A Framework to Implement Academic Digital Badges when Reskilling the IT Workforce

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Abstract

Information technology (IT) plays an increasingly significant role in today's world. The COVID-19 pandemic has increased that reliance. Employers in all industries are struggling with considerable shortages of skilled IT workers and are seeking innovative alternatives to meet these needs. Digital badging and micro-credentials have emerged as an alternative system to validate skills. The issuing of digital badges has spanned across a wide spectrum of settings and purposes. However, there is currently less application of digital badges in graduate-level programs to link to important academic or subject-matter related achievements and higher-level competencies. Reskilling and upskilling existing employees need a more practical and sustainable approach and often do not require completion of an entire IT master's degree. To align with such demand, this study aims to demonstrate how a digital badging system can be used to validate stackable certificates for micro-credentials in a graduate-level program. The paper starts with a background introduction of the current IT employment landscape. The next two sections provide an overview of micro-credentials in workforce development and higher education today. This is followed by a section on our conceptual framework used to determine the potential value of digital badging to our graduate programs. The next section focuses on the case study. The last sections conclude with the lessons learned and the future research directions.

Keywords: Digital badge, Micro-credential, IT Workforce, Reskill, Upskill, Graduate program

1. INTRODUCTION

Today's competitive and volatile employment environment poses significant challenges to both employers and educators in higher education institutions, a situation exacerbated by the COVID-19 pandemic. While underemployment has prevailed for many college majors, employers from industries such as healthcare and information technology (IT) are struggling with considerable shortages of appropriately skilled employees (Restuccia, Taska, & Bittle, 2018). The annual Cybersecurity Workforce Study suggests that employment in the cybersecurity field, for example, needs to grow by approximately 41% in the U.S. and 89% worldwide in order to fill the talent gap ((ISC)^2, 2020). Increasingly, organizations that have primarily relied upon

colleges and universities to supply job-ready graduates are looking at other sources to find employees with the skills that they seek (Welch, 2021). To stay relevant, educational institutions preparing students for the ever-changing technology world need to keep updating their programs and curricular to address the discrepancies between employer expectations and perceived students' employability. Both the supply and demand sides of the employment landscape are seeking innovative alternatives to close these gaps. Digital badging and micro-credentials have emerged as alternative credentialing systems to validate skills and competencies with the ultimate goal being to build a highly-skilled and constantly reskilled and upskilled workforce (Erickson, 2015).

Micro-credentials are certifications that demonstrate competency in a particular skill, verified by a central authority, such as an academic institution (Fanfarelli & McDaniel, 2019). For micro-credentialing, digital badges are more than just an image showing a skill, they should also be verifiable through a set of metadata (Gibson et al., 2015). Clicking on the badge should enable any employer to independently verify, in more detail, the individual's skills.

Digital badges now serve as a part of an individual's branding when displayed on social media outlets like LinkedIn, Facebook, and Twitter. To-date most of the digital badges have come from non-traditional training providers such as Coursera (www.coursera.com), credentialing organizations such as CompTIA (www.comptia.org) or professional organizations such as the Greater Washington Partnership Capital CoLAB (capitalcolab.com). An example of a digital badge issued by Coursera and authorized by IBM is shown in Figure 1.

Several factors are, however, now suggesting the need for more higher education institutions to consider the implementation and adoption of their own digital badging in traditional education settings. Employer hiring practices are increasingly dependent on digital searches, including an applicant's social media presence. Accrediting agencies and governments are focusing more on program outcomes and what students are able to achieve after graduation. Young adults are demanding shorter and more workplace relevant learning. A large number of non-traditional training providers are issuing digital credentials (International Council for Open and Distance Education, 2019). In addition, employers are saying that they cannot simply hire a brand-new workforce because of the cost and the perceived deficit of qualified recruits (Marion, Fixson, & Brown, 2020).

Figure 1: Example of digital badge issued by Coursera

The issuing of digital badges has spanned across a wide spectrum of settings and purposes. They can be used in informal learning setting as well as government settings, and in all levels of education from K-12 to higher education (Stefaniak & Carey, 2019). However, in graduate-level programs there is currently less use of digital badges to link to academic or subject-matter related achievements and higher-level competencies. The main purpose of this paper is to conduct a case study to explore and gain a better understanding of digital badging systems and how they can be integrated with stackable certificates in a graduate-level program. The intent being to better position our graduating students in the cybersecurity and technology job marketplace given the increasing trend by employers towards skill-based hiring practices (Ark, 2021)

2. MICRO-CREDENTIALS IN WORKFORCE DEVELOPMENT

A micro-credential is defined as a certification that attests proven competency in a particular skill (Ryerse, 2017). Micro-credentials are also described as "on-demand, shareable, and personalized" and are have traditionally been used to update existing skills or provide alternatives for people that do not hold traditional degrees (Jones-Schenk, 2018). According to Lemoine & Richardson (2015), micro-credentials are associated with competency-based learning and acknowledge proficiency in particular skills. A 2018 study surveyed 750 Human Resource (HR) leaders at U.S. organizations on their best practices in hiring appropriately skilled employees

(Resei et al., 2019). The survey results highlighted that hiring managers often referenced micro-credentials for job applicants' skills and competencies instead of only relying on applicants' academic transcripts and on-site interview performance. Further evidence shows that micro-credentials are an excellent tool for employers to identify a candidate's "authentic skills" and clearly evaluate and align the candidate's skill level in relationship to the position skills (Gauthier, 2020). The evolution of micro-credentials awareness has influenced hiring in the IT industry in which more and more emphasis is directed on verifiable skills (Welch, 2021). Skills-based hiring has become an increasing trend during the COVID-19 pandemic (Roslansky, June 08, 2021).

As micro-credentials that reflect specific skill attainment have gradually gained significance in workforce development, competency-based hiring is becoming widespread. Employers demand an articulate and verifiable understanding of a candidate's capabilities prior to extending a job offer. Consequently, the micro-credentialing system can be perceived as a double directional mechanism: (1) for the employers to easily match the required skills for the position with the candidate's abilities, and (2) for the applicant to highlight and verify their competency, proving their adequacy for the job (Gauthier, 2020).

There is also another trend where some large employers are developing in-house micro-credential programs for current and future employees. In-house micro-credentials are used to train new employees and to re-train the current employees. In addition, such micro-credential programs may also be offered to the employees of other organizations. For example, Google created a group of private companies including Bank of America, Walmart, Sprint, GE Digital and PNC Bank who are willing to hire candidates who complete Google certificates (Oliver, 2019). Another example is the Greater Washington Partnership CoLAB, a consortium of major employers and academic institutions in the region between Baltimore, Washington DC, and Richmond. CoLab has created digital badging in data science and cybersecurity based on the needs of these employers and undergraduate courses in these fields taught at member universities (Blumenstyk, 2019).

Along with this trend in industry, more and more higher education institutions are beginning to offer micro-credentials to allow their graduates to be better identified by potential employers for their specific employable skills (Oliver, 2019). The next section provides a brief overview of micro-credentialing in higher education realm, from community colleges to graduate schools.

3. MICRO-CREDENTIALS IN HIGHER EDUCATION

There is an increased demand for traditional degree programs to also create programs that are aligned with industry needs and that can be validated by employers (Resei et al., 2019). Micro-credentials are not intended to replace traditional degrees, but to supplement the knowledge and skills acquired through traditional learning or to better identify knowledge, skills and abilities at a more granular level. In higher IT education, micro-credentialing can have several advantages as students look to incrementally deepen their knowledge and skills either through updating their current knowledge (upskilling) or re-training and gaining new abilities (reskilling). They do not want to wait two or four years until they graduate to get the recognition for those new skills.

College students are showing a distinct preference towards work-integrated learning and curriculum that incorporates these industry requirements, hoping to obtain a better employment opportunity (Oliver, 2019). Additionally, students are looking for institutions that are providing micro-credentials that hold "value" when presented in the industry (Gauthier, 2020). Therefore, institutions are expected to develop micro-credentials that are "endorsed by leading employers" (Resei et al., 2019) and prepare candidates for industry requirements.

According to Fond et al. (2016), three in every four higher education institutions regard micro-credentials as important to their future. Hanafy (2020) suggests that higher education institutions consider transforming their curriculum systems to include micro-credentials as stackable certificates. Such practice allows potential employers to have direct access to candidates' specific skills. The importance of the micro-credential implementations in educational institutions has been widely explored both in academia and in the industry. Moreover, the micro-credentials system has been adopted at various formal education levels – from community colleges all the way up to some graduate levels.

Community colleges are an important part of the U.S. educational profile and the National Student Clearinghouse for Education Statistics (NCES) estimates that at least 38% of undergraduate

students in 2018-19 attended community college. These institutions are well positioned to become leaders in providing digital badging as they offer many shorter programs as micro-credentials that focus on developing the competencies sought by employers (Gallagher & Maxwell, 2019). Using digital badging for these micro-credentials allows a visual indicator of the skill developed to be displayed, accessed, and verified online. An example institution that has successfully developed digital badges in technical areas is the Colorado Community College System (Perea, Chieppo, & Woodmanee, 2018).

Several higher education institutions have also implemented digital badging, mainly in undergraduate programs. In addition to helping improve workforce readiness, the micro-credentials have been shown to increase student engagement. Moreover, the implementation of digital badging has demonstrated a positive impact on student retention in their first-year experience (Mah, 2016). Digital badges have also been adopted by a number of colleges and universities to reward students for accomplishments such as achieving undergraduate academic milestones in the Illinois State University Honors Program, co-curricular activities including projects and workshops at the University of California, Davis, and competencies in support disciplinary work at Portland State University (Wienhausen & Elias, 2017). Rimland & Raish (2019) explained that Penn State uses digital badges within undergraduate general education courses to recognize information literacy skills. Additionally, other universities use badging programs to track student progress.

Implementation of digital badging at the graduate level is not as common but some higher education institutions have embraced the concept, mainly in professional development programs. For example, Stony Brook University School of Professional Development uses digital badges to denote skills and knowledge mastered in graduate coursework (Wienhausen & Elias, 2017).

Digital badging provides the verifiable evidence of achieving a micro-credential, in much the same way that universities use the transcript for validated evidence of a degree. These digital badges can be used to denote particular technical skills or for other workplace skills such as teamwork, critical thinking or entrepreneurship. For students, they can denote skills acquired to meet specific workplace needs, in demand by potential employers, and they may earn badges as they incrementally work towards a degree. Students can display these digital badges on their social media throughout their university program, illustrating their growing skills. Social media has increased the focus on digital-badging as an appealing image of the individual's credentials such as a certificate or certification. It enables the individual to update their profile and increase their likelihood of being identified when employers search sites such as LinkedIn for potential candidates for specific positions with defined skill requirements.

Another benefit of a digital badging system is that it offers a clear understanding of the learning outcomes to both the student earning the badge and any potential employer (Pangaribuan & Febriyanto, 2019). Additionally, the system can contribute to a higher engagement level of the badge earners. A survey that evaluated the IBM Digital Badge Program found out that 87% of the employees that received IBM badges stated that "were more engaged" because of the badging system (IBM, 2019). The same survey showed that the digital badging programs are helping leaders and managers to reward and recognize employees' efforts. This is also an important concept and mechanism for academic degree programs to reward the students' efforts incrementally, which potentially increase the student retention rate.

In summary, digital badges are used by companies and higher education institutions in two main ways:

- Looking for new talents: while micro-credentials refer to the acquired skills, the digital badges are perceived as "a visual representation and evidence" as well as an "icon" that can specify a candidate's abilities (Bowen & Thomas, 2014). The badging system can be seen as a bridge between formal education and employment readiness.
- The re-training of existing employees: employers offer digital badges as a proof of completion of continuing learning requirements and as evidence of the updated skills (Hurst, 2015). The implementation of digital badging at the organization level illustrates employers' commitment in employees' professional development (Pakstis, 2019).

4. CONCEPTUAL FRAMEWORK FOR IMPLEMENTING DIGITAL BADGES

When faced with implementing micro-credentials and digital badges in their graduate programs, the authors visited a strategic model for when to incorporate new materials into the IT curriculum (Liu & Murphy, 2012) and adapted it to the task at hand.

Liu and Murphy (2012) depicted an educator's dilemma as a challenge to find the balance between accommodating new materials emerging from the discipline and maintaining a viable curriculum without overload. The model provides a conceptual framework to help dissect the challenge discussed in the previous sections. We adapted six forces from the original framework to help us make a valid "when and if to implement digital badge" decision, as illustrated in the figure below.

Figure 2: Conceptual Framework of Six Forces (see appendix)

The first force driving our decision is based on the widely recognized "*Diffusion of Innovation*" theory which asserts that the adoption of technological innovation usually follows an S-shaped curve (Rogers, 1983). Five categories of adopters are involved in this curve over periods of time. It starts with a small group of "innovators", gradually leveled up by the "early adopters" and "early majority", and lastly followed (saturated) by the "late majority" and "laggards". This theory provides a macroscopic angle to examine how digital badging is growing to address the gap between education achievement and employment preparedness (Welch, 2021). Even though digital badging credential initiatives have been implemented and promoted by some employers, some non-traditional training organizations, and some education institutions, more opportunities are yet to be created in universities, particularly at the graduate level, to connect students' skills and capabilities with workforce needs (International Council for Open and Distance Education, 2019). In reviewing digital badges in the higher education space, little focus seems to center on graduate students including adult learners and career changers during the movement to digital badging. Following the process outlined in The Innovator's Solution (Christensen & Raynor, 2003), we felt the need to start early and assume the role of an early adopter of digital badge programs targeting graduate-level or post-bachelor students.

The second force in the framework is *the current status of digital badging in industry*. More and more industry leaders have launched their own digital credential programs or have partnered with educational institutions to offer job-oriented courses coming with digital badges. For example, IBM's digital badge program had garnered more than an estimated 200 million social media impressions through early 2018 (Credly, 2020).

The third force in the decision-making process is *the impetus for digital badges*. Both faculty and student interest are important. Faculty members wanted to develop a digital badge program to provide stackable credentials in a modular manner and respond to workplace needs. On the other hand, students are more likely to obtain micro-credentials that they believe would add value to their employability, including employer acceptance and recognition. One study showed that when transcripts were juxtaposed with digital badges, 86 percent of knowledgeable employers preferred a digital badge over an academic transcript when verifying a student's specific skills (Finkelstein et al., 2018). Most of these skills are included in the curriculum but may not be readily discernable by a potential employer when looking at transcripts. Course names and their content vary across institutions. Digital badging will make actual content more obvious.

The fourth force factor is *the adoption status of digital badges in other institutions*. Adoption by another institution is often a consideration in university approval processes and needed to be thoroughly investigated. As discussed above, several higher education institutions are now offering digital badges and many of these are appearing on social media.

The fifth factor in the model is a consideration of *avoiding curriculum "bloating".* Due to its modular and stackable nature, digital badging should not cause curriculum bloating. Students can achieve a badge after competing smaller units of an existing degree program, for example Python Coding included in a computer science program. Students can have some freedom to select different digital badges offering them a degree of personalization.

The sixth factor is *the level of risk*. Risks for adding a new alternative pathway program vary from one institution to another and often relate to its risk posture. Due to the intensively competitive and dynamic higher education environment today, time is of the essence to prepare students for the workplace. Hence, the agility of converting or mapping existing curriculum to suitable skill-based and workforce-related micro-credentials turns out to be a significant critical success factor. Another risk factor is the additional costs for awarding digital badges and ensuring their verification when clicked. This has been made much easier now that several vendors provide badging service. There is also the concept of open badging which allows verifiable badges to be shared across organizations. The Open Badges organization reports that 475,000 open badges were issued in 2020, and over 43 million open badges have been issued in total (IMS Global Learning Consortium and Credential Engine, 2020).

5. CASE STUDY: MICRO-CREDENTIALS AND DIGITAL BADGING AT THE GRADUATE LEVEL

Our analysis based on the above conceptual framework led us to decide that now was the time to implement a digital badging program at the graduate level provided that we did not incur any major costs, given current budget limitations.

The faculty in our school ascertained two years ago that our existing approach of master's degrees in IT and Cybersecurity, with specialties offered, worked well for new entrants in the field, but not for existing workers looking for a quick sprint of additional knowledge and skills for the "new" economy (Liu & Murphy, 2021). At that time, we examined our existing master's level curriculum in IT and cybersecurity and recognized that our existing 12-credit specialties covered most of the content needed for some of these quick sprints. We decided, therefore, to separate them out into new certificates, including:

- Cybersecurity
- Data Science
- Digital Health
- Digital Transformation
- Project Management

Each of the certificates was created from courses in the specialty tracks of the master's level programs which were already approved by the university. Under the micro-credential approach, students can enroll in the certificates individually and get the master's level certificate in as little as two semesters. Due to many recent revisions in the university's curriculum process to maintain the university's agility in today's environment, the certificate program was created and approved in less than one year and began in Fall 2020.

We believe we now have the curriculum structure for our micro-credentials. Our next step is to add digital badging to indicate the significant achievement of each of these certificates and to tie them to employer stated skill requirements.

We gained some experience over the last six months at the undergraduate level as a result of being added as a higher education institution to the area's Capital CoLAB initiative. To meet the stringent requirements for their existing five digital badges in cybersecurity and data science, we had to map our undergraduate courses against their major employer-generated knowledge, skills, and abilities (KSA) list. This provided us with valuable insights into the employer-requirements and the perceived relevance on what we were teaching.

Based on this background, we mapped our graduate cybersecurity and data science certificates to similar, but higher level, KSAs to determine the first two graduate badges in our university.

Having established the KSAs for the graduate certificates, our next step was to invest in a badging system. Through the Capital CoLAB, we have been working with Credly and decided to continue with them, so that we used the same platform for undergraduate and graduate badging programs. We felt this would minimize the training requirements of our faculty and staff. As the badging costs are primarily based on the number of badges issued, we were able to start small given the size of our program. Credly staff were also helpful in the design of our badges, both in terms of visuals and in terms of metadata for verification purposes.

Having designed and developed the first two badges, we then turned to developing the KSAs for the other three existing certificates. We first looked at industry certifications in the fields. This

was easier for Project Management but Digital Health and Digital Transformation were a little harder as they are newer entrants in the field. For these, we used the learning outcomes from each of the courses in the program as the major drivers for the KSAs, taking advantage of the research we had conducted in the industry when developing these courses. This is still a work in progress and we expect badging for all the certificates to be in place in a 90-day timeframe.

While researching the value of micro-credentials, we also identified the need for early recognition of skills in the program for career-changers in our M.S. in IT program. We began by creating a new certificate, Business Information Technology, which covered the first four courses in the M.S. in IT program with a focus on skills such as requirements analysis, computer infrastructure, cybersecurity, and data management. Following the university's approval for the new certificate, we also developed the accompanying badge, both to be introduced in the fall of 2021. We believe this will facilitate early recognition for career changers as they further pursue their master's program and look for entry-level jobs.

6. LESSONS LEARNED AND FUTURE RESEARCH

As higher education institutions, large and small, we need to remain agile in today's fast changing world. We are, in part, being increasingly measured by our ability to place our graduates in excellent jobs in the workforce. Therefore, we must listen to the expressed needs of the employers who are recruiting our IT students, both undergraduate and graduate. One of these requirements is more detailed documentation of the skills of our graduates' technical skills and soft skills. A transcript is no longer enough. Badging provides this visibility into the knowledge, skills, and abilities that we are teaching, and enables our students to take it to the social media realm where more and more hiring professionals are looking for IT talent.

Micro-credentialing is the precursor to badging and this allows us to re-evaluate our curriculum to ensure we are meeting both employer and student needs for incremental learning. Making education available in smaller units does not distract us from our overall educational mission and instead, is largely a repackaging of content we already deliver. Badging these micro-credentials allows students to display their increasing skill level to their peers and to potential employers. Micro-credentials also provide vehicles for students to personalize their education.

The infrastructure for badging can be obtained through the Open Badge initiative under which many of the traditional problems of vendor-specific approaches can be easily avoided. Mapping the curriculum to an external badge can be time consuming but if approved, will provide for additional status for the badge. Internally developed badges can be mapped against course and program outcomes and require less effort.

As we begin to award badges for our undergraduate (through the Capital COLAB project) and for our graduate students (through the university), we will launch the assessment process of the effectiveness of the alternate credentialling systems. We will follow students who are awarded badges in both programs, assess their social media presence based on their demographics, examine the effect the badges have on their job acquisition process, and determine their retention and completion rate in the degree program. This further research should inform us, and others, of the value of external and internal digital badging for graduate-level educational programs.

The authors acknowledge that the current study provides limited empirical evidence on the effectiveness for digital badging due to the early stage of implementation in the program. The research next in line will provide further insights on how the digital badges impact the student retention rate in the degree program and change the visibility of graduates in the job market.

7. CONCLUSION

In summary, the present paper contributes to a relevant and recent topic on the emerging, alternative systems of digital-badging and micro-credentials. A case study is carried out to demonstrate how a digital badging system can be used to validate stackable certificates for micro-credentials in a graduate-level program. The paper provides new findings on how to implement digital badging systems and how to tackle some problems and challenges.

Digital badging based on micro-credentials are becoming an increasingly disruptive part of education and job acquisition, particularly in the social-media world of the day. They document and allow for verification of specific skills and professional development. They also increase transparency into the quality of our educational programs, better communicating what has been

learned than is commonly available on a university transcript. Given the need for reskilling and upskilling in the fast-moving IT field, digital badging of micro-credentials in the academic community is a must.

To end with a quote:

"While the traditional college degree will hold sway in 2026, more employers may accept alternate credentialing systems as self-directed learning options and their measures evolve" (Pew Research Center, 2017).

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Appendices and Annexures

Figure 2: Conceptual Framework of Six Forces