

Digital Badges in Informal Learning Environments

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Abstract— The awarding of digital badges has become pervasive across social media systems. Digital badges are visual representations of individual accomplishments and/or competencies and skills. The Mozilla Foundation is leading an effort to standardize the issuing and collection of digital badges with the release of the Open Badges Infrastructure (OBI). The OBI provides a framework for educational institutions and employers to issue digital badges and for badge earners to share their badges across social media systems. This paper discusses the idea of incorporating digital badges into the National 4-H Recognition Model (USDA, n.d.). 4-H in the United States is a youth development organization that serves nearly 6.5 million youth and is administered by the United States Department of Agriculture (USDA). If done properly, the awarding of digital badges may increase the goal setting habits and motivate young people to join positive youth development organizations like 4-H.

Keywords-*Digital Badges; informal learning environments; 4-H; Robotics*

I. INTRODUCTION

A diploma is the ultimate outward sign of learning accomplishment. However, some would argue that such diplomas do not communicate detailed skills and abilities nor do they provide information on those skills learned outside of the classroom for learners [1]. Mozilla, a non-profit software development company, has developed the Open Badges Infrastructure (OBI) for learners to showcase their skills and abilities through digital badges. Researchers and educators are interested in the unique opportunity to apply community-based assessment practices whereby the badge issuer authenticates the skills and abilities of the learners that lead to the awarding of a digital badge. Community-based assessments, unlike formal educational courses, may be done by course developers, peers, the content management system, or even by learners themselves [5]. There is also interest in the role digital badges play in goal setting and motivation to pursue additional academic experiences in out-of-school time learning.

This paper specifically discusses the idea of incorporating the Mozilla Open Badges Infrastructure (OBI) into the National 4-H Recognition Model [1]. The 4-H organization in the United States is a youth development organization that serves nearly 6.5 million youth and is administered by the United States Department of Agriculture (USDA). *Head, hearts, hands, and health* are the four Hs in 4-H and

represent the values of the organization. If done properly, the awarding of digital badges may increase the goal setting habits and motivate young people to join positive youth development organizations like 4-H. The 4-H program in the United States was originated by the Smith-Level act of 1914, which created the Cooperative Extension System, a unique partnership with the 109 land-grant universities in the United States, the USDA, and the National Institute of Food and Agriculture [2]. Currently 4-H is the largest youth serving organization with about 6.5 million participants and is found in every state and territory of the US. Educational programs are delivered in out-of-school programming, in-school enrichment programs, clubs and camps. 4-H offers a wide variety of science, engineering, technology and applied mathematics educational opportunities – from agricultural and animal sciences to rocketry, robotics, environmental protection and computer science [2]. The rest of this paper is organized as follows. Section II presents the current need for a digital badging system. The specific purpose of digital badges is presented in Section III. Section IV describes the OBI and it's implementation in the 4-H youth development system. Section V contains the conclusions and future work.

II. NEED FOR DIGITAL BADGES

Beyond the formal classroom, there are many opportunities to develop and refine skills and abilities as a young person or as an adult. These experiences include visiting informal learning institutions, participating in informal focused learning programs, and utilizing media to pursue interests [3]. Consider that learning is a lifelong endeavor and often is accomplished through self-interest projects, self-directed experiences, information gathering, and community participation or on-the job experience [4]. While these learning pursuits can be personally fulfilling, often times, employers and educational institutions do not recognize or place value on the skills and abilities developed through informal learning. In addition, with the proliferation of computing technologies along with the interconnectedness of the networked learning environments education has been transformed from the classroom to many web-connected spaces. Digital badges can act as a bridge between formal education and the larger connected learning environments by recognizing skills and competencies across these contexts also known as learning ecosystems.

While Mozilla and others advocate the use of digital badges to document individual's discrete skills and abilities, there are some concerns with awarding badges. One potential consequence of awarding badges is to overemphasize the badge as an external reward for learning thereby reducing the learners' intrinsic motivation to learn [5]. This may lead to the gameification of the system where the end goal is badge collection and not the pursuit of knowledge. Another concern lies in the openness of the badge system. The open badges ecosystem will permit the development of many different badges each with a different degree of rigor behind the issuance of individual badges. With such diversity, educational institutions and employers may not accept the premise that a particular badge truly represent the skills and abilities professed. Finally, a concern for the 4-H system is the reliance on community-based assessment and the responsibility of adult facilitators to evenly apply the badge assessments throughout the system. The possibility that a few educators would make exemptions in the badge assessment requirements could jeopardize the outward legitimacy of the entire system to employers and educational institutions.

III. PURPOSE OF DIGITAL BADGES

Digital badges have a wide range of purposes from social belonging and status to representing individual learning achievement. An example of a social belonging badge would be the Google News badge. Google issues readers digital badges at the Google News homepage to help visitors learn about their reading habits and to convey shared interests through social networking. Google may also use badges as a reward system to keep users coming back to the News homepage. The Google News badge is designed with multiple levels and is earned by reading articles on certain subjects at a rate higher than other readers. Digital badges can be found in a number of on-line sites and appear frequently in social networking applications. One example is Foursquare, a website that permits users to provide and share location-based data using mobile devices. Within the Foursquare community, badges can be earned for a number of social interactions including the beginner badges for joining and checking in. While not entirely useful for educational purposes, the Foursquare badges may affirm ones achievements and promote group identification.

IV. THE OPEN BADGE INFRASTRUCTURE

The Mozilla Foundation (2012) has proposed a framework called the open badges infrastructure (OBI) for the digital badges ecosystem, which includes: 1) digital badges, 2) assessments, 3) and the open badges cyber infrastructure. In this proposed framework, the digital badge represents skills and abilities of learners and may come in many different forms. Badges may be awarded for a narrow band of achievement and skills or on the other hand may be more comprehensive and awarded for mastery of a set of skills. For example, a badge could be awarded for learning how to use variables in a program language or a badge could be awarded for mastery of the entire language. The scope of the digital badge is established by the issuing organization,

which can include educational institutions, training centers, or even employers. Assessment is critical to the badges framework to ensure that the badges truly represent the knowledge and skills badge earners acquired and to convey the information stakeholders. However, the level of rigor for each badge is flexible and it is expected that community-assessment methodology will be utilized. Again the badge issuer sets the assessment rigor for their badges. The third component of the badges framework is the cyber infrastructure. The digital badge infrastructure provides the electronic means to store and retrieve the badges and related meta-data about the badge. The Mozilla open badges infrastructure provides the electronic means to issue, store, display, and endorse on-line digital badges. For example, for institutions that want to issue a badge (issuer) the open-badges cyber infrastructure provides a JavaScript application interface (API) to send an assertion (information about the badge recipient) to the individuals backpack. The backpack is the badges repository and is currently hosted by the Mozilla Foundation. The badge recipient is able to access their badge collection through the Mozilla backpack and push those badges to other networks like Facebook.

In summary, the open badges infrastructure allows organizations to develop and issue their own digital badges. Badge recipients can collect digital badges and then display them on social networks or job sites. The badges represents knowledge and skills obtained outside of the classroom, provides a way for badge recipients to be recognized, and unlocks educational and occupational opportunities.

A. Digital Badges for Learning

Digital badges have been popularized in the gaming industry and through social media systems as symbols of inclusion and status. However, the current generation of digital badges focuses on awards for participation rather than learning and achievement. The transformation of digital badges from simple awards to representations of skills and abilities is the centerpiece of the National 4-H digital badges for learning initiative. As a major leader in youth development 4-H is well positioned to adapt digital badging as a part of the overall recognition model.

According the National 4-H Recognition Model (USDA, n.d.), the systematic recognition of learning provides youth positive reinforcement and the necessary motivation to continue to participate in such learning endeavors and to development life skills [6] [7]. Moreover, the existing 4-H model includes five types of recognition:

- Participation in educational experiences
- Recognition of progress toward personal goals
- Recognition of the achievement of generally recognized standards of excellence
- Recognition through peer competition
- Recognition for cooperation

The 4-H recognition model is adaptive to meet the individual needs of youth and supports a balanced approach to encourage recognition from each of the five recognition categories. The model is also designed to satisfy both intrinsic (internal) and extrinsic (external) motivational needs of individual youth [8]. In practice, 4-H awards ribbons, medals, conference trips, scholarships and many other incentives depending on the state and county of the youth participant and promotes the development of internally relevant skills and knowledge through program participation [9].

With the expansion of social media and the use of digital badging for learning the 4-H organization has the opportunity to expand the current recognition model and reach a wider audience [10] [11]. Digital badges also fit in each of the five recognition categories and may provide individualized motivation for youth. In addition, digital badges permit sharing with potential employers and post-secondary institutions to showcase competencies obtained and awarded through the 4-H experience.

Perhaps the ultimate outward sign of learning today is the diploma. Whether from high school or college the diploma is an important signal that an individual has met some benchmarks of learning. However, a diploma may not provide a record of skills and abilities obtained in the formal classroom. Digital badges, on the other hand, may provide an ideal way for lifelong learners to enhance their learning credentials beyond the realm of formal education [12].

A digital badge for learning can be thought of as a visual representation of accomplishments, certified skills and abilities [13]. The relative advantage of digital badges is that they may provide a more detailed view of what the badge recipient has learned when compared to traditional diplomas and can signify learning in informal environments [12]. Under a digital badging system a young person could display dozens of badges providing a detailed picture of acquired competencies and the skills developed in school and out. Moreover, digital badges may be used to show potential employers not just an earned degree but also a detailed list of demonstrated competences. Such as 21st century workplace skills and important life skills like teamwork, innovation, and leadership.

Digital badges are of great interest to the education community because of their potential to motivate youth to pursue the development of skills and knowledge [11][12]. Badges provide an ideal environment for goal setting whereby learners are challenged to meet the criteria established in the awarding mechanism of the badge. Digital badges also provide a blueprint of educational offerings within a community for those new to a community [11]. In the Boy Scouts for example, badges provide motivation to the earners but just as important it is a recruitment tool for potential badge earners to understand what experiences scouting has to offer. According to Halavais (2012), the process of awarding digital educational badges should lead others to engage in learning.

B. Application of Digital Badges in 4-H

One challenging aspect of the current OBI model is the existence of a large spectrum of badge types that can be earned from very simple check-in and get a badge to more rigorous badges that require comprehensive assessment. To provide outward legitimacy that the 4-H badges represent robotics and engineering based skills and abilities the devised 4-H badges assessment mechanism is moderately robust. In general, the steps for youth participants to earn a badge are: 1) identify an adult facilitator who will conduct the assessment, 2) complete the curriculum, 3) complete an engineering notebook, and 4) complete and submit an on-line survey and provide the adult facilitator the engineering notebook for review.

Following the OBI model the current 4-H Digital Badge ecosystem is comprised of five badges all focused on robotics including: 1) Robot Hands, 2) Robot Movement, 3) Mechatronics, 4) Robot Platforms, and 5) Robot Competitions. The badges can be earned by youth aged 9 to 15 that participate in one of the five robotic programs.

To earn a robotic badge youth must provide evidence of progress in four main areas (science abilities, workforce skills, science knowledge, and engineering performance). Science abilities include skills like observation of a phenomenon, prediction, and redesign. Secondly, youth will display improvements in 21st Century Workforce Skills including critical thinking and problem solving skills. Third, youth will provide evidence of learning gains in science knowledge and big ideas related to the projects including friction, balance, circuits, and electricity. Finally, youth will be assessed on the completion of program benchmarks like construction and functioning of the robotic system or sub components. Performance in all four areas is measured by a 22-item 4-point Likert-type scale, three to four essay questions and a review of engineering notebooks that youth complete in the project, and the approval by adult facilitators that work with youth in the five badge areas see “Table 1.” for a list of criteria and assessment procedure.

TABLE I. ASSESSMENT FOR BADGE ISSUANCE

Badge Requirements		
<i>Evidence</i>	<i>Example of Skills</i>	<i>Measurement</i>
Science, Engineering, and Technology Abililites	build/construct, communicate results	16 self-reflective Likert-type survey questions
21 st Century Workforce Skills	critical thinking, decision making	6 self-reflective Likert-type survey questions
Science Knowledge	scientific habits of the mind	engineering notebook entries
Performance Benchmarks	build a robot hand, program a robot to move forward	3 to 4 essay type self-reflective questions

The survey instrument was field tested with 30 youth ranging in age from 9 to 15 in two US states. In addition, 15 adult facilitators also took part in the piloting of the instrument. The goals of the piloting process were twofold. Goal one was to introduce the digital badges issuance and

assessment framework to youth that had recently completed one of the five robotic projects. The second goal of the pilot was to test each survey question with respondents thereby reducing the overall measurement error. To test each question on the survey youth were given instructions to answer the questions by circling the corresponding number in the 4-point Likert-scale. Next, the researchers read each question with the youth and asked their level of understanding and what could be done to improve the questions. This was done for all 22-questions and the four open-ended questions. Results of the field test showed that 12 of the survey questions needed to be reworded with simpler words like substituting *autonomous* with *runs by itself* or additional examples were needed like (*why and how things work*) was added to the questions *I can apply basic scientific principles to my 4-H robotics project*. In addition, the Likert-scale headings were changed for four of the survey items. In addition, a focus group interview garnered important feedback on the proposed process to earn and issue badges from the youth and adults point of view. Most importantly the adult facilitators felt that they could conduct the required assessments to enable the issuance of digital badges to youth that they teach. Upon the completion of the pilot process the surveys were incorporated into the 4-H digital badges cyberinfrastructure and will be tested with additional groups.

V. CONCLUSION AND FUTURE WORK

While the OBI is still at the very beginning of implementation in industry and educational institutions, it has the potential to bridge formal and informal learning environments by recognizing skills and competencies through learning ecosystems. Youth serving programs like 4-H will implement badges for their members with the expectation that it will enable youth to compete for employment and academic pursuits. More research is needed to determine the role of badges on motivation and goal setting. In addition, developers of the ecosystem will have to establish validity and reliability of individual badges through assessment processes.

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