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# Developing Laboratory Skills Digital Badges

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Specific laboratory techniques such as using micropipettes, performing PCR reactions, or plating microbes, along with other employable competencies, can be marketable attributes for undergraduates seeking research opportunities. Digital badges could be used to certify achievement of these skills to allow students to easily communicate their employment readiness on their CVs or LinkedIn profiles. Prior to this conference session, participants completed background readings/videos, took a survey, earned a digital badge, and created a free Badgr account. During the synchronous workshop, participants worked together to identify skills for sample badges in one of five categories, wrote criteria for those badge awards, saw how to create a digital badge in Badgr, and discussed implementation strategies. Participants were generally in favor of the Association for Biology Laboratory Education issuing some standardized digital badges in the future.

**Keywords**: digital badges, micro-credentialing, motivation, employability

## Introduction

Digital badges offer an opportunity to motivate students to learn skills and to publicly advertise their acquired skills. Digital badges are awarded by issuers based on specific criteria and carry metadata on the issuer, criteria for award, evidence of awardee meeting the criteria, and the date of award. Awardees can embed digital badges on public profiles (LinkedIn, Facebook, etc.) or professional documents such as CVs or application materials, and reviewers can access the metadata associated with the digital badge via the embedded badge link.

Digital badges have the potential to motivate higher education students by gamifying learning and by providing small and large goals to work toward (Gibson et. al. 2013). Traditional badges have been used successfully in other arenas, such as Boy and Girl Scouts programs, to motivate participants, and digital badges have been used in online programs such as FourSquare and Duolingo to motivate engagement. Digital badges have also been applied to higher education, although their use is not yet widespread.

Laboratory courses involve many discrete skills such as pipetting, using a microscope, and working with a particular model organism or specific assays. Digital badges could be designed to recognize these individual skills or other soft skills like teamwork, or skills gained by teaching assistants (Cole 2020). In fact, one university has utilized a digital pipetting skills badge and found that it improved students' skills and confidence in pipetting (Towns et. al. 2015).

In addition to improving skills and confidence in students, laboratory skills-based badges could also prove useful for future research experiences. Digital badges are a way for students to showcase particular expertise they learned in a laboratory class, allowing potential employers or review committees to quickly assess which applicable skill sets a student has.

Despite the potential for digital badge use in laboratory classrooms, they are not yet widely used.

Potential reasons for this may be the time investment needed to develop and design badges and criteria, previous complexity of technology to integrate these into Learning Management Systems, a paucity of research studies showing their usefulness, or the lack of a universal set of standards for creating and awarding badges. This workshop and resultant article presents the newest research on badges and summarizes the technology and processes for biology laboratory coordinators to create and implement digital badging.

## Materials

There are several digital badging platforms that could be used for creating and awarding digital badges such as https://credly.com and https://accredible.com. Our session highlighted Badgr, https://badgr.com, as a preferred platform due to its easy integration into the Canvas learning management system (LMS). Instructors can often work with their campus information technology offices to integrate Badgr into their LMS, and instructions for Badgr in Canvas can be viewed at https://support.badgr.com/en/knowledge/checklist-for-badging-in-canvas-courses. To deliver workshop content and give participants experience with LMS-integrated badges, we created a Canvas course for our workshop at https://canvas.instructure.com/courses/2895293. Enrollees in that Canvas course could earn a workshop readiness badge by completing our pre-workshop survey, recommended readings, and taking a simple quiz.

Prior to creating badges, participants created an account in Badgr and set themselves up as an "issuer." The following site provides an introduction to badging and the Badgr platform: https://support.badgr.com/en/knowledge/what-are-open-badges. To experience receiving a digital badge, we also recommended earning this simple badge on web exploration found at https://explore.badgr.io/.

## Notes for the Instructor

Workshop participants generally had little to no experience with digital badges prior to the workshop but were able in a short period of time to learn about badges and begin to design them. Prior to the workshop, we polled participants about the general areas related to lab course objectives they were most interested in exploring for digital badges and found broad interest across these categories: lab safety; soft skills, like communication and teamwork; scientific literacy; scientific communication; and wet lab skills. Others mentioned less often were field research and teaching skills (for awarding badges to course teaching assistants).

The biggest investment with implementing digital badges is usually the time spent designing the badge itself. We gave workshop participants 45 minutes to work in small groups to design a single badge for a lab course in an assigned category based on their survey results. We asked groups to 1) identify the specific skill and student/course level for a badge, 2) Develop a badge description, and 3) Design criteria for earning the badge. We also suggested that groups consider breaking larger skills into multiple badges such as a level 1 and a level 2 version of the badge for more basic or advanced skills. For criteria, we advised that they should focus on how students can demonstrate the skill and how it can be assessed in small- or large-enrollment class settings. We suggested they consider using multiple types of criteria such as student upload of evidence, performance on an exam/assignment, Instructor-verified performance, and straight-forward completion/attendance/participation.

Badges developed included chemical safety, verbal communication, drawing inferences, basic light microscopy, team champion player, and seminar style presentations. Each badge included a description of the skill and list of criteria used to earn the badge. Below are two example badges developed during the workshop:

Level 1 micro-pipetting (wet lab skill): Students can correctly select the appropriate micropipette and tips. They can explain the steps to accurately pipette liquid volumes.

Criteria:

- Video of student selecting the correct pipette for a given volume and explaining their selection.
- Video of student pipetting, from choosing the correct tip, to setting the correct volume, to drawing up solution and expelling into the microtube; with explanations of each step.
- Accuracy of pipetting volume assessed by weight of pipetted liquid with a balance.

Supported Hypothesis Development Level 1 (scientific communication skill): able to define a testable hypothesis for a given experiment and identify dependent and independent variables. Provide a rationale based on accurate knowledge.

Criteria:

- Assessed by written hypothesis: Hypothesis has a single, testable outcome (there is a null hypothesis)
- Assessed by written hypothesis: Hypothesis is supported by a rationale and/or available information
- Assessed by 80% score on quiz: Students are able to select appropriate hypothesis or rationale from question bank.
- Assessed by 80% score on quiz: Students are able to define the dependent and independent variables for an experiment.

In designing digital badges, it can be useful to break larger skills into multiple badges such as level 1 for basics or introductory level, and progress to level 2 or more advanced levels in the same, or a different, course. This allows students to earn badges as they develop skills and allows the issuer to keep criteria simple for each individual badge.

Several groups in our workshop decided to specify the badge level for the skill they worked on as they identified different expectations depending on the course. For example, one group designed a level 2 micro-pipetting badge which included assessment based on creation of a standard curve to ensure higher precision in pipetting whereas a level 1 badge could be earned for simply selecting the correct micropipette, correctly setting its volume controls, and properly handling the pipette when pipetting so as not to damage the instrument.

Generally, attendees were enthusiastic about the potential for digital badges in their lab courses. Our discussions focused on challenges and opportunities in using badges. The main challenge identified was in the time needed to design a badge. Though all of the groups made good progress in designing badges, many groups were not able to finalize badge materials within the 45-minute time period. Participants found that designing outcomes and assessable criteria were challenging and time-consuming. The time investment needed to design badges from scratch seemed to be the largest impediment to implementing badges.

Participants did note two potential opportunities to lower the time-investment barrier for badge implementation. First, participants commented on the benefits of collaborating in small groups on badge design. The significant overlap in basic lab learning objectives for our ABLE participants made finding shared badge interests simple and led to fruitful collaborations.

Another means to reduce time-investment in setting up badges that our participants discussed was the possibility of badges or badge templates created by a larger organization such as ABLE.

Badges shared beyond a single course or school have the potential to not only save instructors time in designing badges, but for the badges to carry more meaning for badge recipients as they would be more uniform and have increased recognition. Participants expressed interest in shared badges that could be implemented easily by individual instructors. Given ABLE's mission and community, it seems worth exploring what role ABLE may have in leading efforts to design lab-based digital badges as a shared resource, and at least 10 individuals are interested in serving on a subcommittee to lead this effort.

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