Design Principles for Digital Badge Systems

A Comparative Method for Uncovering Lessons in Ecosystem Design

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Abstract. This paper describes a method for studying programs that issue Open Badges to recognize learning. The Design Principles Documentation (DPD) Project followed the development of 30 educational programs that planned to issue open digital badges to recognize "lifelong learning" accomplishment. The DPD Project's aim was to formulate general design principles based on the practices observed among the 30 research subjects. Analysis yielded 37 principles across four researcher-selected functions of digital badge systems: recognizing learning, assessing learning, motivating learning, and studying learning. This work describes this research methodology and its affordances for uncovering relationships between different elements of badge system design and between those elements and the larger project contexts in which they operate.

Keywords: Open Badges · Digital Badges · Design Principles

1 Introduction

Digital badges, as a technology used to credential learning achievement, serve a variety of functions within a learning ecosystem and in turn require supporting practices to support program goals and serve earner interests.

Open Badges are a subset of digital badges that follow the Open Badges Infrastructure (OBI) standard originally set out by the Mozilla Foundation [7]. In programs that use badges to recognize learning, each badge is a symbolic representation of specific achievements. Each Open Badge consists of an image packed with computer-readable metadata. Through the symbolism of the selected image and the information embedded in it as structured metadata, each badge makes specific claims about earners and can marshal collections of evidence to support those claims. Badge earners may share these claims with various audiences, and those audiences in turn may examine the metadata and evidence to make decisions about the validity of those claims from their own perspective.

Open Badge programs establish the claims they want to make with badges and build programs to control the social and technical practices through which badges are issued to the earners who participate in their programs. The collections of practices

that control what badges mean to each issuer and how they are issued are what are often referred to as "badge systems."

Badge systems in education encompass the goals, badge definitions, procedures, and technology particular to a learning program, and they are situated within that program's particular context. For example, when the arithmetic practice site *Buzz-Math* describes its goal of fostering "inspiration and motivation in mathematics education" where students "master concepts based on the Common Core Mathematics Standards for Middle School," the badge system they build contains badges defined around that goal and procedures structured around the technical infrastructure of its parent company's self-paced online learning environment [1]. The same goal implemented for in-person learning would result in a system that may share features around what claims the badges would make about earners but would consist of a vastly different set of practices mediating how badges would be issued and what evidence would be available to back up their claims. Some of the practices implemented in a self-guided online context would not be appropriate to implement for students in the same room as their instructors.

2 The Design Principles Documentation Project

In order to better understand what factors affect which practices are appropriate in a given context, the MacArthur Foundation commissioned the Design Principles Documentation (DPD) Project at Indiana University in concert with the *Badges for Life-long Learning Initiative*, a grant program that funded 30 projects to award open digital badges across many different educational contexts. These grants, part of a series of Digital Media and Learning (DML) grant competitions, encompassed programs across a wide spectrum of educational niches from formal classrooms at middle school through post-secondary levels to informal learning environments in museums, libraries, after-school programs, online learning platforms and more.

From these 30 projects, the DPD Project drew a collection of specific practices for using badges to recognize learning. Using open digital badges in learning in 2012 was uncharted territory, and the DPD Project set out to capture major features of the design processes at each of these projects as they moved to implement badge technology in each of their contexts. The goal of this research was to uncover lessons about the factors that make certain practices appropriate in particular contexts.

To capture the developing knowledge about what challenges and opportunities arise from specific combinations of contextual factors and badge system practices the DPD Project chose to characterize each project's specific practices in terms of general design principles, abstracted from their contextual factors. For example, BuzzMath's practice to "recognize developing mastery of Common Core skills" is an example of the general principle "use badges to map learning trajectory." This approach echoes Design-based Research (DBR) methods in its focus on how complex interaction between different elements of learning systems are designed to support learning [2].

The balance of this paper will describe the DPD Project's research methodology and the limitations and affordances of this method for comparing badge systems and

drawing out lessons about the appropriateness of specific practices within specific program contexts. The DPD Project's Interim Report details the general design principles uncovered among the subject programs and begins highlighting relevant literature in educational disciplines [4]. Future papers will focus on findings that arose from this process.

3　　Capturing Badge System Design Principles

3.1　　Four Functions of Digital Badge Systems

Design Principles Documentation Project researchers selected four functions of digital badge systems to analyze, based on initial research about digital badges and previous educational literature related to credentialing systems. Grant and Shawgo's bibliography of badge related research shows common strands around credentialing, assessment, and motivation, and the works referenced demonstrate a variety of research methods used to interrogate learning systems [3]. Correspondingly, the DPD Project selected (a) *recognizing learning* (credentialing), (b) *assessing learning*, (c) *motivating learning*, and (d) *studying learning* as four components of well-considered badge systems. Each of these fields has a rich literature that certainly offers insights that will be relevant to developing and studying badge systems.

The imposition of this frame onto the study allowed DPD researchers to leverage deep veins of research, but it should not be interpreted to mean that the system designers at each of the badge projects designed their systems specifically to perform these four functions. In fact, very few projects intended or implemented any systematic practices to serve the function of studying learning.

At their core, badges in educational programs serve as credentials to recognize learning. Each badge makes claims about earner's learning, participation, or achievement. These *recognizing* claims require corresponding *assessment* practices for two reasons: (1) to make the critical decision about whether or not to issue the badge, and (2) to collect the appropriate evidence that could back up that claim and ensure that audiences would respect its validity. Each of the practices developed to serve these first two functions have complex implications for student motivation and can be analyzed from a variety of motivation perspectives. These include including formal theories such self-determination as well as the "folk" theories of motivation that may be most relevant in the minds of badge system designers.

3.2　　Identifying Specific Practices

The process of identifying general design principles for badge systems began with an investigation of the specific practices designed for each project under study. An individual project's practices are system design features that take into account the contextual affordances of their setting, the goals of the project, and the underlying theories of learning from which they arise. Describing them entails capturing these different foundational factors as well as the design decisions made in their light.

The primary source material for identifying specific practices among the 30 DML subject projects was their grant proposal documents. Research team members scanned proposals for each project, which consisted of initial ideas as well as one or two revisions, and pulled out quotations that described specific goals or plans for implementation as well as those that indicated the overall theoretical orientation underlying those plans. Each practice was named with a descriptive moniker, aiming to concisely capture its most important features.

The collection of the specific practices intended for each project arose mostly from analysis of the proposal documents, but initial interviews with each project team were conducted as their badge systems begin implementation. These interviews mostly focused on the changes that had already occurred between proposal and first implementation, but the information gathered here also fed into the researchers' understanding of the initial set of principles as they asked questions about each of the project features they were beginning to understand. From this base of knowledge, the process of formulating general design principles began.

3.3 Formulating General Design Principles

In the functions of recognizing learning, assessing learning, and motivating learning, general principles began to take shape when DPD researchers clustered similar practices [6], and when all were accounted for, gave each principle a descriptive name. Often, well-defined sub-categories of each general principle emerged. For example, related practices that serve the *recognizing learning* purpose of "use badges to map learning trajectory" among the subject group performed this task either by tracking student progression through a series of leveled badges or along "routes or pathways" defining an order in which they may be earned. These sub-categories were formalized as "specific principles," which connected the specific practices embedded in each project's context to the general principles.

Defining principles for studying learning was more theoretical, because few projects intended or implemented systematic practices for studying what was happening in their badge systems [5].

4 Intended, Enacted, and Formal Practices

The DPD Project tracked the development of practices from their initial conception in the grant proposals to how each was first implemented in its project's context and how it evolved when the project reached the end of its grant period and came into some kind of steady continuing state, even if that steady state consisted of discontinued operation, possibly meaning the end of the badge program altogether. This process of practice evolution was defined across three distinct phases, and the DPD Project endeavored to map each program's progression to capture the story of their practices in terms of phases named for *intended*, *enacted*, and *formal (continuing)* practices. Most details about intended practices arose from projects' initial grant proposals,

and the DPD Project captured project leaders' thoughts about how these evolved into enacted and formal practices by conducting interviews.

5   Conclusions

The process of collecting similar practices into general principles allowed rich comparison between projects and the identification of common challenges. Findings about the interaction between program contexts and design principles may be expanded into many future papers.

As an example of possible findings that arose from comparison, two DML competition winners planned to create badge systems to recognize learning in the area of modern agriculture, the UC Davis *Sustainable Agriculture and Food Systems* major and *Sweet Water AQUAPONS*, a high school program in Milwaukee and Chicago. Despite this similar purpose, each program made drastically different choices of practices to *recognize learning*. Where they both used the general principle "use badges to map learning trajectory," they chose opposing specific principles, with *AQUAPONS* choosing to "level badges" where *SA&FS* opted to use badges to "provide routes or pathways."

Though they had differed in recognition principles, thee projects converged in their choices of assessment practices, when analyzed in terms of the general principles that each specific practice represents. Both projects chose to "use e-portfolios" for assessment where badge evidence, including self-reflection was critical to the process. Both projects ran into technical difficulty implementing practices that the DPD Project identified with the specific principle "foster discussion around artifacts" (which falls under the "use e-portfolios" general principle), yet both were so determined to make that a formal part of their badge system that they each made significant changes to their online platforms to ensure that they would be able to enable discussions within their community. Analysis in terms of general principles can show the interaction between practices designed to serve different functions within the system. This pairing of *AQUAPONS* and *SA&FS* shows the necessity of adequate technical infrastructure to support the assessment practices needed to back up the claims made by badges and the social practices desired for motivating participation.

Without the framework relating these specific practices to the same general principles, researchers may have missed the connection between these significant changes across the two badge systems. DPD Project researchers hope that future badge systems may be able to take advantage of this information and recognize that significant investment supporting social interaction in portfolio platforms may be necessary to enact practices aimed to allow formative peer feedback on work related to earing badges.

Future research using this methodology may derive a different set of design principles from badge programs developed with early stage Open Badges technology, but the general approach may prove fruitful to gain similar lessons from badge programs yet to be developed. At this stage the DPD Project's primary goal is sharing out the principles, practices, and case studies via a project website [8].

References

1. BuzzMath. "BuzzMath DML Stage 1 Proposal," 2012. http://dml4.dmlcompetition.net/Competition/4/badges-projects.php%3Fid=2852.html.

2. Cobb, Paul, Jere Confrey, Andrea diSessa, Richard Lehrer, and Leona Schauble. "Design Experiments in Educational Research." *Educational Researcher* 32, no. 1 (January 1, 2003): 9–13.

3. Grant, Sheryl, and Shawgo, Kristan E. "Digital Badges: An Annotated Research Bibliography v1." Accessed December 4, 2013. http://www.hastac.org/pages/digital-badges-annotated-research-bibliography-v1

4. Hickey, Daniel T., Itow, Rebecca, Schenke, Katerina, Tran, Cathy, Otto, Nate, & Chow, Christine. (2014). *Badges Design Principles Documentation Project January Interim Report.* Indiana University. http://iudpd.indiana.edu/JanuaryReport

5. Hickey, Daniel T. "Research Design Principles for Studying Learning with Digital Badges," July 7, 2013. http://www.hastac.org/blogs/dthickey/2013/07/07/research-design-principles-studying-learning-digital-badges

6. Itow, Rebecca. "Badges Design Principles Database Project: Update on Principles," May 9, 2013. http://www.hastac.org/blogs/rcitow/2013/05/19/badges-design-principles-database-project-update-principles

7. Mozilla Foundation, and Peer 2 Peer University. "Open Badges for Lifelong Learning: Working Paper," August 27, 2012. https://wiki.mozilla.org/images/5/59/OpenBadges-Working-Paper_012312.pdf

8. Design Principles Documentation Project. (n.d.). Design Principles Documentation Project. http://dpdproject.info/