Design Principles for Motivating Learning with Digital Badges: Consideration of Contextual Factors of Recognition and Assessment

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Abstract: There is broad interest in the use of open digital badges to enhance learners' motivation. These web-enabled tokens of learning and accomplishment have the potential to induce excitement and elicit powerful forms of engagement and learning. Researchers and developers, however, appear divided on the role of digital badges in motivating learners. Our paper addresses the skepticism and promise that surrounds badges and presents the design principles for motivating learning found among 30 digital badge projects and aligns them with research. In doing so, we consider how contextual factors—such as how badges are used recognize learning and how that learning is assessed—may play out to influence learner motivation in badge-oriented learning ecosystems.

Project Purpose

Traditional physical badges have been used for many years by organizations such as the Boy Scouts of America to acknowledge skills from archery to first aid. Now, so called "open digital badges" have has become popular in a variety of learning environments. The MacArthur and Gates Foundations recently invested more than $4 million to fund projects to design and implement digital badge systems. These newer badges are web-enabled tokens of accomplishment, skill, quality, or interest (Casilli & Knight, 2012). Unlike, grades, transcripts, or certificates, they can contain specific claims, detailed evidence supporting those claims, and links to additional claims and evidence; they can also be readily shared over social media & email and annotated & accumulated in standalone "backpacks." While these features have obvious motivational potential, they are quite new. Little is known about how these features are being used individually or as part of larger educational ecosystems, and there has been little systematic consideration of actual or potential implications for motivation. We tackle one piece of the puzzle by focusing on how contextual factors such as the way badges are used to recognize and assess learning might influence motivation. We investigated the following research questions: (1) Which motivational design principles emerged from the specific practices we extracted from 30 projects? (2) What implications do recognition and assessment practices have on those motivation principles? (3) What is the likely motivational impact of recognition and assessment practices in a typical badges project?

Theoretical Framework

Researchers and developers appear divided on the role of digital badges in motivating learners. Reflecting longstanding concerns over extrinsic rewards, skeptics of badges "worry that students will focus on accumulating badges rather than making connections with the ideas and material associated with the badges" (Resnick, 2012). Badge evangelists find promise in having a new way to assess learners apart from the "current multiple-choice form of testing (that) doesn't measure all that is being learned and de-motivates true curiosity" (Davidson, 2012). Our search for appropriate practices for motivating learning with badges is informed by well-known motivational theories (Dweck & Leggett, 1988; Eccles, 1983; Ryan & Deci, 2002). Our search is further informed by sociocultural views that consider motivation in the context in which it operates (Goodenow, 1992; Hickey, 1997, 2003). Sociocultural views consider motivation primarily in terms of the larger social and technological context and only secondarily in terms of individual differences that learners are presumed to bring to those contexts. Rather than embracing one side or the other on the enduring debate over incentives and learning, we instead documented the emerging practices for using badges to recognize and assess learning, as well as the deliberate ways projects were using badges in attempt to motivate. We then considered the potential positive and negative consequences of those practices and their interactions for the engagement (and potential disengagement).

Data Sources and Analytic Methods

Data came from awardees in the 2012 *Badges for Lifelong Learning* initiative. Thirty educational programs were funded to develop digital badge systems using the Open Badges Infrastructure developed by the Mozilla Foundation. Awardees range from after-school programs aligned with the Common Core State Standards (*Pathways for Lifelong Learning)* to teacher professional development programs (*Who Built America?*) and skill-based digital practice apps (*BuzzMath)*. The research project set out to document the practices for using

digital badges for assessing, recognizing, motivating, and studying learning that emerged across these 30 projects. It did so by capturing "practical wisdom" as projects moved from intended practices (in their original proposal) to enacted practices (enacted in the actual badge system).

The research project organized the practical wisdom across programs as general design principles and project specific practices (The Design-Based Research Collective, 2003). The project assumed that local theories are built in the context in which they are intended to be used where insights can then be transferred to similar situations (Cobb et al., 2003). To identify the motivational practices in each project, we analyzed project proposals to identify the *intended* practices that system designers expected to motivate learning. In doing so, we documented and interpreted key design decisions related to learner motivation and design rationales for these decisions. A design rationale framework provides an account of the decisions teams make and the reasons for their decisions (Jarczyk, Loeffler, & Shipman, 1992; Lee & Lai, 1991). Employing this, our team asked project 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. After identifying the intended practices in each project, we categorized practices into larger design principles by dynamically sorting and re-sorting the practices into different groups of principles. These principles were vetted for feedback and revised both by representatives from the badge projects as well as attendees at the Digital Media and Learning and the Games, Learning, and Society conferences.

Results

RQ 1: Which Motivational Design Principles Emerged from Practices We Extracted from the 30 Projects?

Eleven overarching design principles with examples of practices for motivating learning are in Table 1. These principles aren't meant to be prescriptive—the process of designing a learning environment is not an exact science. 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 within their context to motivate learners.

RQ 2: What Implications Do Assessment and Recognition Practices Have on those Motivation Principles?

To illustrate the implications of assessment and recognition practices on motivation, we will focus on the recognition practice "Providing Privileges," which was particularly prevalent across the projects. Privileges ranged from internship opportunities for youth who had earned particular badges to the receipt of a physical prize such as robots or entrance to a museum. The categories of providing privileges that emerged from our analyses were: 1) tangible prizes unrelated to the subject domain; 2) peer mentorship positions; 3) new related activities inside the program; and 4) access to outside internships.

The contingencies for receiving the badges as well as the types of reward the badges provide reflect different patterns of assessment and recognition that impact the motivational implications of providing privileges. The ways in which students receive those badges are assessment practices. The four categories of privileges constitute recognition practices because they illustrate ways in which badge achievements are acknowledged. By analyzing the different ways that privileges are associated with badges, we show how assessment and recognition practices have implications for motivation design principles. Below, we first outline the motivational principles and then discuss assessment and recognition principles.

Tangible prizes unrelated to subject domain. In some projects, learners are awarded physical prizes when they earn a badge. Students are recognized for their achievements by the receipt of these prizes. In such an environment, the assessment can therefore be viewed as accomplishing any means to receive those prizes. If rote memorization and repeating the easy activities is what boost points to attain badges for prizes, those may be the strategies that are likely to be employed by the learners.

Peer mentorship positions. As a privilege of collecting specific badges, some projects allow learners to be peer mentors. Research has suggested that teaching is 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). This recognition of being a peer mentor is dependent on meeting assessment requirements such as collecting a series of leveled badges to demonstrate expertise in a domain to be allowed to assist peers at lower levels. Inherent in this recognition practice of providing peer mentorship privileges is also peer assessment which have different implications from computer and human expert (e.g., teacher) assessment.

New related activities inside the program. Giving learners access to new activities within the program is a prize awarded in several badge projects. In one example, learners are able to gain access to math contests

within the community and get exclusive access to “problem solving” missions. The recognized privilege and the assessment criteria are therefore linked to the same learning objectives, building on one another.

Table 1: Design principles for motivating learning

Principle name	**Explanation**	**Example**
Recognizing identities	Badges can recognize a learner’s role within the badging system such as recognizing their specialization in journalism, engineering, or peer mentoring. Badges can also recognize learner’s identities by being incorporated into projects that themselves target specific groups.	*S2R Medals* awards learners badges for their journalism and live reporting skills.
Engaging with communities	Some learners are able to earn badges for their involvement in their communities both at the physical and digital level.	*Planet Stewards* awards learners badges for engaging with their online community and acting as science communicator and collaborator.
Display badges to the public	Some projects give earners the option of displaying badges themselves, while other projects automatically display badges.	*Mouse Wins!* automatically displays learner's badges on their website.
Outside value of badges	Some projects integrate practices to give badges value outside of the badge system. These include having badges count as academic or course credit, showing badges to outside agencies, and/or documenting the link between the badges and real life applications.	Earners of *4H-USDA Robotics* badges have the opportunity to earn internships with partner institutions such as NASA.
Setting goals	Badges allow for learners to set goals and visualize the previous goals that they’ve accomplished. Badge systems can use goal setting in many different ways.	*BuzzMath* provides learners with clear learning pathways of the badges they have earned.
Collaboration	Some projects award group badges for group accomplishments as well as personal badges for having a role in a collaboration.	*Robotics and STEM Badges using NASA Content* awards badges to groups of learners.
Competition	Scarcity of badges and use of a point system are two ways that we have seen projects contribute to competition among badge earners.	*S2R Medals* limits the number of badges awarded to learners.
Recognizing different outcomes	The type of learning that a badge recognizes and the way that recognition is managed has profound implications for motivation.	*Design for America* awards learners badges for roles such as "peer mentor" and "project leader".
Utilizing different types of assessments	Projects utilize different types of assessments for learning such as computer, peer, expert, or self assessment.	*Sweet Water Aquapons* allows peers to award badges.
Providing privileges	Learners are awarded a variety of privileges in response to earning a badge such as prizes, the opportunity to take part in new activities, and access to internships.	Earning badges with *Design Exchange* allows learners access to internships.

Note. These principles will continue to evolve as projects move from intended to enacted practices.

Access to outside opportunities. Badge earners have the opportunity to serve as interns for some programs. Evidence from studies using an expectancy-value theory (Eccles, 1983) to understand learner choices would say that if the privileges that badges provided are interesting or exhibit high utility for learners, relative to cost, learners are more likely to initiate and sustain engagement with the subject matter. The assessment is therefore linked to the skills that these outside employers value and recognize so that they are willing to provide these internships.

One of the most salient points of these examples is the difficulty of making assumptions about the outcomes of providing privileges without understanding the context in which these privileges are used. The contingency of the privilege (assessment) and the privilege itself (recognition) are both contexts that matter. Some may undermine motivation while others may support the motivational impact of providing privileges. 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.

RQ3: What Is the Likely Motivational Impact of Assessment and Recognition Practices in a Typical Badges Project?

To answer our third research question, we turn to a case study of the Supporter to Reporter (S2R) Medals project. *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.

Assessment practices used by S2R Medals include leveled badges from bronze to gold that are aligned to standards that teachers are using in school. Leveled badges allowing learners to set goals for themselves and visualize those goals is an important strategy for self-regulated learning in which learners plan and monitor their learning (Zimmerman, 2000). S2R employs different types of assessments including computer scoring systems, peers, and experts. While computer assessment may benefit from being more efficient and free of social judgment, peer or expert assessment may be more meaningful and therefore increase the quality of work put into earning the badge. Relationships with peers are also implicated in the designer's intention of the badges to guide students along the path from novice to mentor, enabling advanced students to become a source of peer assessment for newer students. Such relationships within a learning community can help learners feel more connected and therefore persist within that learning environment (for an example, see Summers, Svinicki, Gorin, & Sullivan, 2002).

Recognition practices in S2R include allowing students to report at real sports events once they reach an appropriate level of expertise based on their accumulation of badges. Allowing students to report at real sports events illustrates the motivation design principle of providing privileges of access to outside opportunities. Privileges that badges provide that are interesting or exhibit high utility for learners, relative to cost, are more likely to initiate and sustain learner engagement with the subject matter (Eccles, 1983). As such, for those who are interested in journalism and find the project to be highly relevant for their goals are more likely to be positively influenced by these recognition practices. This case study illustrates the importance of acknowledging the interactive influences among assessment, recognition, and motivation within specific learning contexts.

Looking beyond the individual, the S2R case study also revealed ways that badges can help motivate *connected learning* (Ito et al., 2013). Much of the impetus behind the MacArthur Foundation's focus on digital badges follows from the assumption that they can help bring together and integrate spheres of knowledge, culture, and social practice that are normally very disconnected for most young people. Specifically, the case study of S2R medals uncovered the various ways that badges were used to recognize learning helped motivate connections between knowledge and abilities that were interest-driven, related to academic pursuits, and related to peer-culture and social networking. For example, examining one participant's S2R Medals home page displays the badges that individual earned, the number of peers who have "friended" him, and the various artifacts the he has produced (1). Clicking on those badge reveals academic *and* professional competencies that the earner had to develop to earn the badge and the specific evidence of those competencies. Finally, the actual interest-driven (i.e., sports-related) artifact that the earner developed included familiar social networking features to make it easy for the earners' peers to "like" and post comments upon the artifact. Arguably, the digital badges motivated the kind of self-directed activity that Getzels and Csikszentmihalyi (1976) said was seldom possible in highly organized school activities but that was necessary for developing problem-finding skills and creativity.

Theoretical and Developmental Significance

Educational technologies are advancing at a much faster rate than research around those technologies; the recent surge of digital badges is no exception. As projects develop badge ecosystems, research on the development of these systems becomes increasingly important. In this paper we have outlined badge design principle that badge developers consider for motivating learners. Design principles need to be considered in the context of the

learning environment and individual differences among learners as well as in connection with the other principles that we have derived.

For developers of educational environments, we have offered badge design principles that they consider in educational settings. For motivation researchers, we have provided an analysis of the motivational impact of different badge designs. Our analysis illustrates how the same badge design may be motivationally adaptive in one situation but not the other. Understanding how badges look in practice as well as badge developers' initial instincts in designing badge systems is the next step in evaluating badging practices on learner motivation as well as in gaining insight on ways in which motivation theories extend to or are limited by new contexts in educational technology.

Endnotes

(1) An example S2R homepage is at https://www.makewav.es/r/glennwheeler; one of the badges located on that home page can be viewed at https://www.makewav.es/story/565038 and the story associated with that badges is at https://www.makewav.es/story/569437/title/interviewwithhannahcockroftmbe

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