into the assessment process by empowering them with the ability to issue badges to other users, contributing further to the social process of learning and highlighting peer recognition of achievements. MOUSE described that “this growing ecosystem for learning, participation, and assessment targets domain-specific outcomes in the areas of technology, digital literacy, computation, and 21st Century skills” (DML Proposal). Along this thread, MOUSE designed a learning process that reflects the feedback loop established in industry contexts.

MOUSE Wins! helps carry student learning that begins in school beyond the school day. The online community provides a source of support wherein learners can engage one another, as they interact and earn badges for their learning and achievements. The program works to appeal to youth’s interest in media and technology, help them understand its practical applications, and keep them engaged in developing their skills and literacies within a thriving community. MOUSE aims to promote developmental outcomes and provide ongoing support to youth as they continue on their pathways of learning.
Evolution of Practices and Relation to Principles

What follows is a list of practices as they relate to the general and more specific design principles in each category of practice. The headings name a (a) General Principle, (b) Specific principle, (c) Specific practice. The paragraphs below each heading detail the project’s (a) intended practice, (b) enacted practice, and (c) how that practice relates to the specific and general principles.

Design Principles for Recognizing Learning in Digital Badge Systems

The MOUSE system aimed to use badges to recognize a range of hard and soft skills that would be used by its technically gifted students in their eventual workplaces. The achievements chosen for recognition reflect students’ experience in the school-based MOUSE tech support team program, but as students move through the badge system, they learn general skills like effective communication and teamwork that will be useful to them in a wide variety of careers.

Use Badges to Map Learning trajectory > Provide routes or pathways > Credential as a means to track trajectory

MOUSE intended to employ badges as a way to map students’ pathways and learning trajectories. As described by MOUSE Senior Program Manager Meredith Summs, students progress from “users of technology to specialists in applied technologies and ultimately to makers and creators” (DPD Interview Feb 2013). One of the functions of badges is to connect students’ on-site learning of practical skills and applications to an online achievement system, which would chart the growth of youth and provide them with opportunities to build on the achievements they earn. Credentials are implemented as a formative tracking mechanism, allowing students to track their progress completing the modules and to make changes if their trajectory is not where they would like it.

In the initially enacted badge system, users start out with the certification curriculum and accumulate micro-achievements called Wins!, which later add up to macro-achievements, or badges. MOUSE is still in the early phases of mapping the trajectory. Equipped with the capacity to better track analytics, they are starting to see interesting data bubble up. For instance, the data shed light on how peer-issued Wins! affect the likelihood of youth to submit more projects. The badge system guides students toward the achievements deemed most important as they can see how micro-achievements add up to specific macro-achievements, which take the form of digital badges.

This practice is an example of how a badge system can use badges to map students’ learning trajectory. As intended, students move through the badge system along a trajectory from users to creators; the badges they have earned show them how far along they are on that path.
Have experts issue badges > Credentialed via community > Badges for community

The MOUSE Wins! system intended to include badges that recognize users’ participation and engagement. The initial Community Wins! were intended to reward the number of blog posts, cases (project tickets) case tracking software, comments posted involving troubleshooting issues or open dialogue and discussion on relevant topics.

Figure 1: Intended MOUSE Community Wins!

MOUSE started out with these four initial Wins! and then also introduced four new Community Wins! at the beginning of 2013, including the Creativity, Technical, Inspiration, and Motivator Wins! With the Motivator Win!, MOUSE offers recognition to learners for giving feedback to others and awarding Wins! to their peers.

As enacted, Community Wins! are dynamic and tied to users’ activity in the system, but they do not feed into a community badge. The feature of community badges is an important element of the system, as it supports culture of use, draws engagement to the system, and establishes the values of the community. While they do not lead to OBI issued Open Badges, there is the potential to issue these as badges in the future.

The initial Community Wins! depended on the computer system to recognize, based on MOUSE members’ interaction with the mousesquad.org website. However, as the system developed, MOUSE wanted to recognize achievements that could not be
readily measured by the computer. The Creativity, Technical, and Inspiration Wins! are awarded through peer feedback instead, by a community of peer experts.

This reflects the design principle of “have experts issue badges,” specifically where the issuing party is the peer community itself. As students gain credentials through the system, they are moving along a trajectory toward expertise in the social and technical skills needed to perform technology support.

### Have experts issue badges > Credentialed via community > Peer awarded Wins!

MOUSE intended to give peers the capacity to recognize one another’s learning through awarding Wins! This involves a crowd-sourced element of recognizing one another’s learning, where the community can issue badges for learning.

As enacted in early 2013, Peer2Peer Awards are issued under the umbrella of Community Wins! As of November 2013, MOUSE members are awarding these achievements, and there will be a much clearer picture of how students use it by the time they have had a full school year to grant each other peer awards. From early data, usage is on an upward trajectory.

The design of these Wins! as Peer2Peer awards is an example of community recognition, which we have classified under “have experts issue badges,” even though peers may not always be seen as experts. MOUSE’s intent for this practice was to mirror how peer recognition of team contributions occurs in the workplace. Recognition by others who are on the same level as the recipient is as important in technical workplaces as recognition by those higher up the corporate ladder.

### Recognize diverse learning > Badges for both hard and soft skills

Community Wins! and Certification Wins! aimed to recognize a range of competencies in both hard and soft skills. MOUSE created certification badges that encompass micro-achievements that represent diverse skill sets. The focus of the program is a mix of computational and workplace literacies.

The project is awarding badges for "hard and soft skills." The majority, or at least half, of badges are awarded through MicroProjects. The MicroProjects are monthly challenges in which youth can tackle by posting their work in an electronic or multimedia form. For example, in November 2013, MOUSE challenged students to create animated GIF images themed for ThanksGIFing, helping them develop a granular skill that is popular in the Internet culture. Peers can then award Wins! to recognize their work for aspects such as creativity, inspiration, and technical skill.

As enacted, the diverse focus of Community Wins! across hard and soft skills is critical to the program. MOUSE asserted that recognizing the importance of both hard and soft skills can prepare youth for a diverse range of communities and economies that they will eventually participate in, acting as a better reflection of the learning that is expected to happen (DPD Interview Nov 2013; DML Proposal).
Especially through the MicroProjects, but also generally through their whole program’s goal of providing Wins! across the wide range of skills needed in technical support, MOUSE’s badge system is an example of the principle “recognize diverse learning.”

**Design Principles for Assessing Learning in Digital Badge Systems**

Students are actively involved in the assessment process. MOUSE offers opportunities to learn and practice that resemble or reflect real-world contexts of work in technology, design, and engineering. Peers provided feedback that can complement performance measurements and assessments.

**Enhance validity with expert judgement > Use a combination of human and computer experts > Promote social learning**

Through the selected assessment techniques, MOUSE intends for its badging system to promote social learning, providing local environments in which youth are supported by their school community and a nationwide community to interact with online. Young people are given chances to develop their skills and knowledge through interaction with the learning community of peers and adults. MOUSE intends to offer students the chance to assess one another. The badges are intended to enhance collaborative and individual learning (DPD Interview Feb 2013).

This has stayed consistent through the MOUSE Wins! enacted practices. MOUSE staff are proponents of social pedagogy, and they see users as “givers of cred” who in turn receive feedback and credit (DPD Interview Nov 2013). MOUSE promoted social learning in their enacted practice of involving educators and students in the assessment process, aiming to reflect the feedback loop and organic process of assessment in the workplace.

In the workplace, peers are experts at performing their roles, and all employees on a team have their own specialties. It is natural to seek feedback from peers and offer it in appropriate contexts. There are also automated processes that serve as measurements of worker performance, and the automated Wins! in the MOUSE system approximate the various metrics available to measure tech employees’ achievement and learning. As such, this practice is intended as an implementation of the “use a combination of human and computer experts specific principle of “enhance validity with expert judgement.”

**Use Performance Assessments in Relevant Contexts > Use performance assessments**

Mirroring the work roles that MOUSE students may eventually fill, the system intended to employ performance-based assessments. The integration of performance assessment can be used to measure and award learners for performance-based concrete and “soft” skills. The learning interaction and performance tasks involve face-to-face
lessons combining hard and soft skills through project-based demonstrations over the course of their certification work.

The face-to-face tech support components of the system existed before MOUSE earned a grant through the DML competition. At that point, MicroProjects, which also constitute performance assessments, were already in an early stage of development. As enacted in early 2013, students upload the record of these accomplishments in varying media formats to meet the criteria of a monthly challenge.

The most important performance assessments in the MOUSE Wins! badge system are the times when students have to perform their function as technology help desk staff and solve a technology problem experienced by a member of their school community, often under a time crunch. Students can earn Community Wins! for cases closed as a quantitative measurement of these achievements.

MOUSE’s appreciation of the relevance of performance tasks to workplace environments and the program’s structure as a functioning technical support team make this system an excellent example of how to implement the principle “use performance assessments in relevant contexts.”

**Enhance validity with expert judgement > Use a combination of human and computer experts**

> Badges are validated by a computer scoring system, experts, and peers

The badge system intended to build a validation system, the Wins!Tracker, in which a computer scoring system, experts, and peers can validate learners’ achievements based on the badge level. In their proposal, MOUSE explained that the “Wins!Tracker is a tool that helps program facilitators and mentors access an aggregate view of their whole Squad’s work for any given certification. The interface allows check-ins on student progress during certification work, 1:1 communication functionality to offer feedback, and a “award” control that allows the facilitator to approve certification when complete. All Wins! and Certification Badges awarded appear on students’ Profile pages within mousesquad.org” (DML Badge Proposal).

In the enacted practices, a coordinator views the Wins! and approves the badge to be issued, and the artifact or skill recognized by the badge is overseen by the computer, experts, and peers. This function illustrates what badging can afford to an organization like MOUSE. It enables them to “tap a bunch of different level points to get data” and helps them to scale their system.

This practice illustrates the principle of “enhance validity with expert judgment” by incorporating experts in the process of reviewing the performance of students and awarding them badges. In addition to a computer scoring system, experts or coordinators can play an integral role in appraising the work of students and thereby strengthen the validity of the badge issued.
Use Leveled Badge Systems > Metabadges > Leveled badge system

MOUSE intended to combine the assessment of both hard and soft skills along the progression of levels set out in the learning modules. The level-like nature of micro-achievements can function as building blocks or assessment points in users’ learning progression, as students complete activities and develop the skills that count toward a specialist badge. Macro-achievements, then, function as metabadges, representing learners’ mastery of a broader set of subskills and foundational knowledge. The earned achievements reflect the degree that learners have accomplished learning goals, assessing the growth in learners’ skill and literacy development. As students engage in the activities, MOUSE intended to offer both Community and Certification Wins! as micro-achievements toward earning macro-achievements, or badges, which would be displayed on Mozilla’s OBI.

In their enacted practices, the MOUSE system continued to award micro- and macro-achievements. While the badges themselves are not divided into levels, the Wins! are leveled micro-achievements that can be earned toward the macro-achievements of badges. The granularity of the wins structure the pathway to achievement in the MOUSE squad network as well as higher education and industry. At the same time, MOUSE explained that the micro-achievements were challenging to digest and view as a point of engagement (DPD Interview Nov 2013). On the side of engagement, micro-achievements were less meaningful. During the summer of 2013, MOUSE redesigned and updated the Certification Wins! to make them more engaging.

In the project, as MOUSE builds the capacity for students to acquire Wins! that add up to badges, this practice reflects the principle of “use leveled badge systems.” The leveled system scaffolds students’ learning, providing structure to the experiences of students in gaining skills and extending their abilities.

Involving students at a granular level > Learning pathways and design > Peer assessment and collaboration recognition

The initial release of the process did not include the functionality for learners to add collaborators to their projects. However, learners started to add collaborators on their own, and the project is working toward building in this feature.

In the functioning badge system, assessing and awarding recognition to collaborative teams poses technical and social challenges. In terms of MicroProjects, collaborating team members could either each submit the project for themselves or for the whole squad, which may include up to 10 students. Building a system to properly attribute how these projects are owned in code is complicated, but necessary to properly recognize participants. MOUSE is continuing to address this feature.

This practice is connected to the principle “involve students at a granular level,” enabling youth to actively participate in a synergistic learning process and engage in an exchange of knowledge and perspectives that further their development.
Design Principles for Motivating Learning in Digital Badge Systems

Students play a central role in the badge system, and their active involvement in the program boosts motivation. The MOUSE badge system engages youth by recognizing skills that are not traditionally noticed in the classroom as well as rewarding them for their participation in the community. By enabling students to award Wins!, MOUSE demonstrates the social nature of learning and its potential to inspire growth.

Recognize Identities > Roles within a system > Newly recognized skills in a given context

Badges are issued for both hard and soft skills, demonstrating the value of a range of skills recognized including computational and technological skills as well as interpersonal and communication skills. The project believes this is motivational because it enhances students options to complete the activities of interest to them in the sequence they prefer. The achievements act as reinforcement along the way to a badge.

After enacting their badge system, MOUSE’s Marc Lesser agrees that issuing badges for both hard and soft skills motivates learners. It illustrates different types of leadership. Lesser explained, “Suddenly, for [youth] to be able to have cred for the things that they do well, at least our hunch, is a motivator for them to take themselves [seriously]. In part, it’s just an efficacy thing, if they’re taking themselves more seriously as part of the learning environment, they’ll be more likely to work harder at the things that they’re not naturally inclined to get cred for, or that their natural inclinations or skills are not being credited for” (DPD Interview Nov 2013). Recognizing learning with badges engages youth who are strong in technical or hard skills, helping them take themselves more seriously as part of the learning environment.

MOUSE employed the practice of rewarding students for a broad array of skillsets and establishing their ability. This practice thereby illustrates the principle of “recognize identities,” highlighting the roles that youth can acquire and empowering them to take greater ownership of their learning.

Recognizing Different Outcomes > Performance-based and improvement-based > Reward for number of blog posts

Users are rewarded for the number of blog posts they write and the amount of participation in the community. They are recognized for their active interaction in the program and online. The program tallies up the number of posts made for a dynamic 5 Blog Posts Win!, 10 Blog Posts Win!, and so on.

This aspect has continued in their enacted practices. The program gets more value from learners who are motivated by Wins! for the number of blog posts than detriment to those who want to game this aspect of the system. They have spent little time in addressing learners who game the system. However, there is greater value in the organic
interaction that emerges from user participation and the blog posts they create. This has formed very dynamic wins, in which they top out once they reach a level of “community ninjahood” and don’t need the number of posts incentive any longer to stay engaged. MOUSE assumes intrinsic motivation will become more important as students grow their accomplishments.

This practice demonstrates the principle “recognizing different outcomes.” MOUSE issues Wins! to users for actively creating blog posts, fostering sustained engagement and discussion.

**Utilizing Different Types of Assessment > Peer > Peer awarded badges**

MOUSE intended to allow peers to award achievements to one another, aiming to engage users in the community and motivate them to participate and further develop their skills. MOUSE described, “In addition to system-issued or coordinator- (adult) issued Wins! in development, MOUSE seeks further support to also build functionality for our Wins!Tracker and profile areas that enable youth- or peer-issued badges, with a goal of creating aspects of the system that place youth at the center of the assessment process” (DML Proposal).

MOUSE successfully implemented peer awarded Wins! for some achievements in early 2013. The program continues to view peer awarded badges as a motivator, strengthened by seeing what feedback looks like. MOUSE can watch the progression from users who are awarded a peer issued win and then go on to award them. This hints in the direction that their hunch is right that peer awards motivate more participation.

Reflecting the principle of “utilizing different types of assessment,” the practice includes youth at the center of the process, enabling them to acknowledge their peers’ achievements. Peer recognition serves as a motivating force, underscoring the social nature of learning.

**Engage with the community > Involvement in digital community > Community engagement**

MOUSE intended to reward youth for their engagement in the MOUSE squad community, contributing to their motivation to actively participate in the program. Community Wins! are distinct from peer-awarded badges. The program awards Community Wins! to members for closing cases, or project tickets, through their case tracking software and for posting comments to help members to troubleshoot problems or start a discussion on relevant topics.

In their enacted practices, MOUSE introduced the Peer2Peer Awards in 2013 and Community Wins! with Creativity, Technical, Inspiration, and Motivator Wins! The Peer2Peer Awards features the capacity for students to award badges to one another. They are still continuing this in their enacted practices so far.
MOUSE’s practice of integrating Community Wins! illustrates the principle of “engage with the community.” By awarding Wins! for users’ participation, the badge system promotes further interaction and learning within the community.

Design Principles for Studying Learning in Digital Badge Systems

From the implementation of the badge system, the project tracks and collects data on user behavior and the online experience to provide formative feedback. MOUSE leverages this data to inform decisions or adjustments that can enhance the learning process.

Research For Badges > Use site analytics

MOUSE squad leveraged sitewide analytics for formative feedback loops to the organization for the purpose of the program, interface, system, and content development. They have researched tools beyond Google analytics to collect data at more granular levels, and they intended to employ the Kissmetrics web analytics tool. MOUSE explained, “With this tool we hope to get a better sense of which segments of our member population are most active, at different levels of granularity ranging from state to site, or in different demographic groups. We’ll also have the ability to do comparisons using these different metrics” (HASTAC MOUSE Q&A). The data can illuminate the kinds of interactions and user behaviors taking place across states.

In their enacted practices, MOUSE fully deployed the KissMetrics analytics tool in June 2013. With this tool, they can track the number of logins and see, specifically for a user, when and how they are logging in to complete which activity. The function that they are employing this tool for is two-fold: in the long term, they can get smarter about how pathways connect and longer term outcomes, and in the immediate term, they can bring their feedback loop up to hyperspeed. Marc Lesser explained, “For a given month, if I see tons of students in Chicago who are getting really into creative projects, I can actually blast those sites a note to say “you guys all have something in common here, and here’s how we can support that as a network”. I have data that helps support our sites and provide support to educators. Surveys at end of year can’t be put into place until next school year. Now data can be acted on quickly, in terms of our ability to deliver” (DPD Interview Nov 2013). The data from the tool can enable them to provide feedback more quickly and offer support to learners and educators with greater efficiency.

In this case, the feature of Peer2Peer awards was launched upon its completion in February, meaning that there was little time to introduce it to squads and gather data on its use before the end of the school year in the spring. However, little formative data is available about its effectiveness as of the end of 2013. MOUSE Education Director Marc Lesser notes a difficulty working with school-based users in that “K-12 cycles and web development cycles are not compatible” (DPD Interview Nov 2013).

This practice is related to the principle “research for badges,” as MOUSE gathers formative evidence to inform the implementation of the badge system. The data collected
is used to make inferences and adjustments on ways to connect learners and enhance the user experience.

**Challenges This Project Faced**

The following paragraphs offer ‘challenge vignettes,’ or the narratives of issues that the project encountered during the design and implementation of the badge system. The challenge vignettes illustrate the possible challenges that can arise as well as describe how this badge system chose to confront them. While these stories are grounded within the MOUSE context, the DPD Project investigated them more deeply because they seem likely to appear in other contexts as well.

**Infrastructure Constraints on the Assessment of Learning**

Within the assessment category of practices, infrastructure constraints posed challenges in the design of the badge system and, in specific, the portfolio system online. Similar issues surface when integrating badges as when carrying out an online portfolio system. The process is limited by the initial decisions made about the Drupal modules to build the platforms. MOUSE has taken into account numerous requirements, facing technical challenges and bandwidth limitations. For instance, a set of constraints are posed in schools with regard to the media that is supported by the MOUSE platform and the media (such as, Youtube) that is blocked by firewall settings. There is not a “piping standard” for schools. The program has also considered the image of the assessment process, and the perceptions of youth regarding their interest in the relevance of the badges. “When students reflect to us that things feel “schooly” and boring, it means that they’re bored that we haven’t come up with a more creative way to assess them” (DPD Interview Nov 2013). MOUSE has considered the standpoint of students in designing the user experience of the assessment process.

**Challenge in Studying Learning: Changing the Badge System to Accommodate Research**

During the process of designing the badge system, MOUSE realized that they needed to think seriously about the data and the factors to report on at an early stage. However, they arrived at this realization only a year and half in the process, so they rearranged the design process of new features to include this consideration earlier. As they built new features, MOUSE made an effort to think about how data would be collected and used in the feature’s operation earlier in its design process. This informed their approach by the time they started development on the peer-to-peer issuing system. However, some challenges emerge with making decisions about upgrading and changing the system. For example, for awarded Wins! that are initially tied to specific content, if the content for the Wins! changes, then there are questions that arise with how to migrate the data over and whether or not the achievement remains valid. When changes are made to the initial badges, it prompts further thought about how this would translate for users, such as whether the system would migrate the previous data over or whether they would wipe the system and start from the beginning. In essence, they would focus on thinking about how the
assessment data is related to the user and how to treat the user’s experience when making decisions about upgrading or evolving the content or system.

**Challenge Across Strands: Developing a Culture of Use**

Challenges exist across the strands of recognizing, assessing and motivating learning in building the online achievement system and connecting established subnetworks to grow at a national scale. Issues surround the ensuring of COPPA compliance. In addition, there is the element of fostering a culture of use. The program understood that it would take a period of time, especially in the K-12 setting, for a network of users to build a culture of use around usability. MOUSE set out in the first year to design badge for end users, which had initially been viewed as exclusively young people or learners in their programs. They later realized, however, that they also needed to consider the tools that educators of those learners would employ to curate and think about the various nodes in the learning environment of youth. This brought to the forefront the question of how to involve or get educators into the system and make it an efficient way for them to access information about their students in the assessment process. MOUSE developed the Wins!Tracker assessment tool to provide educators with a way to access them and understand what to do with the nodes. Part of this also includes the issue of badges to educators for their rockstar role in the culture of the network, involving aspects of constructing the recognition system.
Appendix: Who Built America - Badges for History Education

Summary

Who Built America Badges for History Education (WBA) is a project developed by the American Social History Project (ASHP) in partnership with Electric Funstuff and Education Development Center (EDC). The project moves the face-to-face synchronous professional development for grade 7-12 history teachers that the ASHP has been conducting for over 20 years to an online asynchronous space where teachers work at their own pace and without a cohort. This has been a somewhat challenging process, but the use of leveled digital badges and formative assessments have aided in the process.

There is substantial effort to build community within WBA, and teachers can build relationships beyond a small cohort. This professional development helps teachers grow in both content and pedagogy; through a series of tasks and engagement in both the community and with ASHP experts, teachers can earn the badge and title of Master History teacher. The title and badge of Master History Teacher is representative of a teacher’s work, expertise, and experience of growth as a professional, and is meant to be recognized by education professionals outside of the WBA community such as principals and district officials.

Teachers are required to participate in a professional development activity, and are encouraged to share resources, insights, and constructive criticisms. Teachers can then deem certain posts as helpful. One exciting evolution of practice is the project’s original intent to award a collaboration badge. Due to technical limitations, the project needed to revisit how they might assess collaboration. They decided that rather than award a collaboration badge, they would award activities that required collaboration to complete. In this way, they avoid assessing collaboration and potentially stopping useful discourse, and encourage deeper collaborations and connections between teachers.

Timeline

In March 2012, the Badges for Lifelong Learning competition announced the final awards, and Who Built America (WBA) began designing their digital badge system. The American Social History Project teamed up with Jim Diamond at Education Development Center to move their synchronous, face-to-face professional development for history teachers to an asynchronous online setting that uses digital badges to recognize teacher learning. In July 2012, Jim gave an initial report of where the project was headed, making clear that they were still in the early stages of development. By January 2013, the project had developed both their system.
within the platform and the curricula, but by March 2013 it was clear that the project would not be ready to launch until November. October 31, 2013, WBA had a “soft launch” with a focus group of teachers who had met and worked face to face. The following week the project launched with new teachers. WBA is in the process of working with their first group of fully-online teachers at the time this is being written.

**Evolution of Practice and Relation to Principles**

The DPD team analyzed each of the 30 projects’ initial proposals to extract their intended practices for implementing a digital badge system. Then the team conducted interviews with each of the projects after they had had time to develop their systems; from these interviews, the team documented the shifts in practices the projects had made, and categorized their enacted practices into specific design principles in the badge practice categories of recognizing, assessing, motivating, and studying learning. These specific design principles were then categorized into general design principles within each of the four badge practice categories.

What follows is a list of practices as they relate to the general and more specific design principles in each category of practice. The headings name a (a) **General Principle**, (b) **Specific principle**, (c) **Specific practice**. The paragraphs below each heading detail the project’s (a) intended practice, (b) enacted practice, and (c) how that practice relates to the specific and general principles.

**Design Principles for Recognizing Learning in Digital Badge Systems**

Ultimately, digital badges recognize some kind of learning. WBA built their system to recognize both the “hard skills” of content and pedagogy, and the “soft skills” of community building.

**Have Experts Issue Badges > Credentialed via accredited entity and community > Validation by experts.**

WBA intended for the Master History Teacher credential (badge) to be validated by experts both external and internal to the community. They felt that “full certification as a Master History Teacher necessitates a multi-step review process validated by history educators and master teachers. There is no self-accreditation in this system.” In the beginning of the project, WBA had also intended to allow peers to issue smaller badges.

This practice was further refined to state that submitting an artifact does not automatically result in receiving a badge. The learner must engage in discussion with the WBA experts concerning the artifact and the process they engaged in before any badge is awarded. The peer-awarded badges were ultimately not included due to constraints of the platform.

While ultimately the peer community did not award badges, the experts at ASHP do award badges and engage in discussion with teachers about their lessons, implementations, annotations on student work, and modifications of the lessons. By
having history content and teaching experts engage in these discussions and issue badges, the credential may have more weight to both the internal learning community and administrators and district officials who view them.

**Use Badges to Map Learning Trajectory** > **Level badges** > **Badges are leveled**

WBA intended for there to be an explicit balance between low-value and high-value/scarce badges. They wanted teachers to develop a “rhythm of badges” through which the teacher would earn smaller and bigger badges awarded automatically and by experts. They felt that “the process of moving through the inquiry units creates a self-paced rhythm with checkpoints for assessment, both automatic and human mediated.” A self-paced rhythm was also to be developed in earning community badges, with the higher level badges requiring more time and investment in the learning process. The largest badge, the Master History teacher badge, was intended to be awarded twice annually, “giving the accomplishment a ceremonial feel as befits a significant achievement.”

As the project developed, the levels took shape as three types: (a) "Builder" Badges, which are awarded for performance and consist of three tiers (Apprentice, Journeyman, and Master); (b) "Specialist" Badges, which allow a teacher to become a specialist in specific content; and (3) “Community” Badges, which recognize posts to the discussion forum, interaction between peers, and general involvement in the community. The concern about the three types of badges and the tiers within the performance badges was how the structure would be communicated to learners. During the first release of the curricula and badges WBA will pay close attention to how learners understand this structure and process.

By adding levels to a badging system, WBA allows teachers to find benchmarks in their learning and mark smaller accomplishments with a badge before they tackle the ultimate Master History teacher badge. This gives both the teachers and the experts an opportunity to see the learning trajectory and mark achievement goals.

**Make Credential Permanent** > **Never expires** > **Credential is permanent**

WBA intended for the Master History Teacher badge to exist permanently on the website. Even after this ultimate badge was earned, teachers could still earn Community and Specialist badges.

As the project developed, WBA realized a need to convert badges to .PDFs that can be printed and given to administrators. These .PDFs contain information regarding how many hours were spent in professional development, a syllabus of objectives and activities, and other quantifiable evidence that is easily digested.

There is a concern that administrators such as principals may not understand that the digital badge is a representation of the earning teacher’s experience and expertise, thus a paper version has been created to add to the permanence of the credential.
Use Badges as a Means of External Communication of Learning > Credential as external communication

WBA intended for the meta-data contained in each badge to ensure that the credential would be recognized outside of the immediate learning community. They intended to make these credentials even more valued by making the rubrics with which the teachers were assessed publicly available.

Related to the issues that arose around making the credential permanent, WBA realized that professional educators outside of the WBA community may not understand all of the data and evidence a digital badge contains, so they made a paper version of the badge. The collaborator badge was removed because the constraints of the badging platform made it difficult to provide convincing evidence that warranted such a badge.

The concern that educators outside the WBA community will not recognize the work, accomplishments, and expertise the digital badge represents is still a concern for the the project and the teachers. WBA is actively trying to find ways to make these badges valued by the external community.

Align credential to standards > Use community and national/international standards > Align credential to standards

WBA intended to align the curricula the teachers taught to both the Common Core State Standards and to other standards for teaching history. This meant that the work teachers did was also aligned to these standards. This intention did not change as the project developed.

Ultimately, both the credentials and the curricula for students are aligned to the Common Core State Standards, and several other standard sets. The language from the National Council of History Teachers 3Cs standards have also made their way into the curricula. WBA is interested in the Thinking Like a Historian project in Madison Wisconsin, though that project does not include badges.

Seek External Backing of Credential > Externally endorsed > Badge Endorsements By Nationally Recognized Association

WBA intended for their badges to be endorsed by the National Council for the Social Studies, National History Education Clearinghouse, and Stanford History Education Group to help ensure its recognition by people outside the WBA community.

While obtaining endorsements is still part of the goal, this effort has been put aside as the project moves toward its first launch. WBA would like to at least get outside organizations to link to or inside the badge to give it more weight and generally help promote the professional development.

Design Principles for Assessing Learning in Digital Badge Systems
If one is going to recognize learning, they must consider how they are going to assess that learning. WBA’s assessments involve a lot of formative feedback from experts, and some engagement in a peer learning community.

**Enhance Validity with Expert Judgement > Use human experts > Artifacts Assessed By Experts**

WBA intended for teachers’ designs and implementations to be assessed by ASHP teaching and content experts. Performance badges earned from these assessments were meant to recognize achievement in the “‘hard skills’ related to content mastery and inquiry- and literacy-oriented pedagogy. This track progressed in six stages: (1) Learn, (2) Plan for Class, (3) Teach, (4) Reflect on Lesson, (5) Design and Teach, and (6) Reflect and Revise. Teachers must have completed two cycles of stages 1–4 before proceeding to stages 5-6.

Content and pedagogical experts at the American Social History Project will be the main assessors of artifacts, however it may be possible for teachers who have completed the professional development and become master teachers to become assessors as well. The Performance Track stages have been simplified to (1) Know Your Stuff (study and take quiz on content and Common Core-aligned skills), (2) Get Ready to Teach (planning and modifying unit for class), (3) How Did it Go? (lesson reflection with experts and student work analysis), and (4) For Next Time (revising lessons based on reflection).

Teachers who earn Master History Teacher badges can mentor other teachers and help in assessing them. WBA feels that having the ASHP experts conduct the bulk of the assessments will work for now, but if the project grows substantially, the small number of content and pedagogical experts at ASHP may not be able to do all of the assessments on their own.

**Use Formative Assessment > A combination of peer and expert feedback is given > Build community**

WBA intended to have “teachers join inquiry groups, undertake collaborative assignments, and post comments and resources that are rated as valuable by peers, as well as by ASHP and master teachers. Community badges [were meant to] represent the ‘soft skills’ associated with communication, collaboration, and peer engagement.” WBA also intended for teachers to evaluate each other’s “Exit Tickets” of their lessons, reflections and annotated student work. EDC had planned to assist ASHP in developing frameworks for conducting peer evaluations. For the "Specialist" teachers’ Exit Ticket rasks would be assessed by AHSP experts and Master History Teachers. For the “Community” track, “teachers upload or make contributions that are assessed (‘liked’) by other peers using the criteria of ‘is this valuable to the WBA community or wider profession?’”
However, due to platform constraints, WBA decided not issue a peer-awarded badge or implement a “liking” system. Instead, teachers are required to participate in the community forums and offer resources and constructive criticism. They are also asked to respond to theory-related questions as opposed to known-answer questions asked by the ASHP experts. There are four community badges (I <3 Community; Community Member; Constructive Critic; I <3 Sharing). While teachers can still deem another teacher's resource, insight, or constructive criticism helpful, no formal assessment of collaboration will be enacted at this point.

By shifting their practice from peer-awarded badges to expert-awarded badges for participating in a community forum, WBA may actually end up fostering more formative feedback among peers than they would have if peers had awarded more summative atta-boy badges and avoid an implicit expectation of reciprocation. WBA has implemented strategies for revision and feedback that is part of the four stages of the “Performance” track. In this process, ASHP makes comments, asks for further clarification and reflection, and then approves the work. Their criteria for their “Builder” badge is still being determined. Expert feedback is also available via live private chat boxes, though this may not be manageable as the project grows.

Design Principles for Motivating Learning Within Digital Badge Systems

When a system recognizes and assesses learning, those actions impact the motivation of the learner. WBA has taken this into account as they developed ways to motivate learners without undermining the learning.

Evolving Requirements for Badges > No specific principle was derived for this general principle > Evolution of badge

WBA intended to add an “enblazon” widget to the badge awarding system so that badge awarders could add features to an already earned badge. For example, if a teacher who earned the Master History Teacher badge went above and beyond in their community participation, the badge could be modified with a “community blazon.” This was meant to help convey the expertise a teacher had earned in their participation in WBA.

Because WBA was not able to award community badges, they abandoned this practice.

Recognize Identities > Roles within a system > Role recognition

WBA intended for each “track of badges [to correspond] to formal and informal identities within teacher communities. Teachers have opportunities to level up as a collaborator, ‘History Geek,’ ‘Common Core Writing Specialist,’ etc.”
While the different tracks do suggest different roles, the project is ensure how these roles will be taken up because they have just launched their badge system with users.

However, creating these different tracks indicates that WBA values the different roles a teacher can play as they develop professionally, so these roles may be crucial in both building a community of learners and encouraging growth.

**Provide Opportunities for Mentorship > Privilege of being a peer mentor > Peer mentorship**

WBA intended for Master History Teachers to become mentors for other teachers, earning “blazons” for mentorship and review of teachers and their work. Specialists could also review other teachers’ work. This is hypothesized to increase motivation for collaboration among teachers since they must mentor their peers.

The project still plans to for a system through which Master History Teachers can earn the privilege to mentor teachers and review their work. This will not only motivate collaboration, but may also help the ASHP experts as the project grows. This may motivate engagement by inviting awardees to join accreditation team and earn recognition for mentoring.

**Utilizing Different Types of Assessment > Peer > Peer assessment**

Through the mentorship system and community badges, WBA intended to encourage peer assessment. Both Master History teachers and Specialists would have the opportunity to evaluate peer work. This was hypothesized to increase motivation for collaboration among teachers since they must assess and mentor their peers.

Due to platform constraints, community badges are only awarded for quantifiable traits like certain number of posts to the forum. There was an intention for community badges to be awarded by the computer system as a result of users marking posts as "useful" and for sharing resources. In a sense badges are still awarded by peers, but a computer system automates this process.

Master History teachers earn the privilege to mentor teachers and evaluate their work, but WBA is still looking for ways for peers to award each other badges.

**Initiating and Increasing Interest > Give badges for small accomplishments to hook in learners > A specific practice was not further identified**

Initially WBA did not state in their proposal explicitly that they would give small badges to get learners into the system. However, they decided that participants could earn a badge for simply signing up for the program.

Giving out these small badges seems to be a common practice across projects. These are not the kind of badges earners would necessarily push out to Facebook or their backpack, but they engage earners and get them started earning badges in the system.
Appendix: Who Built America Case Study

Provide Privileges > Prizes > Prize

WBA intended for teachers who earned all five community badges to receive a “set of Who Built America? documentaries for their school library.” This was thought to motivate engagement by offering valued educational resources to awardees who earn entire set of badges.

While the community badges have changed, teachers who participate in WBA have access to resources, and master History Teachers can post resources for other teachers to use.

WBA is still engaging in practices in which badge earners receive educational resources.

Competition > Use of point system > A specific practice was not further identified

While the use of a point system was not in place in the initial proposals, when the I <3 Collaboration badge was replaced with the I <3 Community badge, a point system was put in place whereby teachers could earn the new badge by earning points for participating in the community forums.

These points will not be visible to users, so that after they pass a threshold for participation, they will be rewarded with earning the I Love Community badge. The community badges are earned by completing quantifiable tasks like number of posts to a discussion forum.

Design Principles for Studying Learning Within Digital Badge Systems

The initial proposal did not outline practices for studying learning. However, as the project progressed, some opportunities for studying learning surfaced.

Research OF Badges > Teacher Surveys

Early in the project’s development, WBA intended to award badges for completing a survey.

As the project progressed, it was decided that badges would not be awarded for completing a survey. However, the project does intend to administer surveys to teachers to gather data.

Research FOR Badges > Incentivizing Participation

The program intends to do research around the motivational components of their badge system. WBA is actively defining how they are incentivizing participation and investigating how they should research this. It seems likely that this research will eventually perform a formative role, helping WBA improve the badge system, though it is yet to be determined whether WBA will use the information embedded in the issued badges to perform the research.
**Research FOR Badges > Providing Feedback**

WBA is actively finding ways to provide feedback that is useful and used, and how they might gauge teachers' responses to the feedback.

**Challenges This Project Faced**

Who Built America Badges for History Education faced three major challenges as they implemented their digital badge system: The American Social History Project (ASHP) has been dedicated to history and history education since 1981, and have offered professional development for history teachers for about 20 years. Needless to say, moving the professional development online while adhering to the structures and methods the ASHP wished to use was not a simple affair. Additionally, the use of digital badges has been a point of contention for some teachers, as they feel that this is yet another evaluation among many new evaluations of teachers being put in place. Finally, the platform in which WBA was initially working did not accommodate all of the badging practices the project wanted to provide for their earners. Late in the project’s development, they made the tough decision to change to a new platform developer and started again from the ground up; they are hopeful that this move may help facilitate the kind of engagement they were looking for in the beginning of the project.

**Challenge Across Recognizing and Assessing Learning: Moving to Asynchronous Online Instruction**

The American Social History Project (ASHP) has been offering professional development for history teachers for many years. They hold seminars that help teachers grow in their content expertise as well as in their classroom practice. WBA is an effort to move that professional development online. However, because the ASHP has been doing professional development for so long, they have developed a specific way of conducting their professional development and feel that content should be delivered in classrooms using specific practices. Moving this structure away from face-to-face cohorts to an asynchronous online setting using digital badges has been somewhat of a challenge, as the way ASHP wants to assess teacher learning directly impacts how they recognize that learning.

In order to preserve what ASHP felt were essential elements of the learning program, they were forced to implement a complicated set of criteria including conversations with accredited experts. They aim to ensure the validity of the WBA credentials. The first step to earning the title of Master History Teacher is to earn a Lesson Builder badge, which entailed downloading one of the five lessons designed by ASHP, adapting it for one’s particular classroom, and implementing it. Teachers then submit work done by the students with their annotations, and discuss changes they will make the next time they teach the unit with an ASHP expert. The way these lessons are designed reflect the way ASHP thinks the content should be delivered, and since an expert discusses the delivery and modifications to the unit with the teacher, the ASHP maintains a fair amount of control over how content is designed both in that
unit and in future units. This assessment has a formative function in that the teachers receive feedback on their design modifications and implementation, but the summative function of a “correct” implementation indicates that in order to recognize that the teacher has learned the skill of designing curricula with a badge, they must first master the ASHP design model.

**Challenge for Motivating Learning: Teacher Resistance to Assessment**

The challenge of assessing and recognizing mastery of the design model may be impacting the second challenge WBA faced, which was that a focus group of teachers initially rejected the idea of digital badges, indicating that they felt this was yet another evaluation to which they did not want to be subjected. WBA is being implemented in New York, which has just implemented a new teacher evaluation and accountability system that has teachers concerned. While WBA intends to help teachers meet their goals in their evaluations by enhancing their classroom practice, it seems that digital badges were initially seen as somewhat judgemental. Because of the constraints of the badging platform, which will be discussed below, all of the badges are very quantifiable; the badges recognize traits like how many hours a teacher spent in professional development, how many posts they made in the discussion forum, and the quality of the lessons they adapted and designed.

**Challenge for Assessing Learning Through Peer Interaction**

While a community exists, there is little lesson-building-collaboration that is fostered between teachers. This is a result of platform constraints rather than intentional design. Initially, WBA intended to include an “I <3 Community” badge, which would foster and reward collaboration. However, the constraints of the platform and platform developer precluded that badge from being developed. Instead, the project id fostering community through discussion forums in which teachers can ask questions of each other, as well as respond to questions and prompts with a “theoretical bent” (as opposed to responding to known answer questions). This helps the teachers engage in conversations and build relationships beyond their school walls, taking them out of the isolation of their own classroom and providing them with a support network as they grow as teachers.
Appendix: BuzzMath

Summary

BuzzMath is a platform where middle school students develop mathematics competencies corresponding to the Common Core standards. The project issues Open Badges aligned to these standards as students complete activities on buzzmath.com.

The BuzzMath team from the small software development firm Scolab wants to help students in grades 6 through 8 achieve competency in the mathematics standards included in the Common Core State Standards system. To this end, the website guides students through “practice documents” and “challenge documents” targeting each element of the standards (Figure 2). These take the form of sets of assessment questions that progress in difficulty and build on learned concepts as they go. They are designed to complement classroom instruction and assessment. In addition, teachers that use BuzzMath in their classrooms will be able to track their students’ skill development through an integrated dashboard (Figure 3).

Middle schoolers could earn up to 15 gold badges across the Common Core math content areas each year, but they will also have the opportunity to earn smaller achievement badges for meeting small goals. BuzzMath will offer “process badges” to recognize soft skills related to success in mathematics by allowing teachers to award these badges.

The Common Core standards are now in the adoption process by most American states. By implementing a badge program to cover this content, BuzzMath hopes to help students navigate through it by providing clear learning pathways and to offer a reliable set of assessments so that teachers can follow their progress confident that they have a valid picture of learning. The availability of a broad standard ensures that BuzzMath content is relevant to a large audience of students, justifying investment in the project.

BuzzMath targets homeschoolers as well as classrooms and earns revenue on a subscription model (Figure 1). Classrooms can access the site for free, but offers premium features under a subscription.

BuzzMath attempts to fill an important niche supporting the implementation of Common Core standards, especially in their early years when not all math teachers have had the time to build a complete suite of standards-targeted assessments of their own. Using a platform like BuzzMath to provide coverage across the standard could allow teachers time to build on their best lessons first. In the realm of studying learning, offering badges along such a well-defined pathway creates the opportunity for a wealth of data, allowing teachers better knowledge of their classrooms and offering BuzzMath opportunities to study the learning system.
Appendix: BuzzMath Case Study

**Figure 1.** The Buzz Math Home Page

**Figure 2.** A “Practice Document” takes students through progressively more difficult questions in one content area, like number lines.
Scolab, creators of BuzzMath, earned a grant through the 2012 DML Badges for Lifelong Learning competition, sponsored by the MacArthur Foundation.

In the investigation of this initiative, the Design Principles Documentation Project scoured all the competition winners’ proposals in the to describe the practices they intended to use in their badge system designs for recognizing, assessing, motivating, and studying learning. Next, the DPD Project grouped these practices and those identified in other projects and named general principles under which they clustered. The research team interviewed Jean-Philippe Choinière and Jamie Piecora of Scolab in September 2012 to begin the process of identifying the practices that BuzzMath had begun to enact as they were building the system.

Scolab had the idea for an application like BuzzMath on the back burner until winning a grant through the DML competition to develop it. With the grant, they brought on two new programmers and were able to start working on the badges project right away. Planning and development proceeded from April 2012 to April 2013. Development started with the infrastructure, because the content badges required modifications to the database to collect the necessary data. Then the BuzzMath team worked with a teacher in the US to design the content of challenge activities. The DPD Project interviewed BuzzMath again November 2013 as BuzzMath had entered its first full school year of operation and officially launched to determine what practices and principles would become part of the system’s continued formalized operation.

**Evolution of Practices and Relation to Principles**

What follows is a list of practices as they relate to the general and more specific design principles in each category of practice. The headings name a (a) **General Principle**, (b) **Specific principle**, (c) **Specific practice**. The paragraphs below each heading detail the project’s (a)
intended practice, (b) enacted practice, and (c) how that practice relates to the specific and general principles.

**Principles for Recognizing Learning in Digital Badge Systems**

The most important element of the badge system BuzzMath intended and implemented was alignment to the Common Core State Standards for Mathematics. In addition, BuzzMath designed “process knowledge” badges that classroom teachers could award to recognize positive behaviors and habits related to mathematics success.

**Align credential to standards**

Use national or international standards > Common Core standards alignment.

As a growing number of schools in the US implement the Common Core mathematics standards, the need to recognize student skills defined in the standards grows. The schools themselves are the primary audience of this information, but common standards create more audiences among administrators and state officials for program assessment, and outside of the schools among those who employ or select graduates for further opportunities. Providing learning opportunities in this material this learning is BuzzMath's key goal.

As enacted at BuzzMath, each of the "gold" badges are directly aligned to Common Core State Standards. Students will have the opportunity to gain up to 15 gold badges per year across the mathematics standard. The alignment of the curriculum together, it represents mastery across the standards. For example, project member Jamie Piecora explains, “Fractions are a main concept of middle school math. When you get a gold badge for fractions, it is an accumulation of all the common core standards associated with fractions concepts. When you achieve all of the gold badges for a grade level, that would represent a full mastery of all of the concepts in the Common Core State Standards” while there is not exactly a one badge per standard equivalency (DPD Interview).

BuzzMath started with the 6th grade level, hiring a curriculum specialist to go through each activity and ensure their coverage of the Common Core at that level was accurate and complete. In order to take the program from where it started with unaligned math exercises to complete alignment for 6th grade, the team had to figure out where their existing activities fit within the standard and then create almost 40 new activities of 10 pages each, a sum that now represents half of the activities available at the 6th grade level. A great deal of time was dedicated to this effort, as Jean-Philippe Choinière describes, because, “A complete Common Core curriculum was...very important because we wanted our gold badges to represent all the skills in [each] topic.” BuzzMath found that completing the alignment yielded much clearer pathways: for students and teachers, the order they should move through the activities is now obvious, and smaller goals are a lot clearer. The alignment allowed them to structure the activities with review and enrichment sections. The activities’ organization is now much more clear to teachers as
well, who developers had noticed often assigned material in the order it was presented to them rather than spending the time to figure out how the curriculum was designed.

These are examples of powerful effects of the decision to use a practice fitting with the “Align credential to standards” principle. This practice was one of the core guiding principles of BuzzMath’s system design as a whole.

Use badges to map learning trajectory > Level badges > Granular badges.

While the bronze, silver, and gold badges are intended to represent developing skill in a broad area of middle school math, smaller “process knowledge” and “achievement” badges each represent “represent a discrete skill, competency, or activity for a specific grade level” (DML Proposal).

The Common Core standards are compatible with this approach. Drawing from research by William Schmidt and Richard Houang, the standards aimed to define the curriculum as a sequence of content that reflects the underlying “sequential or hierarchical nature” of the discipline. By delineating granular achievements out of a larger structure, the standards allow BuzzMath to recognize these component competencies as well as the broad strokes.

As initially enacted, BuzzMath’s badge system carries both content mastery badges as well as “stars” for successfully completed activities. Typically, 4-6 stars add up to a bronze content area badge, and then more activities allow the user to level up to silver, then again for gold. BuzzMath only will issue the gold achievements representing mastery of a Common Core standard as a Mozilla OBI Open Badge.

One surprise that BuzzMath encountered in building out the content at the 6th grade level was as Jean-Philippe describes: “at first in my head all the topics would have three content badges (bronze silver and gold), but when we started the alignment to a new structure based on the Common Core system, we saw that some topics, like fractions only had just enough activities to have one or two badges at the 6th grade level, then a lot more in 7th grade”, instead of the three they had planned (DPD Bloom Interview). As a consequence, BuzzMath decided the gold badges would represent the targeted component of the standard, and bronze and silver would be added as they fit.

The team would be interested to explore further granular badges, like a “wood” type for smaller accomplishments or special “platinum” for large accomplishments. For the time being, as enacted, the badge of the same type are roughly comparable, and half of the content areas have all three levels in their progression. Bronze badges require a set of easy activities intended for students to complete in about one class period.

This practice fits in the principle of “Use badges to map learning trajectory” because the levels are designed to guide students through the activities to the point where they earn a gold level badge aligned to a component of the Common Core curriculum.

Use badges to map learning trajectory > Provide routes or pathways > Pathways to learning
BuzzMath’s platform, leveled badges and progress bars toward badges are designed to guide students through activities, scaffolding their understanding on the way to gold content badges.

Figure 2 above shows a progression through one activity on number lines as enacted. Locating numbers on the line, as shown is the first concept in number lines. This understanding is built upon by the following concepts, adding up to the understanding expected by the number lines component of the Common Core Standard.

BuzzMath found that integration with the standard created much better coherent pathways for their students. Jean-Philippe says, “It’s no longer just a big wall of activities to complete... Now we have different groups.” He points toward some feedback they received on this point:

“We have a nice quote from a teacher: ‘It allows my student to focus on a goal that is more specific than a number of stars. I also like how the sections are broken up into review, badge, and enrichment.’” (DPD Bloom Interview)

Buzzmath feels that the alignment creates a nice progression felt it was easy to make it clear to outside audiences what leads to each badge, and there are possibilities to enhance the criteria pages further, perhaps including average time to complete badges.

Determine appropriate lifespan of badges > Never expires > Permanence of badges

The badges issued through this system were not intended to expire, as BuzzMath indicated that they should be considered a record of the student’s achievements at the grade level when they were issued: “These badges will represent their mathematical knowledge and skills at each specific grade level.” (DML Proposal). That fact does not change even if a student later forgets a concept. As with all OBI-compliant badges, students will decide if and how to present these badges in their future pursuits.

Jean-Philippe notes, “It’s hard to remove something from the student after they collected it,” wondering if the students would collect badges again if they are designed to expire. BuzzMath explored this option at first, but after talking to teachers and some students, they decided it was not something that looked fun for the students. The team noted that expiration could be an interesting dynamic, to get students to go back and refresh the skill, but they decided to implement this in a refresher section at the beginning of later exercises dependent on the skill instead (DPD Follow Up Interview).

In this way, BuzzMath determined the appropriate lifespan of the badges to be permanent record of the student’s achievement at the time they are issued.

Use badges as a means of external communication of learning > Opportunities outside organization

There are a number of venues outside of students’ schools that would be interested in their badges, including schools to which they may transfer, college admission officers, and guidance counselors. Badges aligned to a well-recognized
standard, “will provide college recruiters, educators, employers, tutors, parents, and scholarship providers with a comprehensive understanding of an individual’s mathematical competencies” (DML Proposal). BuzzMath’s Jean-Philippe comments: “This becomes more interesting for high school students, but there is less of this for middle school...We will continue to make the badge project evolve, but I want the student to be able to print the evidence in a certificate way, so they can show their parents, or so the teachers can show the parents in the meeting...Privacy issues are a big thing. Maybe 90% of our users are limited by COPPA. We decided to go with basic things at first. We want to explore more.” (DPD Bloom Interview)

One possibility BuzzMath might be interested in exploring would be possible collaboration with other platforms to let students start further along in a similar system like Khan Academy, but the team sees that building partnerships with competitors may be difficult (DPD Bloom Interview).

How this practice evolved illustrates some of the issues involved with implementing the “Use badges as a means of external communication of learning” principle, especially for young earners.

**Have experts issue badges > Credentialed via external accredited entity > Award badges through online system**

BuzzMath intended there to be multiple types of badges within the BuzzMath system: content badges for Common Core standards, process badges to recognize demonstrated positive behaviors that lead to mathematical achievement and success, and activity badges for completing small goals and individual activities on the site. BuzzMath intended to record and serve badges through its online system for both content badges and the process badges to be awarded by teachers (DML Stage 2 Proposal).

As enacted, BuzzMath is the sole awarding entity listed as issuer on OBI badges, so students’ achievement is recognized by “external accredited entity”, an example of the general principle “have experts issue badges.”

**Seek external backing of credential > Externally endorsed > Seek Common Core endorsement**

BuzzMath hoped to seek the endorsement of the Common Core State Standards Initiative for its content badges.

BuzzMath is operating without a formal endorsement, feeling that it would be a nice bonus to have an endorsement from the Common Core initiative, but not essential to the value of the badge system. Negotiations on this intent have not occurred.
Appendix: BuzzMath Case Study

Principles for Assessing Learning in Digital Badge Systems

BuzzMath runs assessments for each problem and content badges through the learning activities on the buzzmath.com website. Previous to the badges grant and Common Core alignment, BuzzMath had some basic plans to generate challenges, but through building the badge system, these are now much improved. The assessments are almost entirely automated, as was intended from the beginning. However, after looking into the assessment practices, research, and discussions with other educators in the field, the project is modifying the algorithm to reflect these viewpoints and to provide a better experience for students. Assessments allow teachers to track the performance of all their students, tracking not only mastery of concepts along the learning pathway, but also time spent and accuracy for each concept. While the assessments consist of several pages of related mathematical concepts, BuzzMath has taken great care to ensure that the last several pages of each “challenge document” are precisely aligned to the Common Core.

Use leveled badge systems > Competency levels > Leveled assessments for leveled badges

The bronze, silver, and gold content badges in the BuzzMath system require assessments that reflect the increasing difficulty of the material. As students progress through BuzzMath challenges, they must be capable of employing previously studied concepts as their understanding of the particular challenge is assessed.

As they got started, BuzzMath realized they needed to make some changes to their assessment practices in the activities to match the needs of different classrooms of students. Assessments are generated from the problem types students encounter in practice documents, but BuzzMath has made significant changes to how they are generated over the first year of operation based on student data and teacher feedback.

At first, BuzzMath thought the best assessments would be custom made for each medal, but it would have been an impossible amount of additional work to create all of them. The team felt the best option for challenges was to remix content students had encountered in practice.

The new model allows BuzzMath to manually select pages that they want to be remixed. Problems are drawn from all the available pages via an algorithm that BuzzMath has frequently adjusted to take into account data like how long ago students had encountered that skill. Bronze challenges currently select 5 pages, silver 6 pages, and gold 7 pages as part of an effort to ensure challenges take students a predetermined of time, although the targeted time had to be significantly lowered from initial assumptions.

One decision in tweaking the algorithm was whether or not to favor content that students repeatedly failed to master in practice. The assumption that this would be useful turned out to be problematic, as Jean-Philippe explains, “maybe a student missed this problem 5 times not because of not understanding the math, but maybe because of the
way we explain it.” Forcing students to encounter the same problem again on a higher stakes assessment would not be helpful to their learning (DPD Follow up Interview).

This practice remains an important component of the BuzzMath badge system and represents the assessment principle of assessing in leveled badge systems, specifically aiming to assess developing competency.

**Enhance validity with expert judgment** > *Use a combination of human and computer experts* > *Protecting validity*

BuzzMath intended to design practice and challenge activities so that it is very difficult for students to guess correct answers. Prompts should require answers in varying formats, such as “matching objects, drag and drop, multiple choice, true/false, text input, and ordering” (Stage 2 Proposal), and allowing teachers to see data about how long the student spent on the site and the number of attempts will give them confidence in the validity of the assessment. See Figure 3 for a sample of the teacher dashboard view of one student’s progress and Figure 4 for the visual appearance of available question types.

BuzzMath implemented this practice as designed. Content badges are awarded through the website as students complete challenge activities, and process knowledge badges are awarded by their classroom. In practice, BuzzMath tried to avoid multiple choice as much as possible. They tried to design their new content with a variety of “response objects”, with manipulatives. They hoped that students would need to think more about the problem before answering it than other systems that focus mainly on multiple choice (DPD Follow Up Interview).

Students have a limited number of attempts to complete challenges, while they have unlimited passes through practice sections. Teachers have access to accuracy statistics across all attempts. This combination of computerized tests designed to stimulate different ways of thinking about concepts and exposure of metrics that could help teachers see patterns of invalid assessment is an example of the principle “Enhance validity with expert judgment.” The best fit for implementing this general principle within BuzzMath’s online learning environment context paired with classroom instruction was naturally in the category of the specific principle “use a combination of human and computer experts.”
Align assessment activities to standards: create measurable learning objectives > Common Core State Standards > Align assessments to Common Core

As mentioned above, BuzzMath’s alignment to the Common Core is one of the core features of the badge system. This recognition decision guided the decisions about what assessments were needed. BuzzMath worked with a curriculum specialist designing activities to match the skills set out in the standard.

As initially enacted, BuzzMath’s automated content “challenge documents” consisted of several pages of problems algorithmically generated based on problem types that students see in previously completed “practice documents.” As the program has developed through 2013, the algorithm that generates these assessments has been tweaked frequently, based on how students use it to adjust for length while ensuring good standards alignment. Going forward, BuzzMath will focus on making sure that the last several pages of each challenge are well-aligned to the standard, though they will give themselves the freedom to incorporate some other content in the assessments as well (DPD Follow-up Interview).

Their commitment to these practices and those described under “Protecting validity” above demonstrate the principle “align assessment activities to standards.”

Use mastery learning > Judged by a combination of human and computer experts > Assess mastery of content and processes

BuzzMath intended to issue both “content badges” and “process badges” (DML Stage 1 Proposal). The team wanted to create each content badge to claim the earner has mastered a particular component of the Common Core standards, like “7th grade fractions,” with automated assessments that credibly back up that claim (See Figure 5). Process knowledge assessments cover skills like peer tutoring, self efficacy, and mathematical communication. Both of these badge types are designed to recognize
developing mastery of skills rather than singular accomplishments, but they necessitate different assessment techniques. BuzzMath planned to let classroom teachers assess and award these badges based on their own classroom observation or formal assessments individual teachers may assign for the purpose.

As enacted, the automated system allows students any number of attempts to complete “practice documents” and several attempts to complete “challenge documents.” The students are essentially competing against themselves to improve their badge level, and they have the chance to get instant feedback on incorrect answers. With paid subscriptions, BuzzMath offers a premium answer guide feature that should help students gain formative feedback from failed practice questions. Additionally, teachers can gain access to detailed reports and statistics showing their students’ progress through activities. The implementation of the process knowledge badges is, as planned, largely up to teachers own discretion (DPD Follow-up Interview).

Going forward, it is clear that both the content and process knowledge assessments at BuzzMath are configured around tenets of mastery learning. Their particular implementation of mastery learning requires both automated assessments that provide feedback and human review of students progress and developing soft skills.

![Fraction Badge](image)

**Figure 5.** Content badges show mastery of a Common Core component, like 7th Grade Fractions.
Principles for Motivating Learning with Digital Badges

BuzzMath implemented a badge ecosystem to serve as a roadmap to the middle school math requirements that helps students see clearly how to navigate through the concepts available on the website. Before the introduction of badges, BuzzMath found that students were unsure of where to go after completing an activity. With the inclusion of badges, the pathway to leveling up and completing progress bars will be much more easily understood by the user. Making this clear pathway visible has hypothesized effects on learner motivation and ultimately what the student learns. One thing the initiative intended and is still trying to discern is how to offer the privilege of peer tutoring to students who have successfully completed a certain level. Additionally, BuzzMath hopes to reward hard-working students with other privileges, such as entry into math competitions and featured profiles on the buzzmath.com website.

Setting goals > Display of goal trajectory > Provide clear learning pathways

One of the primary goals of adding a badge system to BuzzMath’s platform was to make the progression of learning clear to students:

“In most cases, content knowledge badges will be awarded in a progressive manner. Students will first earn a bronze badge that will later be upgraded to silver and then gold as they demonstrate an increased knowledge of each concept.”

(DML Stage 2 Proposal)

Leveling up badges from bronze to silver and then gold is an easily understood pathway that is replicated across each of the 15 badge tracks per year of the Common Core.

BuzzMath implemented the badge levels to show the progression between different activities and put clearer objectives in the system. While they would have liked to have duplicated the bronze, silver, gold structure in every badge pathway, some tracks only have two badge challenges (DPD Follow-up Interview).

They will continue to measure and tweak their activities as they learn more about how students move through them, but so far, the team feels that the pathways are one of the main positive aspects of implementing the badge system. Including elements of review within this pathway further strengthens student learning. This practice is an example of the general principle “setting goals” because showing students where they are along a clear trajectory allows them to plan their path ahead and strive for the important milestones and corresponding badges.

BuzzMath believes this practice to be an important component to their badge system that lets students see what progress they have made, how far they have to go toward their goals (and the goals set for them by the Common Core standards). The system will continue to use this principle going forward.

Recognizing different outcomes > Effort-based > Acknowledge related soft skills and process mastery
In order to reinforce positive behaviors and problem solving techniques, BuzzMath intended to offer classroom teachers the chance to award “process knowledge” badges when they see students exemplifying these behaviors that may lead to improved math achievement. The team defined eight categories of skills in this area that contribute to mathematical success and created badges around these concepts. Badges for self efficacy, peer tutoring, teamwork and problem solving are among the process knowledge badges BuzzMath built to allow teachers to encourage these behaviors (Figure 5).

Another type of badges BuzzMath intended, primarily for motivation was “achievement badges,” which recognize accomplishments like 50 stars earned, directly measuring the quantity of activities completed. They will not turn into OBI compliant badges: “These achievement badges are meant to serve as motivation for students and they will only be visible within BuzzMath” (DML Stage 2 Proposal).

As enacted, BuzzMath allows teachers to use process knowledge badges to reward or motivate students in their classrooms however they want. Achievement badges that indicate levels of commitment to progressing through the material are awarded automatically.

Both of these types of badges are examples of the application of the effort-based motivation specific principle of “recognizing different outcomes.” The soft skill-type process badges establish values within the system and abstract goals to strive for, and the achievement badges in the online system remain to motivate students to keep moving.

**Figure 5.** Process knowledge badges intended for the BuzzMath system (DML Stage 2 Proposal).

**Utilize different types of assessment > Expert > Teachers design their own assessments for process knowledge badges**

BuzzMath could easily measure students’ interaction with mathematical concepts when they were working alone with the website software, but the online component has no credible way to assess their process knowledge skills like teamwork and mathematical communication. In order to issue badges in these areas, BuzzMath intended to allow participating teachers to decide on their own how to assess and award process knowledge badges to the students in their classrooms. By the time of submitting their revised DML grant proposals, BuzzMath had decided that “Each student will have the opportunity to earn only one of each badge in the set of process knowledge badges each school year”
and noted that teachers would include information from their Class Tracking Reports in their evaluation. (DML Stage 2 Proposal).

As enacted, BuzzMath has left the awarding of these badges mostly up to teachers. Some teachers tended to treat them as the result of an assessment, while others would choose appropriate situations that occur in the classroom as opportunities to observe students and award badges based on observed behaviors either during class periods or by reviewing Class Tracking Reports on buzzmath.com. There is a near-identical set of process knowledge badges available at each grade level (the 7th grade badges are pictured in the design prototype in Figure 5).

BuzzMath decided early that the use of in-person expert assessment is necessary to recognize process knowledge with badges. The DPD project finds that practices in the “expert” category of “utilize different types of assessment” may motivate students to further participate in learning activities because of the attractiveness of gaining approval from respected authorities like teachers.

**Provide privileges > Peer mentorship > Peer tutoring privilege**

As the badge system took shape, BuzzMath envisioned that students could earn the right to join various learning communities as a peer tutor.

Enacting this practice has challenged BuzzMath to figure out how to inform people of students’ capabilities as potential mentors without compromising privacy as regulated by COPPA. Unfortunately, based on previous experience with implementing this within a similar system, Buzzmath felt that this practice was too resource-intensive to enact. They intended to create a system in which students who collect the gold badge in one topic, should be able to help others, but the question of how to implement this goal remains. BuzzMath points out that in Quebec there is a program sponsored by the government to provide homework tutoring that has partnered with BuzzMath developer Scolab. Scolab plans to build a virtual console where students who need help could interact with tutors. Experience from this project may feed back into BuzzMath.

This intended practice is an example of the motivational principle “provide privileges,” which claims students may be more motivated to engage with learning when opportunities for sharing their knowledge through peer mentorship with others are opened up.

**Provide privileges > New activities & Prizes > Access to new activities**

Early plans imagined badges could qualify students for opportunities offered internally by BuzzMath, like online math competitions: These competitions will consist of challenging problems that students will complete in a specified time period. The names of the top scorers will be posted on the BuzzMath website leaderboard” (DML Stage 1 Proposal). BuzzMath also imagined online learning communities where students could
collaborate to solve challenging problems and assist each other with work (DML Stage 1 Proposal).

As enacted at BuzzMath, badges may motivate students because they show mastery and dedication appreciated by organizations like honor societies. The team continued to investigate running contests with publicly displayed results and contest badges. As of the end of 2013, BuzzMath is planning some class contests, when teachers choose to allow students to complete. Competitions include prizes for best classes or individual students including monetary prizes like gift certificates for Amazon.

The BuzzMath team does not want to focus on practices that bring extrinsic motivation to the forefront, like contests with prizes, but they would like to be able to offer more of these in the future for the enjoyment of students on the side of their more serious progress through the badge system (DPD Follow-up interview). Challenges to introducing this content fall mostly in the realm of needing to allocate resources to build custom non-reusable content for them.

The forthcoming competitions represent a new activity that students can gain access to, which may motivate them to achieve the qualifying level. In addition, prizes provide potential extrinsic motivation. These practices fall under the principle of attempting to motivate student learning by “providing privileges.”

**Design Principles for Studying Learning in Digital Badge Systems**

No research or evaluation practices were necessarily intended but BuzzMath designed the site to obtain data on student activities and making them available to the teacher, allowing teachers to intervene with struggling students. This characteristic of the activity platform allows for possible research. Despite developing no formal plans initially to study the badges in the system, the BuzzMath team at Scolab constantly reevaluated their designs based on informal investigation of how students moved through the system.

**Research WITH & FOR badges** > *Tracking link between badges and test performance.*

At first, it was unclear to the BuzzMath team what sort of evaluation or research might be useful to feed back into the continued development of the project. With this goal in mind, connecting this program to the other measures of students’ achievement in the Common Core seemed the most relevant.

BuzzMath is interested in researching how earning badges is related to achievement on high-stakes testing. The project is gathering educators to help create the challenges within the BuzzMath curriculum to improve the connection between the badges and test-based measurement. This sort of data and analysis would be convincing to stakeholders that the BuzzMath program is effective.

BuzzMath feels that a research team outside of their team may be able to bring an impartial perspective to this kind of research. However, they note that it is very expensive to do this sort of work, which may require one specialist spending months investigating.
BuzzMath hopes to figure out a way to make their system easy and inexpensive for outsiders to study.

**Research FOR badges** *Teacher surveys about process badges*

After the badge system began operation, BuzzMath began to see that teachers were awarding the process knowledge badge differently. Some classes use them more than others. The team has collected a few anecdotes, but now plans to do surveys to see how teachers award and use these process badges in a more formal sense. They would like to know specifically if teachers like the set of existing process badges or if there are others that should be added. The DPD project records this practice in the “enacted” category because of the anecdotes collected, but not in the formal/continuing category yet, because no formal plans exist to systematize this research method.

**Challenges This Project Faced**

**Have Your Business Model Ready (Recognizing)**

BuzzMath noted one of their key lessons learned while building a badge system as, “Explore how your badge system will integrate with your current business model early in the project, especially if you are a for-profit company” (Project Q&A).

In our follow-up interview Jean-Philippe Choinière expanded on BuzzMath’s selection of a business model:

“When you are a new product, when you try to sell it, your business model can change quickly. In the last year, we changed the business model two times, maybe three. When you switch to only having paid users inside a program, then the number of badges issued will be very limited, and you need a big sales team to sell it. That was the first approach. Today, we are more on a freemium model, teachers can create classes, etc, students don’t have access to detailed solution or text to speech, teachers don’t have access to all the reporting.

BuzzMath reports that this approach is working well. Lots of classes have signed up, with more joining the freemium model each week. In this model, the badges fit well. In previous model, BuzzMath felt they weren’t as easy to integrate.
Resources
http://www.hastac.org/dml-badges/buzzmath
Appendix: PASA Pathways for Lifelong Learning

Summary

The Providence After School Alliance (PASA) partners with after school and extracurricular programs to offer quality learning experiences to middle and high school students. In their DML Proposal, PASA described their mission “to expand and improve quality afterschool, summer, and other expanded learning opportunities for the youth of Providence by organizing a sustainable public/private system that contributes to student success and serves as a national model” (Stage 1 DML Proposal). Specifically, PASA supports the operations and infrastructure of the local AfterZone network of organizations that administer learning experiences to middle school student and a similar network of organizations offering programs to high schoolers that includes a social and discovery-based website called The Hub.

PASA, the Providence Public School District, and the AfterZone Site-Based Management Agencies (SMAs) support the operations and programming of the AfterZone network. Employed in 20 cities, the AfterZone model is an after-school program for middle school students that provides youth with hands-on learning experiences with real-world applications.

PASA’s high school program’s participating sites provide expanded learning opportunities (ELOs) to students in high school, enabling community educators to assess out-of-school learning pathways. Expanded learning opportunities also open the possibility for high school students to earn academic credit for learning that takes place outside of school, supporting and strengthening students’ in-school learning. Each ELO is aligned to Common Core standards and approved by the Providence school district. As a part of this initiative, the Hub website provides students a place where they can connect their in-school learning with out-of-school experiences, finding ELOs, blogging, and uploading artifacts to showcase their learning in an online community. The program provides a referral and support tool, offering students resources to prepare for college and life after graduation.

To chart and communicate youth’s informal learning and achievements, PASA implemented the Pathways for Lifelong Learning badge system across programs. Bridging the AfterZone and Hub systems, PASA is “developing badge-supported learning pathways which will reflect, motivate, assess and validate the learning interests of youth through middle school, high school, to graduation, and onward” (Stage 1 DML Proposal). PASA launched the digital badge system to enable learners to communicate their extra-curricular experiences and accomplishments to school educators, staff, post-secondary institutions, and employers. Additionally PASA aims to provide a model for other cities looking to build badge systems in after school or expanded learning networks. They describe that an “online badge system that allows youth to capture their learning when and where it happens will also provide a systemic,
replicable model for cities that want a systems approach to building engaged learners” (Stage 1 DML Proposal). While the Hub site is specific to Providence, PASA hopes the model represented by this badge system can serve as resource for other cities interested in implementing similar initiatives.

**Evolving Practices and Design Principles**

What follows is a list of practices as they relate to the general and more specific design principles in each category of practice. The headings name a (a) **General Principle**, (b) **Specific principle**, (c) **Specific practice**. The paragraphs below each heading detail the project’s (a) intended practice, (b) enacted practice, and (c) how that practice relates to the specific and general principles.

**Design Principles for Recognizing Learning**

PASA coordinated the badge system implementation across Rhode Island public schools, empowering youth to communicate their extracurricular learning and experiences to organizations, institutions, and potential employers. At the high school level, PASA awards academic credit for earning specific badges, enabling informal learning to translate to formal settings. The different programs vary in decisions made about what learning to recognize and who recognizes that learning. In this context, PASA placed measures to assess program quality to ensure rigor across programs. Additionally, the badges are aligned to relevant state standards and the national Common Core.

**Align credential to standards** > **Use national or international standards** > **Standards alignment**

PASA intended to align afterschool programming and extracurricular activities to the nationwide Common Core State Standards and to relevant school and state standards. The project planned to map the badges to the standards of accredited institutions or agencies. In addition, PASA also intended to integrate a program assessment inventory method they had already constructed, the Rhode Island Program Quality Assessment (RIPQA) tool. They aimed to set consistent standards and ensure steady improvement of the quality of the programming in a list of “indicators” set out in the RIPQA. Equipped with this tool, badge issuers and program providers can further strengthen the educational rigor and communicate the quality of youth’s learning experiences across organizations by ensuring that participating programs keep improving.

PASA enacted their plans to assess program improvement with the RIPQA tool, and they noted how various expanded learning opportunity (ELO) programs aligned to elements of the Common Core standards for high school. Challenges emerged in standards alignment, as program partners were caught between conflicting perspectives and directions. Some ELO educators did not want to align program activities to the domain of formal schooling. Conversely, other educators were already covering the
standards and noticed this only when the alignment process started. As the badging initiative progressed, a greater number of ELO programs have been aligning to standards (DPD Follow-up Interview). PASA aligned some badges to academic standards, specifically at the high school level. Other badges, such as those designed for middle school, are not likely to be aligned to content standards. When the program applies to be an ELO, the school district would review their application for approval and then determine how the program aligned to the standards (DPD Follow-up Interview). Further, some of the programs are aligned with industry, including areas of arts programming and environment groups. Coordinating with the schools, district curriculum leaders review the curriculum and standards alignment of the ELO programming to ensure a good fit with what high schoolers are learning in the classroom. Moreover, there is a prospect for alignment and collaboration between programs in other cities for standardization.

This practice of “standards alignment” illustrates the principle of “align credential to standards,” ensuring that the curricula and badges are consistent with a set of standards that can translate across settings. In this way, badges can communicate specific competencies that are recognized, promoting clarity in the interpretation of skills represented by badges.

**Award formal academic credit for badges > External collaboration**

As described in their initial proposals, PASA intended to collaborate with the Providence school district to align after school program curriculum with school-based standards so that the schools could award formal credit to youth for earning specific badges. All programs are run by after school program providers from the community.

In addition, PASA planned to integrate services from an existing partner, national data management tool [YouthServices.net](http://YouthServices.net), with The Hub to automatically update the profiles of youth to reflect new badges that they qualify for in their field. The system also allows the badge opportunities and achievements to be shared as “news” items on the HubProv homepage and other online networks. The project uses YouthServices primarily to measure assets of the system, such as program attendance, students’ applications, school data, student identification, location of residence, and previous middle school attended. PASA set up a data feed from YouthServices to provide students with real-time updates on their online profiles. The data was embedded in YouthServices from the middle school network, and PASA worked with them to ensure that YouthServices worked with the HubProv platform.

In carrying out the badge system, PASA incorporates YouthServices.net to measure the attendance of students. A pending agreement with youthservice.net will allow PASA to automatically award attendance badges (DPD Initial Interview). The program collaborates with community partners to provide expanded learning opportunities. PASA collaborates with the Providence school district to enable high school students to earn academic credit for their badges at PASA. All programs are run
by after school program providers from the community. They continue to use program participation of middle school students in PASA to guide program participation at the high school level.

As shown in PASA’s practice of “external collaboration,” the badge system demonstrated the principle of “award formal academic credit for badge” by enabling high school students to receive formal credit for earning certain badges. Through external partnerships, the project promoted the capacity to pave pathways that make an impact across school and organizational settings.

Use badges to map learning trajectories > Provide routes or pathways > Flexible learner pathways

A central aspect of the learning process PASA intended involves uncovering which program categories students choose and the reasons for it. The badge infrastructure is categorized differently in middle school and high school programs. Whereas the middle school programs are categorized into arts and sports skills, the infrastructure at the high school level is defined in bigger categories including technology, business entrepreneurship, school and college, jobs, community and culture. These categories are then divided into finer-grained subcategories. As has been the case before adding badges, participating students can look at available programs on the Hub website and apply directly to the program themselves.

Figure 1. PASA example of youth level badges

PASA observes the choices of programs that students make and the reasons behind them, charting the next steps in the pathways, and intended to continue this monitoring while implementing the badge system, tracking students’ pathways.
As enacted, the project sheds light on the user behavior of program participants and can better understand the next steps in the pathways. PASA Deputy Director Alex Molina explained, unpacking a cluster of related functions of the diverse options students pursue:

We’re using that data to make sure we’re giving [students] the right tools to make informed decisions about what they’re interested in. Once they get to high school, they have an idea of what they’re interested in… The data goes online. Young people can then see what they’ve done in the past and what they can do in the future. Even more, we’re working hard with the district and the Office of College and Technical Careers to make sure [students] understand exactly the long term impacts, and how an adult could come in and say, ‘Hey, it looks like you’re really interested in technology. You’ve done these programs in middle school; this in high school. You have these skills. Think about X.’ That’s for youth, and what we hope to do--this is in the planning process with the district right now--is to personalize those experiences, so the next step is as young people go to those pathways. [As] they get those badges, it would unlock those internships and unlock a lot of opportunities” (DPD Follow-up Interview).

The visibility of students’ pathways across allows for these possibilities that combine to improve the interaction between students and the various programs they participate in, and it enhances their ability to choose a pathway through different middle and high school experiences that is fun and educational.

This practice shows how PASA makes various learning pathways available in the badge system, as an implementation of the principle “use badges to map learning trajectories” The badge history of students offer insight into the steps that students take in charting the course of their learning pathways.

**Recognize educator learning** > *Students award badges to educators*

PASA also intended for students to award badges to educators and to create the badges themselves. The project would like to enable students to award badges to their community educators and program providers, offering recognition for strengths. PASA said that they planned to facilitate “design session with students to identify the kinds of information that would be valuable and the type of recognition that would be valuable in this relationship” (DPD Initial Interview). In this way, the community can arrive at developing badges that would meaningfully recognize and offer proper credit to educators for their work.

The project is developing the capability for youth to award badges to educators. In the badge system, the only implemented badges are those PASA awards to youth. This practice has not yet been enacted yet, but it remains a possibility on the horizon. Alex Molina raised a point with respect to communicating the value and meaning of a badge within the urban community. He explained:
One thing that we’ve discovered is that young people are really attracted to the experience, and they’re connected to adults, and that’s why we’re trying to ensure there’s a currency behind badges and that it opens doors, because we’re scared that badges for young people and the community doesn’t mean much. . . However, they keep talking about the experience and the connection to adults, so for that reason, what we need to do for the next six months of the year is to make sure, if we do give badges, to open something up and it means something else. Because right now, they’re like “Great, it’s a badge. What can I do with that?” So we need to make sure that it is of value, and we haven’t done that yet, because young people really don’t know the value of a badge, and that’s something we’re working hard to fix (DPD Follow-up Interview).

As Alex described, the main obstacle to implementing higher level practices is that students need to understand how badges work on a personal level before they can contemplate doing more advanced things like awarding badges themselves. As PASA introduces badges to the community, the goal they described for moving forward for this process was “showing the value” of earning a badge and how it could translate into access to additional opportunities and experiences. Through this lens, PASA hopes to reach the point of implementing advanced badge practices like students awarding badges to educators.

This intended but not yet enacted practice represents the principle “recognize educator learning” with digital badges and would provide distinctive credentials for participating adults, but much culture-building work remains before implementing this could become an option.

**Have experts issue badges > Credentialed via accredited entity and community >**

*Accredit program providers to award badges*

As described in their proposals, while central PASA administrators would be the primary badge awarders, the project would also incorporate the capacity for distributed program providers and participating young people to award badges. In this respect, PASA hoped to establish a threshold for an individual to qualify to issue badges.

Besides this, PASA also intended for educators to receive badges in the badging system, which would involve steps in the process of becoming endorsed program partners for PASA. The project discussed the creation of digital badge pathways to receive endorsement, describing the process of manually constructing it and understanding what is involved in building this system (DML Stage Two Proposal). The inclusion of this process strengthens the way the badges are validated.

As enacted, PASA issues all the badges in the program so far. The project has ongoing work on designing peer to peer, peer to instructor, or instructor to student badges for HubProv, the online platform designed for high school youth. As it stands, students
demonstrate their skills on the HubProv website and present in a final demonstration session before they can receive a badge (DPD Follow-up Interview).

The practice of accrediting program providers to award badges in PASA’s system is connected to the principle of “have experts issue badges,” in which the project presents a case of “credentialed via accredited entity and community.” Before a badge is issued, a panel of community judges review and assess the learner artifact, and programs are held to the standards that PASA established. In addition, the intent will be for badge awarders outside of PASA’s internal staff to qualify first before they can award badges, though this has not been implemented.

**Design Principles for Assessing Learning in Digital Badge Systems**

PASA aligned the badge system and curriculum to relevant standards, leveraging the Rhode Island Program Quality Assessment tool to ensure consistency of high quality experiences across programs. At the high school level, students can receive formal credit for earning badges based on their participation and achievements. Besides using a computer scoring system, the project also included peers and a panel of community judges in their plans for the assessment process. Peers were intended to play an important role in assessing the learning of one another, and rubrics have been developed for badge issuers to ensure that the assessment process is consistent with specific criteria.

**Align assessment activities to standards: Create measurable learning objectives > National/State Standards > Standards alignment and earning credit for participation**

As intended, PASA aimed to align the badge system and assessment process to relevant content standards. Because the after school ten week programs directly results in elective credit, PASA has begun to build ways of ensuring that their assessments meet schools’ standards for awarding credit. By integrating the RIPQA, the project aimed to include program AfterZone and high school program providers in a continual process of quality improvement. The project also intended to align badges in high school programs to the Common Core State Standards. Many programs have applied to be expanded learning opportunities for high school youth, and they would typically outline learning goals and share their curriculum, which PASA would analyze to determine how it aligns with the Common Core State Standards (DPD Follow-up Interview). This process is intended to ensure that a strong case can be made to participating schools that students should earn academic credit.

The enacted practices include the alignment of badges to standards at the high school level. The high school programs are all aligned to the Common Core State Standards and relevant school and state standards, enabling them to earn credit that transfers to their regular classes for participating in after school programs. For different programs, the curricula are aligned to distinct standards depending on the field or area. PASA Deputy Director Alex Molina described,
It begins with standards alignment...[and] culminates when their teacher recommender, their community provider, and panelists come together and assess if their learning has happened. We give them the goals and outcomes, the standards, they review it, and they’re looking, especially for the teachers and community partners, from point A where the students started to the end, if they have hit those points. There’s other things they need to do besides showing those skills. They need to come to the program at least 80% of the time. They need to blog, and to some extent they need to defend their thesis, what have you learned. Those adults come together, they have the rubric, common assessments, and they know what they’re looking for with those things.... At the end, everybody comes to a consensus that the young person met every benchmark: “Here’s proof, here’s evidence. He or she should get credit and a badge.” (DPD Follow-up Interview)

PASA exemplifies the principle of “align assessment activities to standards: create measurable learning objectives” through their practice of “standards alignment and earning credit for participation.” Aligning curricula to standards, PASA illuminates the skills and knowledge to be assessed and justifies the value of the badges and students’ learning to the schools who award them academic credit.

**Enhance validity with expert judgement** > *Use a combination of human and computer experts* > *Validation by a computer scoring system, peers, and a panel of community judges*

PASA intended for program providers to set benchmarks and nominate youth for badges. As the process of benchmarking and nomination happened, YouthServices.net could log student progress along a pathway. When students qualify for a badge within their fields, their profiles will be automatically updated to reflect their accomplishment (DPD Follow-up Interview).

As PASA carried out their badge practices, they employed a computer scoring system with YouthServices.net to validate certain criteria for badges, including students’ attendance data. The badge issuing process was intended to includes an automated component, and the project is continuing to develop peer assessment and build in assessment by a panel of community judges based on the use of rubrics. As enacted, badges are awarded solely on students demonstration day at the end of each ten-week after school program, though attendance information and blog post data collected online is used in their assessment.

The badging practice of “validation by a computer scoring system, peers, and a panel of community judges” exhibits the principle of “computer experts” and specific principle “use a combination of human and computer experts.” Educators and judges from the community achieve certain qualifications before engaging in the assessment process, providing an appraisal of student performance based on carefully developed rubrics.
Enhance validity with expert judgement > Peer feedback > Peer assessment

PASA intended to develop more opportunities for peers to use rubrics in assessing blogs about specific skills and challenges. The project envisioned youth as integral to the assessment process in offering feedback to peers.

As they implemented their badge system, PASA is currently still in the process of developing peer assessment mechanisms and practices. Alex Molina reported that HubProv serves mainly as a place for students to interact but not truly assess one another, so this functionality is not used to currently award digital badges (DPD Follow-up Interview). The project faces the task of building a culture of use, as it introduces badges to the student community and communicates the value of badges.

In the badge system, PASA intended and has been working toward incorporating the practice of “peer assessment,” which embodies a form of the principle “enhance validity with expert judgement.” Peers can contribute to the formative process of assessment by supplying feedback on one another’s learning.

Use rubrics > General rubrics > Rubrics are used to assess learning

PASA integrated rubrics in their plans for the assessment of students’ performances, adopting and modifying existing rubrics from Ohio, New Hampshire, statewide material from Rhode Island. PASA intended to further develop and improve the rubrics for better alignment and consistency as they progressed.

As this practice was enacted, PASA employed detailed rubrics to assess artifacts and learning. These rubrics are being adopted and modified from several existing rubrics, including the abovementioned from Ohio, New Hampshire, and Rhode Island. The rubric has been modified and updated to meet student's learning goals and needs. By adjusting the rubric, PASA worked with the district and community providers to ensure that the rubric is readily interpretable, enabling panels to form a clear basis for understanding the outcomes to assess. Specifically, the students go through a “final demonstration session” before a panel of judges before they can earn a credit-bearing badge (DPD Initial Interview). The program duration is at least ten weeks for credit-awarding ELOs at the high school level. When youth present their work after ten weeks of the program, they are assessed based on a rubric by a panel of school and subject specialist community members, including entrepreneurs, teachers, and peers. The rubric is used to assess whether the student has demonstrated the achievement of learning goals and expectations, before awarding students badge and credit.

Illustrating the principle “use rubrics,” PASA implemented rubrics developed to offer a guide to assess student learning and achievements and ensure assessment consistency for high-value badges that also indicate conferral of school credit.
Use formative functions of assessment > Assess program quality, accredit experts and issue program level badges

The project intended to develop a common assessment method based on the RIPQA to ensure that participating programs met the quality levels PASA wanted to achieve, and more specifically, that they keep making progress on many “indicators” of quality (RIPQA). They envisioned a “program endorsement” badge for program providers based on the achievement of progress measured by the RIPQA.

Figure 2. PASA planned to endorse participating program providers

PASA leveraged the RIPQA in assessing program quality in its badge system implementation. The RIPQA is based on a set of indicators for what a quality assessment program would look like. These indicators are organized into five core areas: (1) Health, Safety, and Environment, (2) Relationships, (3) Programming and Activities, (4) Staffing and Professional Development, (5) Administration. As a whole, the assessment method provides a set of guidelines on aspects of a quality program.

This practice fits under formative functions of assessment for PASA’s effort on ensuring that programs make progress toward high marks in the RIPQA. This is not a practice for providing formative feedback for students, but there are to be badges issued under this practice. The project is still continuing development on badges for program providers, primarily issuing badges to students. However, PASA’s practice of
implementing the RIPQA demonstrates the process of employing feedback toward the ongoing quality of the programs.

**Design Principles for Motivating Learning**

PASA employs badges as a way to map student progress, attendance, and achievement of learning outcomes in a variety of after school activities. Badges were intended to be awarded not only by program staff but also by peers, though peer awarding has not been implemented to date. At the same time, the program includes the caveat that the mere addition of a badge to an otherwise unmotivating activity does not automatically increase student motivation; one story detailed below among PASA’s challenges that system designer Kerri Lemoie shared was about a student who did not find the badge a motivating force to complete the activities (DPD Initial Interview).

**Give badges for small accomplishments to hook in learners**

> **Acknowledge continuation of interest**

The project intended to initiate learner interest and sustain student engagement by awarding badges for subskills of specific subjects, created by the specific programs and tailored to the learning pathways through which each program led students. PASA explained that the badges “reflect and enhance ongoing behaviors in middle school programs—passion, perseverance, etc.—[and] will act as goals and guides along learning pathways extending through high school and beyond” (DML Stage 1 Proposal). As described in the project proposal, badges can motivate learners to persist in a specific area by reflecting a continuation of interest and promoting their mastery of specific skills or subjects. Further, the experience is rooted in youth choice. PASA explained, “Some youth explore multiple interests or take part in leadership opportunities, but many repeatedly take the same “types” of programs, reflecting an interest in a particular learning pathway. Hub Director Damian Ewens explained:

Imagine a kid takes two or three STEM-related programs. What we're defining right now is that if they've taken three of them in a row, we're using that as a proxy for interest. By the time they hit eighth grade, if they take three (and attendance expectations and such are met for the program), they would have the opportunity to be the first to apply to our STEM-related programs in the high school level. (DPD Initial Interview)

As students decide on which program to take, they play a central role in paving their own trajectories of learning and charting out their own pathways. Badges could act a means of demonstrating students’ interests and ability in specific content, functioning as milestones in students’ learning and acquisition of skills.

The project has not carried out the practice yet, but hope to look at the skills in the Spring 2014 (DPD Follow-up Interview). They are planning to award the badges on the youth profile, working with the providers to identify where in the program young people
would practice granular skills that could serve as the basis for minor badges. PASA aims to plan the skills to recognize together with the school district and with employers in Rhode Island, who are looking for future employees who are able to communicate effectively, persevere, solve problems, and work in a team.

This intended practice has not been enacted yet, but forms an example of the principle “give small badges to hook in learners,” because PASA uses badges to encourage continuing interaction with particular learning pathways. The badge system would then provide guideposts to youth and encourages further growth as youth continue to develop and pursue their interests until they complete 10-week programs and earn the full-value PASA badges.

**Provide privileges > New activities AND Internships > Give students privileges and new opportunities**

PASA intended to open up privileges to students for earning certain badges. Badges are intended to motivate students by providing access to internships and other resources. The project proposal explained, “As 8th graders and high schoolers attain certain badges they would receive special privileges—8th grade-only programming, paid internships through The Hub, personalized tutoring, etc. As the badge ecosystem develops, opportunities and privileges would expand significantly, supporting healthy behaviors, college access, leadership development and more” (DML Stage 1 Proposal). The projects offers privileges to badge earners to promote youth development outcomes and foster their learning.

No formal grant of privileges based on the earning of badges has been implemented to date. However, as enacted, badges act as a motivator by helping provide access to higher-level programs and opportunities. As youth earn specific badges, they will look more qualified to those who approve their application to more advanced ELOs that can then further advance their knowledge and skill mastery. In this way, PASA can indirectly offer them opportunities to gain additional experience in a certain field based on their previous experience (DPD Follow-up Interview). However, plans are moving forward to help young people leverage their after school experience to open new opportunities. Alex Molina reported in December 2013 that through partnering with the school district Office of College and Technical Careers that “the next step is as young people go to those pathways, they get those badges—it would unlock those internships and unlock a lot of opportunities, so we’re at maybe about six months to a year to finalizing that” (DPD Follow-up Interview).

PASA illustrates the principle of “provide privileges” through their practice of giving access to internships and other opportunities, both through informal current practices and their continuing ambitions. These privileges can advance youth’s competency development and open up further ways to apply their learning.
Utilizing different types of assessment > Peer > Feedback on peers’ blog

The DPD project noted that PASA’s intended practice of peers endorsing each other’s work was aimed at motivating participation. As youth are encouraged to participate in peer assessment, they can provide one another with peer feedback, which the project intended would then unlock additional privileges, such as new learner activities, within the site.

As enacted, PASA gives capacity for peers to comment on one another’s blogs on HubProv. The project plans on developing the possibility for peers to give a “+1” to indicate a good review or feedback. Additionally, this has the potential to lead to additional privileges with what they can do on the site. While there is student communication on the website, however, PASA would like to increase the volume of interaction between students in providing feedback (DPD Follow-Up Interview).

As illustrated through this practice PASA’s badge system provides an example of the principle “utilizing different types of assessment.” One of the possible effects of students’ interaction on the Hub is that they may be further motivated to learn because of peer feedback and increasing social connections.

Provide privileges > User-created badges > Users help create badge graphics

PASA intended for users to take part in creating the images that are used as badges. By obtaining student input, PASA hoped to enable youth to take greater ownership of their learning experiences and contribute to the program design.

As they built the functioning program and badge system, PASA used input from youth to design the AfterZone brand for middle schoolers. The Hub Youth Team co-created the Hub programs, logo, website and collateral materials. AfterZone and Hub students took part in the graphic design of middle and high school badges with a professional designer from Embolden. The after school system also held badge design competitions and incorporated elements of AfterZone and Hub branding. Alex Molina confirmed this as an important continuing practice of the PASA system, saying “young people are the customers, like any organization you’re going to listen to your customers to inform product design and delivery” (DPD Follow-up Interview).

Illustrating the principle of “provide privileges,” PASA implemented the practice of “users help create badges.” By including the input of youth, the project enables them to take greater control of their learning experience, which may increase their connection with the credentials and motivate them to learn and participate more.

Setting goals > Display of goal trajectory > Badges mark completed milestones towards goals

PASA intended to measure students’ progress toward growth. PASA intended to build Progress and Recognition badges to acknowledge achievements along a pathway from which users are awarded points. After users have reached a number of points
required by the benchmark, PASA planned to award a Progress badge. This element of the program aimed to recognize skills or competency-based achievements along a path toward a PASA Recognition badge. PASA intended for the badges to recognize students’ efforts en route to a larger goal.

The project works to ensure that badges can connect students’ in-school and out-of-school learning. Youth are informed of choices through discussions with teachers and also on the online portal. On the youth profile, students would see the badges that have already earned and additional badges that they could earn, finding out about skills and competencies that they can continue to develop and grow. PASA has not yet started to award Recognition or Progress badges, but they have been issuing Completion and Skill badges, which students earn during the final demonstration day. Completion badges are awarded for completion of the program, and Skills badges are awarded for mastery of certain skills achieved by the student. Students can see which badges they have earned and which others are available. As described by PASA Deputy Director Alex Molina, “the big picture includes working with the district to create a portfolio that connects students’ in-school and out of school experiences, providing youth with the tools to create their own personal learning pathways” (DPD Follow-up Interview). By showing their badges and achievements, then, students would be able to access other opportunities and apply their learning to institutional or professional contexts.

PASA demonstrates the principle of “setting goals” through their practice of “badges mark completed milestones towards goals.” The project propels learners to persist and grow their abilities further by awarding badges that mark the milestones students reach in developing their skills and competence.

Design Principles for Studying Learning

PASA’s research practices include collecting data on program attendance and user engagement. The type of choices students make can inform further design and iteration of the badge system and map out their learning pathways. As PASA carries out assessments of its programs, the evidence gathered from these assessments can be applied to make adjustments or improvements to the learner experience.

**Improve badge impact > Research FOR badges > Formative program assessment**

The project intended to develop a common assessment across projects. PASA wanted to implement program assessment to ensure the rigor of students’ experiences and accomplishments. Specifically, the RIPQA tool includes a set of “indicators” from which educators can assess the quality and improvement of PASAs varied participating programs and strengthen the consistency of high quality from program to program.

PASA enacted the practice of using the RIPQA to conduct regular program assessments. The program offers aligned professional development and holds providers to high attendance and enrollment benchmarks. PASA leveraged the assessment evidence
to serve formative purposes and enhance the quality of the program experience. The project will employ program assessments to conduct research and iteratively refine the program experience, as noted in the formative assessment practice “assess program quality, accredit experts and issue program level badges.” The project has adjusted the training as they implemented the badge system. PASA Deputy Director Alex Molina described that, in middle school and eventually in high school, they will work on another assessment tool for young people (DPD Follow-up Interview). For middle school, the method is called the Survey of Academic Youth Outcomes Staff Survey (SAYOS) by the National Institute of Out-of-School Time (NIOST), focusing on youth outcomes and the growth of students over time (DPD Follow-up Interview). The tool is not employed at the high school level, and the project is working with NOIST to explore assessment methods and showcase student growth.

The principle of “research with badges and for badges,” referring to efforts to improve badge systems, is embodied in PASA’s practice of “formative program assessment.” Through assessments of program quality, PASA uses the data and evidence to inform the further design and development of the user experience.

Challenges This Project Faced

PASA faces challenges in motivating learning as well as across the strands of motivating and recognizing learning. The project encountered the challenge of building a culture of use within the urban community. It tried to get youth to recognize the value and meaning of badges, connecting them to opportunities and experiences. PASA believes that its badges in and of themselves are not motivating if attached to an activity that is not inherently motivating. Moreover, PASA works with communicate providers to get across the potential of badges and to carry out its program effectively.

Infrastructure challenges and access to technology

PASA encountered challenges in terms of infrastructure constraints and district-wide access to technology. Alex Molina, PASA Deputy Director, stated “We work with schools that don’t even have computers or laptops, or there’s no wireless access, and young people go home where there’s no access to technology either.... the reality is that we’re working in an urban environment, and [on] the idea of badges, a lot of urban centers or cities are not going to be ready five, ten years down the line. The school district does not even have the infrastructure to do this” (DPD Follow-up Interview). There are considerable difficulties in implementing the badge system if the school infrastructure cannot support it. Molina pointed out, “What I’m scared of is if we don’t fix those structural issues, badges may become another assessment for the haves that have the access to technology. They know how to leverage complex networks, and urban
youth are going to get left behind, so that’s one of the challenges we want to address: that badges don’t become another line in the sand that says you can’t access this because your school’s not providing this” (DPD Follow-up Interview). The project met the challenge of ensuring that students have access to opportunities and experiences even with technology hurdles.

**Badges do not overcome unmotivating activities by themselves (Motivating)**

A compelling point is that badges in and of themselves do not motivate. Kerri Lemoie said, "One of my students didn't do his weekly task. Another student got a badge for doing his, and I said to the first student, 'But you'll get this badge!' And he still hasn't done his task. He just wasn't interested in doing the task. The badge didn't even matter. It didn't matter how cool it looked or that his friend got it. He just didn't care about it" (DPD Initial Interview). This illustrates that offering students a badge for performing an activity that is not intrinsically motivating does not automatically translate into motivation for that task. This challenge relates closely to building a culture of use around badges, as described below.

**Building a culture of use in recognizing and motivating learning**

A challenge surfaced in building a culture of use in the urban community for recognizing and motivating learning with badges. PASA Deputy Director Alex Molina described, “We’re learning that badges are a cool thing for us adults or those who work with technology, but for a lot of urban youth, it’s not there. How do you convince young people that a badge has a currency when they’re facing other issues—when they’re at a failing school, when they’re competing for jobs with adults? And until a badge gives them a job or really gets them to college, it has no value to them, especially for urban youth, the value is engag[ing] in high quality experiences with an adult that cares” (DPD Follow-up Interview). In the communities, youth face a number of immediate and pressing concerns, and they may not recognize the value and potential of a badge. Molina describes the structural challenges in recognizing the value of the badge and its capacity to effect change and open up concrete pathways for learners to pursue (DPD Follow-up Interview - December 20, 2013). He explained, “Young people sign up for programs not because they’re going to get a badge. They sign up for programs, because they get to work with a cool adult. They get to participate in something that school’s not giving them” (DPD Follow-up Interview). Often, the reasons that youth sign up are based largely on the experiences they gain rather than for the badges they could earn.

PASA faces the challenge in communicating this value to students and building up a culture of youth, because they are managing a citywide network of programs, permitting them less face-to-face time with individual students. Molina stated, “From PASA’s perspective, also, we’re not a program, we’re a system that enables people to access those [opportunities], so a lot of times, we don’t have a one-on-one with the student. We allow programs to work with students, so that’s been a difficult thing” (DPD Follow-up Interview). The project works with the programs to deliver the content to young people; they do not tell the programs how to teach the subject, but rather how to work with students in implementing the protocols.
References:


Appendix: NOAA Planet Stewards

Personalized Learning in 3D GameLab

Summary

Planet Stewards is a badge-driven learning program that guides high school science students through the exploration of careers in five categories of Earth sciences. It is a partnership effort by the National Oceanic and Atmospheric Administration (NOAA) and Boise State University’s 3D GameLab, an online learning platform designed around quest-based learning. 3D GameLab developers, headed by Lisa Dawley of GoGo Labs and Chris Haskell of Boise State, partnered with NOAA to offer badges based on NOAA’s educational content. Planet Stewards won a grant through the MacArthur Foundation’s Digital Media and Learning (DML) competition to build a badge system around planet science career pathways. The project involved not only developing the badges, but also the quest-based curriculum around NOAA’s educational content. The program also considered the developing Next Generation Science Standards and the published guiding principles that form the basis of those standards as they decided what science and engineering practices would be emphasized in the career quests.

The team from 3D GameLab worked closely with subject matter experts working in NOAA’s various planet science programs from climate studies to oceanography. The placement of the project within a “career pathways” group of DML winners guided the team to organize the badge system around possible careers for students to explore, so that students could earn a badge for exploring the work done in each of 15 planet science careers. For each career badge, Planet Stewards defines a set of quests and activities that help students understand the type of work performed in each of the system’s science disciplines.

On the 3D GameLab website, students see their options for quests to attempt, with descriptions, requirements, standards alignment tags, and user ratings. Completing quests unlock further quests, and students earn badges after completing each career’s map of quests. Though many of the learning experiences associated with the badges are online, the program is offered by participating teachers working with their own students. 3D GameLab designed their online platform so that teachers can adapt the basic quest-based curriculum to the needs of their particular classroom and can require students to complete all sorts of assignments that the teacher can assess. The 3D GameLab platform allows teachers to select and organize quests from an available collection and offer them to their students.

Because teachers are an integral part of the program’s operation, 3D GameLab offers training and certification on behalf of NOAA to ensure that these teachers’ students get a good
experience and that the badges they earn maintain NOAA’s high standards. After completing a training session and earning their own NOAA certification badge, teachers gain the privilege of cloning the Planet Stewards curriculum into their own classroom quest map and customizing it if necessary. As their students progress through the system, teachers assess their completion of quest assignments and award badges by certifying their completion of each career quest map.

**Timeline**

The Planet Stewards project is a collaboration between NOAA’s education effort and 3D GameLab, both initiatives with established infrastructure prior to the project. NOAA made a proposal to the Digital Media and Learning (DML) competition for leveraging its existing education content to recognize high school science students for increasing their scientific literacy in topics covered by the agency. In phase two of the DML competition, NOAA partnered with 3D GameLab, and revised their proposal around quest-based learning, envisioning a focus on rewarding students for progressing toward science standards. The team was placed in a group of projects pursuing career pathways and found a new focus for the Planet Stewards badge system around career exploration.

In the investigation of this initiative, the Design Principles Documentation Project analyzed the proposals and related materials outlining project plans, characterizing practices they intended to use in the badge system designs for recognizing, assessing, motivating, and studying learning. Next, the DPD Project grouped these practices and those identified in other projects and named general principles under which they clustered. In November 2012, the DPD research team interviewed Lisa Dawley, co-creator of 3D GameLab and Peg Steffen, education coordinator in NOAA’s National Ocean Service in order to identify the practices that had begun to be enacted in the badge system.

System development proceeded, and Planet Stewards held its first teacher training session in Spring 2013, following up with bigger sessions in the summer and fall. After these trainings, teachers could begin implementing Planet Stewards in their classrooms however it best fit in their curriculum. The first group of teachers started offering the program throughout the fall and winter of 2013-14. In October 2013, the DPD Project interviewed Lisa Dawley again to characterize how practices had evolved and determine the formal continuing practices of the badge system.

**Evolving Practices and Design Principles**

What follows is a list of practices as they relate to the general and more specific design principles in each category of practice. The headings name a (a) **General Principle**, (b) **Specific principle**, (c) **Specific practice**. The paragraphs below each heading detail the project’s (a) intended practice, (b) enacted practice, and (c) how that practice relates to the specific and general principles.
**Design Principles for Recognizing Learning**

Planet Stewards runs on 3D GameLab’s quest-based learning platform, and is accordingly organized around quests, organized along learning pathways that represent career roles and study areas filled by working NOAA scientists. Planet Stewards offers badges for exploration of careers in five areas, corresponding to major components of NOAA’s mission: Climate Science, Freshwater, Marine Life, Oceans and Coasts, and Weather. Students progress through these five tracks of three career badge quests with some degree of choice over which careers they will pursue. In completing the quests needed for each badge, students practice the skills used by scientists in each of these fields and those skills identified by applicable standards covering high school science education.

**Contextual Factor** > *Coinciding badge and curriculum development*

NOAA and 3D GameLab partnered to apply for the DML competition grant. Prior to receiving the grant, NOAA had some educational materials covering the areas targeted by Planet Stewards, but the badge project included a lot of work to turn this existing material into quests on 3D GameLab’s platform.

The idea of fifteen badges in five “areas”, with three badges in each area was sketched out in the original proposal, but the team had to then define them in terms of career pathways. This required 3D GameLab to involve NOAA subject area experts to find out what they thought were the relevant career groupings and pathways. Lisa Dawley explains, “The badge was the frame, and then we started drilling down on that, for what content needed to be covered” (DPD Initial Interview). NOAA’s educational director Peg Steffen detailed this process:

We used that career pathways framework, and then we took a look at what kinds of science careers NOAA is good at. We used existing materials, videos, and activities, to weave them into a matrix highlighting career pathways that students might take an interest in pursuing...We also wanted to make sure that this also was relevant to the content that was being covered in the classroom, and since NOAA is a science agency primarily, and they do a lot of applied science so there were lots of opportunities to weave applied science with the careers with the existing materials into the 3d gamelab platform. (DPD Initial Interview)

The DPD project identifies this process as coinciding badge and curriculum development despite the prior existence of some educational content. Molding that content into the 3D GameLab quest system was involved and required significant reconfiguration of material to align to the badges named after careers.

Sheryl Grant’s “buckets” describing stages of development badge projects start in or pass through may illuminate the differences between Planet Stewards’ approach and other projects that coincided badge and curriculum development. Planet Stewards did not start from scratch, because NOAA brought years worth of material developed for disparate education efforts, and the 3D GameLab system already had almost all of the
features required to issue badges. Grant would characterize this starting point as a “layered build,” referring to the layering of the badge system upon existing content and technology stack. Either of those two variables may differ between projects.

In contrast, a process of building badges to match previously developed educational content, badges would be named and aligned based on the structure of the existing content, which in this case was not previously tightly aligned to careers of NOAA scientists. See Figure 1 for an example of the three careers selected for the Freshwater career category.

Upon reflection after initial implementation, Lisa Dawley describes the team’s approach as an instructional design process not just a badge design process. Badges represent the educational objectives that you normally start with in an instructional design process. Outcomes in this system align to the badges. She emphasizes that the element of alignment to career pathways took on a stronger role as development progressed from initial ideas to the first design (DPD Follow-up Interview).

**Freshwater Badges**

![Coastal Manager](image1)  ![Ecologist](image2)  ![Hydrologist](image3)  ![Freshwater “Super Badge”](image4)

**Figure 1.** The three careers in the Freshwater track (Coastal Manager, Ecologist, Hydrologist) and the metabadge earned for completing all three.

**Align credential to standards > Use national or international standards > Alignment to National Science Education Standards and Next Generation Science Standards**

Before shifting their focus to career pathways upon being assigned into the career pathways DML competition group, the Planet Stewards team intended primarily to target scientific skills students could develop by interacting with NOAA educational material (DML Stage 1 Proposal). Specifically, they intended to recognize skills identified as important for high schoolers by the Next Generation Science Standards and include recognition of these skills where relevant within the career pathways structure. By the time of the second Planet Stewards proposal to the DML competition, the team described their intent to cover “Skills and knowledge... drawn directly from the National Science
Education Standards for 9-12 grades. We are also able to adapt content to the Next Generation Science Standards that will be released later this year. Emphasis will be placed on science as inquiry, in which students learn skills such as observation, inference, and experimentation” (DML Stage 2 Proposal). After the assignment into the career pathways group and the 3D GameLab team’s first meeting at NOAA, Planet Stewards solidified on a focus on career badges, with related skills embedded within careers (DPD Initial Interview).

As the team began implementing the system, the NGS standards were not finalized. However, standard development was based on a previously published framework and guiding principles, which named the skills to be included in the standard. Planet Stewards used the guiding principles, which identify science and engineering practices, core concepts and ideas. Upon initial enactment of the badge program, Peg Steffen felt this approach of focusing on the “framework” rather than waiting for the finished standard made more sense for a project like Planet Stewards, because the forthcoming standards will contain performance expectations, which would be tougher to fit content to. In contrast, Peg thought that it would be easy to tie the activities to the named concepts in general, partly because they had been solidified for a while prior to the development of the specific standard (DPD Initial Interview).

As the team planned the career pathway badges, they kept their eye on the framework, “pulling the major pieces from the framework that they wanted to make sure they covered in different badges (DPD Initial Interview). As part of the process, the team contracted with EdGate Correlation Services, whose employees analyzed the badge system and tagged each badge with the elements of the framework. As standards are updated, EdGate plans to help Planet Stewards keep 3D GameLab updated and properly tagged (DPD Initial Interview).

While it is no longer the primary focus of the badge system, the continuing practices represent a clear case of using the principle “align credential to standards.”

**Recognize diverse learning > Badges for Knowledge and Skills**

Planet Stewards intended to help students learn about the skills practiced by scientists working in the various disciplines represented by the career badges. Embedded in the activities corresponding to each badge are tasks that let students to exercise these skills. Planet Stewards planned to recognize these skills primarily through the career badges. Lisa Dawley said, the whole idea of the science career badges “is that the skills are woven in with the content” (DPD Initial Interview).

However, the 3D GameLab system has the capability to award credentials that are not OBI-compliant digital badges as well, as it has done in its other quest-based content programs. These are called “achievements” and are often automated indicators of progress, based on factors like total number of quests completed (DML Stage 2 Proposal). Though not explicitly described in their initial proposals, Planet Stewards enacted several
achievements of this sort that appear on students’ score cards to recognize particular discrete skills that they wanted to reinforce that were separate from the recognition embedded in the career badges. For example, one is named “Science Communicator.” How they appear in students’ scorecards is shown in the mockup for the DML proposal shown in Figure 3 below in a separate box from the badges.

Between the skills developed completing the badges and those recognized specifically by “achievements”, Planet Stewards recognizes diverse learning that would be expected from a program covering a wide range of science careers and knowledge.

Use badges to map learning trajectory > Provide routes or pathways > Badge hierarchy

From NOAA’s first proposal for a grant to build the Planet Stewards badge system, they had the idea that teaching about careers would be an important component of the system, arguing that, “NOAA science provides unique opportunities for students of all ages to learn more about potential career paths” and providing examples of the wide variety of skills that come together under the job descriptions of various NOAA functions (DML Stage 1 Proposal).

As enacted in the Planet Stewards badge system, the quests and badges provide pathways for students to explore these careers. The collection of badges is designed like “a pool of quests with a flowchart (DPD Follow-up Interview). Quests often open up further quests upon completion, so students are guided through the system, scaffolding their knowledge and skills as they explore different careers, though there is no expectation that every student will complete all 15 career badges (DPD Initial Interview).

The implementation of the pathways has changed slightly from initial designs, in order to reinforce the focus on deepening student knowledge of science careers. Planet Stewards implemented five metabadges awarded for completion of all three career badges within each of the five career areas in the system. Lisa Dawley rejected the characterization of this structure as a hierarchy, or at least insisted that it’s a “minimal hierarchy” and that the focus of the system is more on defining pathways than defining levels of skill or knowledge (DPD Follow-up Interview). None of the maps of quests within one of these areas looks like any other, with quests branching differently depending on the decisions of the NOAA subject experts and instructional designers who developed the pathways (See Figure 2).

The Planet Stewards program, as implemented is a good example of the “provide routes or pathways” specific principle of “use badges to map learning trajectory.” The idea is to show the connections and differences between the different planet science careers, and building pathways that let students progress through them provides some freedom to focus on individuals’ interests while also ensuring that students have ample opportunities to practice the skills they should be learning in high school science.
Figure 2. The five career area pathway maps differ based on the combination of skills required in each career.

Seek external backing of credential > Externally endorsed > Backing by NOAA and other agencies

NOAA proposed the Planet Stewards badge system based on its educational content and goals for the DML competition. As part of the competition process, NOAA partnered with 3D GameLab’s developers and found that the 3D GameLab quest-based learning platform was a good fit for its goals. From this point, the Planet Stewards team intended to issue badges from the 3D GameLab application but clearly identified as NOAA badges.

As this plan moved toward a working badge system, the team met with subject specialist NOAA scientists to define and focus the badges. Peg Steffen told the DPD Project that the live offices whose scientists fill the positions represented in career badges were responsible for generating and validating the particular badge sets:

The people that were responsible for helping to generate and validate the weather and climate badge sets work for the National Weather Service and Climate Program Office. Since we do that science, we made sure that those people were involved. (DPD Initial Interview)

This close collaboration in development allowed NOAA to be confident that the badges carrying their logo would represent a level of quality and accuracy that they would want to be associated with their agency. From the perspective of the issuer application 3D GameLab, this partnership exemplifies the principle of “seeking external backing of credential” by means of “external endorsement.” NOAA signs the badges with its logo and name. Before the endorsement portion of Mozilla’s Open Badges specification is complete, this will likely be one of the most common forms formal endorsement of badges takes.

Seek external backing of credential > Externally valued > External recognition

In addition to collaboration with NOAA, the Planet Stewards team also thought about seeking recognition by other outside entities. Possible partners like the College Board are already deeply embedded in providing credentials for high school students.
The National Research Council is another example of an organization Planet Stewards felt might be interested in supporting the badge system in some way.

In describing the plan for the badges, Planet Stewards announced an intention to create badges that would be valued credentials of student achievement in important fields, credentials that might be recognized to qualify those students for opportunities:

The badges will convey that the learner is qualified as an inquirer of science, in a variety of areas, and that they have a thorough knowledge of a content area in science. This might qualify them for college and work apprenticeships in ocean, air, and environmental studies, among other fields. Prerequisites include completion of 8th grade. (DML Stage 2 Proposal)

To date, no formal agreements have developed from this intent. The DPD Project records this as an intended practice under the principle “seek external backing of credential” to record that Planet Stewards investigated and continues to think about possibilities for increasing the value of their students’ badges through collaboration with other organizations. The team would still like to pursue opportunities along this line in the future (DPD Follow-up Interview).

**Award formal academic credit for badges > Seek college credit for badges**

In one way the Planet Stewards badges can be associated with formal academic credit in the classrooms in which the program runs. Teachers assessing students’ work will incorporate Planet Stewards assignments into class requirements as they deem appropriate. However, the Planet Stewards team also intended to explore the possibility of granting badge-earning high schoolers some college transfer credit awarded by 3D GameLab’s parent university, Boise State (DPD Initial Interview).

No formal plan has developed from the discussions with Boise State to date, but Planet Stewards still intends to investigate this possibility in the future. This represents a strong possible use of the principle “award formal academic credit for badges.”

**Determine appropriate lifespan of badges > Never expires > Permanence**

From their early proposals, Planet Stewards intended to give students a permanent record of their science exploration, saying “badges will exist permanently as they represent a specific era of educational achievement in grades 9-12” (DML Stage 2 Proposal). The initial plans for permanence focused heavily on how the badges would be aligned to science standards and the value of the permanence would be attached to the value of meeting of the credential.

In their integration with the OBI, Planet Stewards implemented this dedication to permanent credentials, but the focus of badges had shifted to career exploration. With their collaboration with EdGate to support correlation of their activities to standards, the evidence pages for badges will be updated with the developing correlations as the science standards are finalized.
Use badges as a means of external communication of learning > Transparency and communication

Upon their initial partnership 3D GameLab intended to build an associated display widget that could be embedded on other websites to allow students to easily display the badges they earned:

With a heading such as, “I’m a certified scientist!” at the top, clickable badges representing individual areas of achievement, and a “Mozilla Open Badge Certified” statement at bottom, viewers will understand that these badges represent areas of educational achievement aligned to completion of competencies in science education. (DML Stage 2 Proposal)

Upon digging into building for Mozilla Open Badges to implement Planet Stewards, the 3D GameLab team realized many of the desired capabilities for the imagined display widget existed in Mozilla’s badge organization program, the backpack. They decided to train their users to use the backpack for sharing instead of devoting limited development time to duplicating existing functionality. The language Planet Stewards used in the proposal is an example of the principle “Use badges as a means of external communication of learning.” The proposed practice was to support communication of learning was implemented to the point of providing users support in using the backpack tools but was not needed to any greater extent.

Have experts issue badges > Credentialed via external accredited entity > Badges issued by NOAA credentialed teacher

Once they had decided on a career exploration framework, Planet Stewards intended to put NOAA’s educational content onto an internet platform and create a badge system that would allow students to earn credentials recognizing them for practicing the skills used in each of the system’s identified careers. However, NOAA scientists would not be available to administer learning experiences themselves or to perform assessments of the wide variety of materials students could turn in to meet the criteria of the different quests. The Planet Stewards team decided that the classroom science teachers leading students through the program would be the ones to assess activity and to award students badges (DPD Initial Interview).

As detailed below in the challenges section, the need to train teachers to hold students to standards consistent with the high value NOAA wanted to maintain for its badges became one of the biggest concerns of the badge system.

As enacted, Planet Stewards runs a quest-based training program for teachers and completed its third session in Fall 2013 (What’s new with NOAA Planet Stewards). The 3D GameLab team continues to seek for methods that will allow the training program to scale up so that more teachers and students have the opportunity to implement Planet
Stewards in their classrooms. This is an example of turning teachers into accredited experts and using the recognizing design principle “have experts issue badges.”

**Design Principles for Assessing Learning in Digital Badge Systems**

The Planet Stewards badge system utilizes the 3D GameLab online environment, but the program is administered by high school science teachers to their classrooms of students. The quest system allows students to make submissions of various types through the platform, but it does not feature automatic assessment of the submitted items for Planet Stewards, so the classroom teachers are responsible for assessing the completion of quests. In order to not hamper student progress, teachers can mark some quests to not require assessment before students can move forward along the learning pathways.

**General Principle > National/state standards > Assessment activities are aligned to standards**

From the beginning of 3D GameLab’s involvement with the project, there was a strong focus on using the learning experiences in the Planet Stewards quests to forward students progress toward meeting the goals exemplified by science standards, particularly the National Science Education Standards and the framework underlying the Next Generation Science Standards. The 3D GameLab platform, as shown in Figure 3, which appeared in the project’s second stage DML proposal, has support for standards built in. The player scorecard shows students’ progress toward each component of standards they are targeting, and each quest has the capacity to be tagged so that its completion can mark students’ progress toward various standards components. The inclusion of this capability forced the team to ensure that teachers’ assessments would constitute adequate measurements of these learning claims.

When the badge system began operating in high school classrooms, the project’s shift toward career exploration toned down some of the effort to target standards, but no capabilities were removed from the system. Furthermore, Planet Stewards, through collaboration with EdGate’s standards correlation program continued to strengthen its ability to recognize student progress toward these national standards. Lisa Dawley describes the implemented pattern:

We did indeed create a curriculum matrix that aligned all quests to NGSS. We worked with a company called EdGate to create a digital mapping of these standards, a sort of Rosetta stone that would align our work to all 50 state science standards (personal communication, 20 January 2014).

The full integration with EdGate’s mapping is not yet complete as of January 2014, but it is “one of the next major features in our development queue (personal communication, 20 January 2014).”
Appendix: NOAA Planet Stewards Case Study

Figure 3. The player scorecard shows progress toward standards (DML Stage 2 Proposal).

Use leveled badge systems > Competency levels & Metabadges > Leveled assessments for leveled badges

Initially, Planet Stewards intended to focus on standards and design the badges around “levels in achievement of competencies, and will be tied to learner analytics that visually illustrate progress toward completion of national science standards at the 9-12 grade level” (DML Stage 2 Proposal). The hypothetical designs that appeared in the proposal were not thought to be complete. The proposal detailed the process for moving from these initial thoughts to a completed design for badge levels, saying “Levels have yet to be identified, and will require thoughtful discussion between project directors, instructional designers, and subject-matter experts from NOAA (DML Stage 2 Proposal). Before the 3D GameLab and NOAA education teams met to work out the levels, the system focus changed to career exploration, and at the July 2012 workshop at NOAA headquarters, the basic map of the badges based on career exploration was developed.

As enacted, the badge system contains minimal levels because of the focus on careers, none of which are elevated to greater importance than the others. However, there are elements of leveling that remain in the system. Teachers assess artifacts students submit for each quest. Lisa Dawley emphasized that the assessments and badges themselves don’t level, as the higher level badges are simply metabadges for completion.
of all the careers in a pathway. However, the complexity of what it takes to complete a quest inside the quests that lead to each career badge scaffolds and gets progressively more involved (DPD Follow-up Interview). For example, the career tracks in the Freshwater career category each have badge pathways culminating in an “Epic quest” featuring larger requirements (See Figure 4). As always, teachers design and run their own assessments based on their own curricular goals and quest customization, the default listed quest criteria and their NOAA certification training. As students move through the quests, and the requirements grow more complex, teachers must also adjust assessments to match.

The change in focus from achievement of standards to career exploration necessitated a change in the levels structure imagined for the badge system. At first, the design for levels fell under the DPD Project’s specific principle of “competency levels,” but the eventual career badges and higher level career area specialist badges are a classic example of “metabadges,” badges awarded for the completion of a particular set of lower level badges.

**Figure 4.** The quest map of the Coastal Manager career badge, part of the Freshwater career area.
Enhance validity with expert judgment > Use a combination of human and computer experts > Validation at multiple levels

This practice is a function of the quest-based learning environment in 3D GameLab and its interaction with classroom assessment. Each quest has an associated task, something that the students must do or submit. The 3D GameLab team, led by Lisa Dawley of GoGo Labs and Chris Haskell from Boise State University, intended to design a system where teachers would “own all the awarding activity,” where they would have the ability to customize the quests their students encounter to match the skill level, feedback needs, and pacing that works in their own classrooms (DPD Follow-up Interview). Dawley explains, “Each quest has a task, and it’s up to the teacher to determine whether the minimum requirements for that task are met...Either you meet the requirements, as interpreted by the teacher, or you don’t meet the requirements and you need to go back and keep working on it until you do” (DPD Initial Interview).

This pattern was enacted as planned. Teachers determine for themselves “key milestone quests”, synthesizing steps, where teachers would really want to take a look at the work, that should require manual approval. The other less important ones could be automated, so the student could keep leveling up without needing to stop for approval (DPD Initial Interview). Planet Stewards found that some teachers might want to review 75% of the quests students complete, where others opt for a periodic milestone review. Dawley feels that this freedom increases the flexibility for teachers to be able to use the system in a broad range of classroom contexts, but makes it more complex, so some teachers don’t like having to figure out when to review or not. Dawley recounts that some teachers did not even realize they had this power, which had implications for future sessions of the Planet Stewards teacher training (DPD Follow-up Interview). Even where students are allowed to move past a quest without waiting for teacher feedback, the materials they submit are still visible to their teachers and can become part of later human assessments or impromptu formative interventions (DPD Initial Interview).

This practice is an example of the “use a combination of human and computer experts” specific principle of “enhance validity with expert judgment,” as the teachers can decide when and how to apply their time and effort, and when it would be better to let students move through the system more freely.

Enhance validity with expert judgment > Give human experts badges > Assessment of participating teachers

As detailed below under the challenges faced by this badge system, Planet Stewards realized from the beginning of planning to use the 3D GameLab platform that teachers would need help implementing quest-based learning and specialized training to become familiar with the NOAA content. Teachers are identified, training runs for 3 weeks. Teachers perform quests asynchronously, and combine with online live events.
Teachers had to finish that and earn their badge, which allowed them to clone the whole Planet Stewards curriculum and start issuing. The assessments teachers encounter in their training quests were intended to take similar forms to the assessments they would later need to perform on submissions made by their students.

Lisa Dawley reports the training assessments were successfully implemented as planned and continue with new and growing groups. Upon completing the training quests and passing Planet Stewards’ assessments, teachers earn a NOAA certification badge. This practice is an example of “enhancing validity with expert judgment” by building their experts’ familiarity with quest-based learning and the NOAA content.

**Design Principles for Motivating Learning**

The Planet Stewards team intends for students participating in this program to have the chance to learn about conservation through questing in the 3D GameLab platform. The website will afford students the chance to interact in a community, sharing what they have learned and collaborating with others in quests. The badge system follows 3D GameLab’s quest-based platform, each new badge "unlocking" further opportunities within the system. The initiative hopes that this feature will encourage students onward while giving them choices about which quests and careers to pursue. The team intended for participating teachers and advanced students to have the opportunity to design quests of their own.

**Provide privileges > New activities > New learning activities and privileges**

3D GameLab’s vision for the quest-based learning platform was to motivate students to engage with learning material by involving elements from games, like user choice, into learning. 3D GameLab co-creator Chris Haskell claims early research shows over 60% of students continue questing even after earning an A grade, illustrating the motivational potential of the platform (The Power of Quest Based Learning). One of the elements that may have motivational potential is the ability for students to choose particular paths through the system, and prioritize what they want to work on first.

The questing platform, enacted as intended, opens up later quests based on the completion of prerequisites. The new activities progress from simple introductory activities to more interesting and involved quests, including some that use NOAA data. In the quest map for the Coastal Manager badge, for instance, students start with video content NOAA has created to get them familiar with estuaries, and move to analyzing real-time data from NOAA’s estuary data collection sites.

This is an example of how the Planet Stewards program may motivate students by opening up new and more interesting learning opportunities as they get further into their learning.
Set goals > User-determined learning trajectory & Provider-determined learning trajectory > Quest paths

This practice is related to opening up new learning opportunities and describes the ability for students to see the learning opportunities and badges available in the system and use that knowledge to set goals for themselves. The Planet Stewards system in 3D GameLab was intended to reveal the available quests, though many of them are initially locked to students until they complete prerequisites.

As intended, the Planet Stewards badge system allows students to choose which careers to explore and allows them to see a possible target level (earning the career badge) that they could set for adequate exploration of that career. In addition, the tasks they complete are tied to their classroom grades in ways that their teachers determine, and students may use the quest to track the assignments they still need to complete to meet course requirements. In analyzing how this motivational principle functioned in the badge system’s function with its first testers, Lisa Dawley points to anecdotal evidence already available, saying the team received feedback from students including comments like, “I had no idea that jobs like this even existed,” “Being a marine biologist is not what I thought it was,” “I thought that was a career I was interested in, but now I’m not,” and “I’m interested in ocean science, and I thought I liked this job, but I found a job that I like better” (DPD Follow-up Interview)

From the point of building the career badge quest maps, the Planet Stewards team did not expect students to be able to complete all 15 career badges. They necessarily would decide on a subset to try for, with some guidance and possibly restriction from their classroom teachers (DPD Initial Interview).

Students ability to decide what to pursue and see the steps to achieve it is a good example implementation of the “set goals” motivational principle. Here, both user-determined and provider-determined trajectories come together through the NOAA-created, teacher-mediated, student-completed quest maps.

Recognize identities > Roles within a system > Career exploration choice

Although the Planet Stewards team did not articulate it specifically in their proposals in a motivational context, the DPD Project noticed the structure of the principle “recognize identities” as possibly motivating students within this badge system. Before deciding on specific badges, Planet Stewards proposed a focus on “role and identity,” referring to how “3D GameLab allows users to create their own avatar to represent their identity. The quest groups, badge names, and graphics will illustrate growth and achievements in scientific roles over time” (DML Stage 2 Proposal).

As enacted in the badge system, the roles named in badges are those of careers employing adult scientists. Earning a badge with the name of “Ecologist” allows students to try that role on for size, with a badge certifying their accomplishment on their profile. Their reactions, as described above under “set goals” display how high schoolers tried on
roles, and in some cases found that they didn’t like the actual work done in their selected scientist role.

The DPD project identifies this as a case where “recognizing identities” could have a motivational effect on students choosing learning content to pursue.

Design Principles for Studying Learning

Research studying learning that occurs in Planet Stewards is closely related to the data that is collected through students participation on the 3D GameLab platform. The designers are focused on improving the badge system, learning how it can best operate in classrooms, and figuring out how to support larger and larger groups of students exploring careers.

Study badge impact > Research OF badges > Data mining

The 3D GameLab developers had been studying activity in their system informally before partnering with NOAA to create Planet Stewards. They intended to use many of the same techniques with the NOAA badges, planning to implement data and text mining of the system logs to learn about the activity happening in the badge system. Some methods of analysis used in the past include looking at the pattern of user activities and trying to determine patterns behind more successful and less successful users. Data available includes logins, what quests students played, and how long it took to complete questions.

Lisa Dawley mentioned that the team had an eye to developing key performance indicators (KPIs) from the broader pattern recognition efforts, which they would then use a KPI instrument to be able to refer to the same metrics over time. She explained two approaches with building tools that distill data from a system like 3D GameLab: “Either you want to be able to quickly tell what is going on, or you want to be able to look at real-time data,” meaning that desirable queries either answer the most important questions about system activity or provide insight that can be immediately used (DPD Initial Interview).

As enacted on 3D GameLab, organizers have collected logs of activity since the beginning of operation, which can be analyzed at any time. Dawley notes that the data coming out of the system can be particularly valuable in sustaining a project as an important tool to convince funders of its impact. Her function as CEO of GoGo Labs involves reporting to funders and investors on findings from the logs about usage. Dawley elaborated on the benefits gained by collecting data about how long it takes students to complete quests, explaining,“For curricular design, you can create a quest with a guess as for how long it will take, but you don’t know in advance. That takes data.” The team will be collecting this data through a larger pilot program with students in Fall 2013, and afterwards Planet Stewards will be able to share estimates about the number of
hours teachers should plan to devote to different parts of the system as each teacher decides how it can fit into their own curricular designs.

As initially enacted, pulling some of the system-wide data still requires a laborious process where programmers manually query the database to measure aggregate activity, but work is underway building an administrator dashboard to access these performance indicators on a realtime basis. The 3D GameLab team has completed a control panel for teachers to make student progress through badges and quests visible for the purposes of their classroom management (DPD Follow-up Interview).

The DPD Project classifies this type of research as studying the impact of badges, or “research OF badges.” Its aim is to determine how the badges work in the system, and what effect they have on students’ lives.

**Improve badge impact > Research FOR badges > Quest analysis**

Distinguished from research OF badges is the function studying system activity can have to improve the badges and quests in Planet Stewards. Lisa Dawley explained that “we were doing the data mining before the badge piece came in, but now badges give an interesting way to look at the data. It’s another way to sort and look at what’s working and what’s not working” and noted that one new metric available for analysis was the aggregated level of learning outcomes, when previously outcomes had been represented by students’ grades:

Before, we’d look at who got an A, B, C, D or F and ask what were the actions or the click behavior that they took to get there, to the A or to the F, and trying to drive more students in the direction of the A...Now it’s not looking at the outcome as the grade, but the outcome as the badge or no badge. (DPD Initial Interview)

The system delivers feedback on the curriculum through queries like these comparisons for curricular improvement. Planet Stewards administrators can determine which quests are most popular, which get the highest ratings as well as whether they are taking the amount of time expected. They can compare this output to various features of the different quests, like whether they had video or whether it involved project-based learning as part of a process of evaluating the quests and determining whether to revise requirements, content, or descriptions.

**Challenges This Project Faced**

Planet Stewards is an ambitious badge system in many respects. Particularly, implementing any system nationwide to be administered in many classroom contexts by teachers whose curricular needs varied forced Planet Stewards to figure out how to ensure consistent quality of the badges. A second challenge detailed below shows how the badge system administrators from 3D GameLab were put in the position of technology support for the teachers and students using their system, and that role extended to the software running other components of the wider badge ecosystem.
Training badge-awarding teachers: NOAA certification for valid assessments (Recognizing and Assessing)

One of the distinguishing features of the Planet Stewards badge system is that high school teachers across the country gain the privilege of awarding their students high value badges under the widely-recognized NOAA name. However, one of the main consequences of this design decision is that Planet Stewards had to design practices to ensure that badge earners were held to the high standards NOAA desired. This became one of the main system design challenges Planet Stewards faced, and it impacted the team’s decisions around both recognition and assessment practices.

The team from NOAA and 3D GameLab decided that the need for consistent assessments across many classrooms required teacher training and that the ability to offer the Planet Stewards curriculum would be limited to teachers with the training. They proposed a solution tailored to the capabilities of the 3D GameLab platform:

Groups of quests that are associated to awarding the badge will be “locked.” It will require the teacher to complete a pre-training in the use of a quest group, as well as a verification that they are a certified teacher in order to unlock access for her class of students. (DML Stage 2 Proposal)

Certification of teachers would then open up the ability to “clone” the Planet Stewards quests, customize them to the needs of a particular classroom, and then to issue badges.

Implementing the training practices first occurred in Spring 2013 with a pilot group of 20 teachers interested in running the Planet Stewards program. Speaking from 3D GameLab’s perspective, Lisa Dawley described one of the goals of the training program as ensuring badge integrity, saying “when you’re a platform and you’re issuing badges on behalf of someone else, [where the assessment isn’t automatic] you want to make sure that the assessments are valid.” The training also ensures that teachers will be able to support their students’ use of the quest platform, help them work through the content and assignments, and adequately assess the learning claimed by the badges.

While teachers may be initially attracted to either the NOAA content or the 3D GameLab quest-based learning methods, they need to learn about both in order to run a successful program in their classrooms. Through the training program, teachers learn about quest-based learning, instructional design for quests, and how to integrate activities in the online platform into their classes. Dawley says, “We first pull them into this piece, then we introduce them to the Planet Stewards curriculum.”

There remain challenges for the badge system’s training practices. The team determined that the pilot round of training with 20 teachers went well and immediately made plans to follow up with larger groups in the summer and fall. Dawley has an eye to scaling the training system as the next large challenge to face, saying “My next question is ‘ok this works with 20, what happens when you try to scale to 5000, and we haven’t addressed that yet’” (DML Initial Interview). The question remained when the DPD Project checked in with Planet Stewards again
in October 2013. As Dawley explains, this “limits the scaling of the Planet Stewards platform, because they can't just say ‘Kids, go play Planet Stewards. They have to be trained’” (DPD Follow-up Interview). That fall, 70 teachers went through a third round, but the Planet Stewards team is still considering how to scale the teacher training portion of the badge system even more, recognizing that teachers’ ability to attend training sessions synchronously and the associated costs are obstacles to overcome.

For the teachers who went through the training, their user accounts in 3D GameLab gain the technical privileges necessary to run the program. Though not initially intended, Planet Stewards expanded their certification to include awarding teachers an OBI-compliant badge to recognize them as a NOAA-certified educator. This carries NOAA logo and may prove to be an attractive credential. The Planet Stewards team felt that offering a badge for teachers also made the training requirement more clear in terms of representing an actual certification and endorsement to be able to offer the curriculum.

Resources


Dawley, L. (2013a, October 6). DPD Follow-up Planet Stewards Interview.


