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EXPLORATORY STUDY: DIGITAL BADGING

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ABSTRACT

Aim/Purpose	To inform educational stakeholders about of the emerging digital educational badging technology, the industry, and how it applies to adult learning.
Background	An overview of the developing badging system, concepts, key terminology, advantages, challenges, and examples of badge utilization.
Methodology	Exploratory study
Contribution	Makes known how the current state of the badging system, its fit with adult learning theories, its features, its issues, and offers avenues for future research.
Findings	Digital badges align well with adult learning theories. Badges can improve adult student access to higher education, aid in reducing credential fraud, increase granularity of academic records, and allow for more personalized learning. The challenges include a crowded badging platform market and concerns with the value proposition of badges by employers.
Recommendations for Practitioners	Before an organization engages in a badging strategy for adult learners, it needs to understand the badging system to include the advantages and challenges of this rapidly growing practice.
Recommendations for Researchers	Understand the badging system, how adult learning theories apply to digital badging, and the research needs associated with this developing credential.
Impact on Society	Badging marks a shift in how we think about formal human development; from institution-centric and bounded to learner-centric and unbounded.
Future Research	Most current research involves motivational impacts on K-12 learners. This article highlights the need for more research regarding impact of badges on adult learning is needed.
Keywords	badges, open badges, badging, access to higher education, transcript ambiguity, credential-fraud, open pathways, badge challenges

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INTRODUCTION

A pedagogical outcome of the changing higher-education industry is the development of the digital academic badge. Although new to academia, physical badges used as representations of rank, experience, or achievement are well known throughout the modern world. Though badges are often associated with Boy or Girl Scout merit badges, historians have dated badge-use to denote rank by Roman legions hundreds of years Before the Common Era (Speidel, 1996). Only since 2011 have digital academic badges appeared on the higher-educational landscape (Gibson et al., 2015). Since 2013, Surman (2018) posits that millions of badges have been issued by governments, industry, and educational institutions. Fong et al. (2016) found that 20% of U.S. colleges have issued badges since 2016. Technavio analysts forecast the global digital badge market will see a compounded annual growth rate of 31% from 2018-2022 (as cited in Technavio, 2017), which translates to a $205 million digital badge market by 2023 (Marketsandmarkets, 2019).

Research by Raish and Rimland (2016) posit that Human Resource (HR) professionals welcome the idea of badges, providing more granular information on a job candidate's skills and knowledge. Yet, most HR managers were unsure of the validity of open educational badges. Liyanagunawardena et al. (2017) acknowledge limited research exists on open badges. The problem is the peer-reviewed research that does exist does not consider how badges might be useful for adult learners and current research fails to address the development of the emerging global system associated with the badging movement.

The purpose of this exploratory research is threefold: expand knowledge of a novel idea, disseminate knowledge, and identify future research needs. The goal of this investigation is to answer three questions: How do theoretical frameworks of adult education apply to badging? What developments are occurring with the global digital badging ecosphere? What are the research needs associated with digital badging? This study provides an overview of the emerging global badging system, highlights key terminology, provides examples that demonstrate how organizations are utilizing badges, and emphasizes future research needs associated with this emerging technology.

RESEARCH METHODOLOGY

The research approach used is best described as an exploratory study. Yin (1993) argues the exploratory approach is ideal for background investigation, making known the unknown, before engaging in formal social research via explanatory and descriptive studies. Yin (1994) contends that using varied sources of evidence ensures validity of the exploratory construct.

Table 1: Types of exploratory research (Swedberg, in press)

Types of exploratory study	Goal of the study
Standard exploratory study type 1	To be the first investigation in a topic where little is understood, a publishable work using multi-methods
Standard exploratory study type 2	Create new hypotheses and notions for a topic that is already known and produce publishable work using standard methods and significant sample size.
Informal exploratory study (pre-study)	Expand the development of novel ideas by any means; sample size may be small.
Pilot study or exploratory study for thesis proposal	Investigate a topic informally in order the general design for a dissertation yields important results. Standard and irregular methods may be used; a representative sample is not necessary.

Types of exploratory study	Goal of the study
Exploratory study for student exercises	Used to teach students how to theorize empirical issues without rigid methodological procedures.
Institutionally supported high-risk exploratory study	Develop radical ideas where risk for failure is high.

Swedberg (in press) posits that exploratory research in social sciences is often noted as the essence of good science and was once widely practiced but has become neglected and forgotten. Swedberg argues exploratory research consists of five diverse types (see Table 1).

This study is best described as an informal exploratory study (Swedberg, in press). Researchers new to the badging development can use this report as a starting point to gain a better understanding about the history, facts, applications, and systemic developments related to academic digital badges. Although the concept of badging has been researched quite extensively since 2011, the insights of thought leaders focused on the developing badging ecosphere has not been captured in the academic literature. Documenting the perceptions of badging developers is a goal of this investigation as the original thoughts are useful to researchers to better understand the overarching badging concept. Although academic badging has been around formally for seven years (Open Badges, n.d.), it is still a novel idea to many within and outside of higher education. Swedberg argues a key purpose of informal exploratory studies is to expand novel ideas by any means. For these reasons, the research in this report involved accessing a mixture of peer-reviewed studies and open source information.

Since much of the research associated with the Instructional Management System (IMS) Global Learning Consortium's (e.g., Global) effort for establishing global badging standards is not in scholarly literature, the author used media reports, corporate websites, trade outlets, press releases, and personal communications to gain insights regarding how the global badging system is maturing. I utilized the University of South Florida's online database and its version of Google Scholar for scholarly, peer-reviewed research. Keywords included *digital badges, open badges, digital badges,* and *badging;* sometimes, these terms were paired with specific secondary terms such as *employment, platforms,* and *ecosystem*. Yin (1994) espouses that external validity is more difficult with exploratory cases; however, it is possible through the use of theoretical connections and the ensuing generalizations that could be made. This research focuses on variations of adult learning theories as they relate to academic digital badges. Many other theories, including additional learning theories and human capital development theories, are also possible theoretical linkages with respect to academic digital badges but not addressed in this exploratory case.

THEORETICAL FRAMEWORK

Regarding digital badge research, much of it has focused on intrinsic and extrinsic motivation (Mah, 2016). An EBSCOHost database search using the terms "digital badges" between 2009-2020 results in 2,219 articles. Narrowing the search to "academic digital badges adult learners" using the same period results in 8 peer-reviewed academic journals. Of the 8 articles identified, only 4 focused on digital badges as related to adult learners.

A second search using the terms "academic digital badges adult learning" yielded an additional peer-reviewed reference. Cross-referencing these five journals with Google Scholar provides insights as to how often the research is cited by other scholars (see Table 2). This literature review suggests that much of the current literature related to digital badges is not centered on adult learners and what is available is not widely regarded. Gross and Clark (2018) posit that 35% of college students, some 6.6 million people, are considered adult learners (aged 25 or above), so research that provides theoretical links between adult learning theory and digital badges is highly relevant.

Table 2: EBSCOHost digital badge adult learner/ing results cross-referenced with Google Scholar

Citation	Type of Study	Number of times referenced
Young, D., West, R. E., & Nylin, T. A. (2019). Value of open microcredentials to earners and issuers: a case study of national instruments open badges. *International Review of Research in Open & Distance Learning*, *20*(5), 105–121.	Case study	1
Mathur, A., Wood, M. E., & Cano, A. (2018). Mastery of transferrable skills by doctoral scholars: visualization using digital micro-credentialing. *Change*, *50*(5), 38–45. https://doi-org.ezproxy.lib.usf.edu/10.1080/00091383.2018.1510261	Case study	2
Raish, V., & Rimland, E. (2016). Employer perceptions of critical information literacy skills and digital badges. *College & Research Libraries*, *77*(1), 87–113. https://doi-org.ezproxy.lib.usf.edu/10.5860/crl.77.1.87	Empirical study	52
Fields, E. (2015). Making visible new learning: professional development with open digital badge pathways. *Partnership: The Canadian Journal of Library & Information Practice & Research*, *10*(1), 1–10. https://doi-org.ezproxy.lib.usf.edu/10.21083/partnership.v10i1.3282	Descriptive	16
Ady, K., Kinsella, K., & Paynter, A. (2015). Digital distinction: badges add a new dimension to adult learning. *Journal of Staff Development*, *36*(4), 24–27.	Descriptive	2

Like many industries, education is seeing demand from its stakeholders for more customized learning versus the one-size fits all factory model of education that has been the standard for more than 150 years. Bulger (2016) conveys that personalized learning is the buzz-word in education circles; however, scholars cannot agree on a shared definition as the concepts of personalized learning are broad (see Figure 1). Examples are discussed in the findings as to how badges support tailored learning. Self-directed and self-paced fall within this broad range of terms. Knowles' (1990) theory on adult learning, andragogy, includes the ideas of self-directed and self-paced learning.

Knowles (1990) argues that six foundational assumptions are related to how adults learn differently than adolescents:

1) They have a need to know; they understand the benefits of acquiring new knowledge or skills or understand the drawbacks of not knowing or lacking a certain skill
2) They possess an independent sense of self-understanding that makes them self-directed
3) They have more experiences than young learners
4) They develop a sense of willingness to learn based on the knowledge and skills they need in their current situations

5) Their orientation to learning is life-centered, which is different from the subject-centered orientation by younger learners and

6) Adults have different motivators for learning, such as work promotions, career changes, improving self-esteem, better quality of life, etc.; a course consisting of a range of badges where learners choose which subjects to focus on more intently based on their current situation may be appealing for adult learners

Figure 1: Personalized learning terms (Bulger, 2016)

In addition to Knowles, numerous other adult learning theories are worth considering with respect to digital badges and personalized learning. See Table 3 for a brief overview of some well cited adult learning models.

The highlighted theories of adult learning suggest that learning for adults is a highly personalized event. Badges support this notion by allowing scaffolding of badges that is personalized to the learner. For example, an adult working in healthcare who wants to learn about operations management might create an operations course based on personal experience in healthcare operations as well as select badges in areas of operations management tailored to his/her unique healthcare background and life/career needs.

The idea of highly personalized learning pathways will change how faculty think about curriculum design. Standardized approaches to learning will become outdated. For example, operations management courses in university business programs vary from one school to another. In a badged future, operations management knowledge and skills may vary from one adult student to another while both are enrolled in the same course. Outcomes will differ depending on the student's self-direction, expe-

riences, characteristics, willingness, and life or career-stage. Two students might have different operations management experiences, which may be a better reflection of reality as real-world operations vary by company and industry. Operations in a manufacturing facility are quite different from a hospital setting. Like any developing technology, badging is highly dynamic; however, to understand what is happening, one must first become familiar with the phenomenon and its vernacular.

Table 3: Selected learning theories

Author	Findings
Jarvis (1987, 2006)	Learning process theory. Experiential learning depends on post-experience outcomes involving the inter-association between a person's personal store of knowledge, the nature of the person, the nature of the experience, the nature of the interaction, the social context, and the chronology of events related to the experience. Not all experiences are important, some are insignificant.
Cross (1981)	Characteristics of the learner and the learning environment influence the learning process. Adult characteristics such as employment status, marital status, parenthood, age, etc. combined with learning style influence adult learning.
Caffarella (1993)	Self-directed learning theory. Adults initiate learning; adults plan and manage their own learning with a balance between autonomy and reliance.
Kolb (1976)	Experiential learning theory offers a 4-stage model that begins with concrete experience (stage 1) as the foundation for observation and contemplation (stage 2) which are then formed into ideas and generalizations (stage 3) resulting in guides for generating new experiences (stage 4).

FINDINGS

It is a challenge to investigate a developing innovation as it is still developing. Digital badges have had exponential growth since the idea was put forth in 2011 (Open Badges, n.d.; Mozilla Foundation et al., 2012). Millions of badges are being issued across the world each year by a range of organizations for a wide variety of reasons. For higher education however, an industry dependent upon the value of its credentials, it is vital to understand the facets of this innovation prior to engaging in a badging strategy. Likewise, for researchers investigating badges, it is essential to know about the history and various features of a badging system beginning with a shared understanding of what a digital badge is.

A DIGITAL BADGE IS:

A digital representation of a skill, learning achievement or experience. Badges can represent competencies and involvements recognized in online or offline life. Each badge is associated with an image and some metadata. The metadata provides information about what the badge represents, and the evidence used to support it. (Mozilla, 2014).

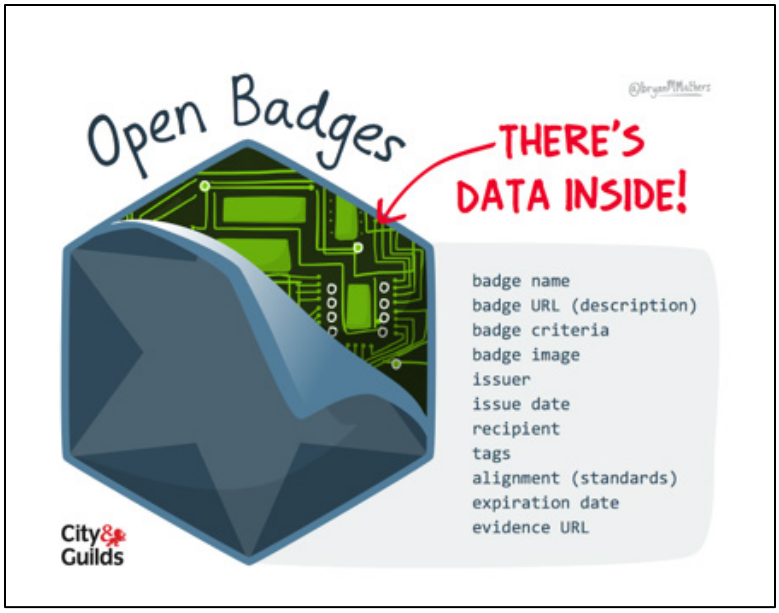

Figure 2: Badges contain metadata (Mathers, 2016)

Learners earn educational digital badges through short courses, online, in-person, and hybrid formats that cost much less than full credit college courses. This range of learning mediums, along with lower costs promotes greater access to higher education by adult students. Additionally, the short courses allow adult learners more choices which aligns with Knowles (1990) adult learning theory and the idea that adult learners are life-centric learners who desire to tailor education to meet their current needs. For example, an adult learner who works full time in health care may not be interested in pursuing a general course of study in project management, instead they might decide to stack a series of badges focused on health care specific project management.

The Badges provide more information than a traditional transcript because they contain rich metadata, such as the issuer of the badge, standards alignment, evidence of learning, learning objectives, and could even include Uniform Resource Locator (URL) links to short videos of the student communicating what s/he learned (see Figure 2). A significant advantage of academic badges is the ability for the learner to transport, display, and share badges. Furthermore, the digital securing of badges allows potential employers the ability to verify the authenticity of the credential with a mouse click. A robust effort is underway by an assortment of stakeholders from education, industry, and government to assist with the implementation of this new educational product.

The IMS Global is a non-profit collaborative consisting of more than 500 organizations focused on creating and guiding policies and standards for the future EdTech system; it serves as the organization providing the oversight, policy, and guidance on badging standards for the Academy (IMS Global, 2018b). IMS understands that because future digital credentialing (not just badges but also micro-certificates, continuing education certificates, business-application specific certificates, nano degrees, etc.) is secure, verifiable, portable, transcriptable, exchangeable, and managed by the learner, it will require a set of open standards to provide better value by avoiding high-cost, single-proprietary integrations. With this goal in mind, IMS manages the Open Badges Infrastructure (OBI) standard for a specific type of digital badge, the open badge.

Open badges

Learner-agency principles serve as the foundation of the open badges concept (IMS Global, 2018b). Learner-agency means students assume control of their credentials; they can claim and display badges across a range of digital mediums (e.g., LinkedIn, Facebook, Twitter, etc.). Three key roles (issuers,

earners, displayers) pertain to OBI and its overarching goals center on building an adaptable, decentralized framework that captures learning wherever it takes place, allows anyone to issue badges, and provides earners control over how they characterize their learning (Mozilla, 2014). More formally, Hickey and Otto (2017) cite the Bologna Open Recognition Declaration created during the ePortfolio & Identity (ePIC) Conference in Bologna, Italy, in 2016, which espouses:

> Open Badges, the open standard for the recognition of learning achievements, has proved the power of a simple, affordable, resilient and trustworthy technology to create an open recognition ecosystem working across countries, educational sectors, work, social environments and technologies. Open Badges have demonstrated that we have the means and the opportunity to put an end to the disparities of the recognition landscape. Connecting and informing competency frameworks, they become the building blocks of an open architecture for the recognition of lifelong and life-wide learning achievements. They create the conditions for individuals to be in control of their own recognition, to establish their identity and agency, whether formally (within institutions) or informally (across communities) (1st paragraph "The Importance of Open Recognition" section).

Open badges are also open because they do not rely on one system, such as a single learning management system, social media platform, or badging site, which means open badges provide greater freedom of badge issuing and application of badges by organizations and individuals. For adult learners who are self-directed (Knowles, 1990), open badges are compelling. Using the aforementioned healthcare project management example, the adult learner may choose to take courses through a variety open offerings such as their workplace, local colleges, online universities, or government agencies to scaffold a meaningful skillset for their particular situation. Understanding the developmental history and origins of the open digital badge provides insight into the evolving badge system and brings to light other concepts associated with this unique credentialing model.

The concept of alternative credentials first surfaced in the early 1980s (Green, 1980 as cited in Grant, 2016). Moodie (2011) raised awareness about the digital badging ideal and the MacArthur Foundation's $2 million competition for designing an open badging standard that could be used by a wide range of stakeholders to verify accomplishments and experiences of individuals. This competition eventually led to the first open badges coalition.

The first Open Badges system was initiated in 2011 by a network of partners with the non-profit Mozilla as the key coordinator. The effort, funded by the MacArthur Foundation, was based on a 2010 white paper titled "Open Badges for Lifelong Learning" by Knight et. al. (Open Badges, n.d.; Mozilla Foundation et al., 2012). From 2011-2013, Mozilla developed the badging infrastructure then launched Open Badges version 1.0 in 2013 (Open Badges, n.d.). In the spring of 2014, a group of business and education organizations made public assurances to support the distribution of educational digital badges, which later formed into the Badge Alliance (Open Badges, n.d.). The Badge Alliance created 11 working groups focused on badging infrastructure and system. On January 1, 2017, Mozilla and the Badge Alliance transferred the responsibility for the progression of the open badges' technical standards and communities of practice to IMS Global, which, along with the Mozilla Foundation and Collective Shift (a non-profit focused on social change and owner of the LRNG learning platform), serves as the Badge Alliance Steering Committee (IMS Global, 2018a; Badge Alliance, n.d.) to provide oversight and guidance for the evolving badge system.

The developing global badge system

The major pieces of the IMS digital badge system include platforms, open pathways, backpacks, CLR (Comprehensive Learner Record), and CASE® (Competencies and Academic Standards Exchange). The goal of the system is to capture all learning: formal, informal, and non-formal (Merriam et al.,

2007), achievements, and experiences throughout a person's life into a secure, verifiable digital record maintained by the student. Badges allows for the stacking of micro-credentials from a wide range of trusted issuers into advanced credentials using an integrated data exchange system. A close look at each facet of the badging system provides a better understanding of the overarching system. The concept of badge platforms is a suitable place to start understanding the badging system as it provides a broad vision of the developing badging industry.

Badge platforms

What started as a 2011 white-paper idea of an open badge prototype has grown to scale with an evolving system to include more than 15 million open badges issued by tens of thousands of issuers since 2013 (Surman, 2018). Issuers, which might be a worksite supervisor, a small business, a college department, or some other person or firm, are using a variety of badge platforms. Platforms provide services such as baking (securing / encrypting), verifying, storing, showing pathways, and providing issuers with analytics. Appendix A includes a list of the more well-known badge platform providers (Badge Wiki, 2018). Recognizing the rapid rise of badge platforms and a need for standardization and integration, IMS Global established a certification program for badge platform companies to ensure interoperability between products and content.

Seventeen badge platforms (13 different organizations), certified to issue, display, and host badges, are listed in IMS Global's (2018d) official list of certified open badges v2.0 products (see Appendix B). Certification by IMS is possible for badging systems that issue, display, or host badges (IMS Global, 2018e). Certification requires membership in the IMS alliance or affiliate, passing all tests associated with the service type (issue, display, or host), agreement to have the tests completed by a designated IMS representative and confirmation that the results are accurate and free of misrepresentation. The tests include proof of conformance to Open Badges specifications, which requires the candidate to issue a baked badge (see glossary) and demonstrate various functions, depending on the service type. Certifications to be re-run on an annual basis (IMS 2018e). A recent development by Concentric Sky's Badgr platform builds on the idea of learning pathways.

Learning pathways, open pathways

Whitehead (1929) introduced the idea of scaffolding learning with more recent support by Van de Pol et al. (2010) and Coe (2011). Scott's (1992) research into how students learn physics brought to light the notion of learning pathways; it is a course of learning, chosen by the learner, that includes a series of stages from pre-conception to targeted outcomes, where learning transitions are unique to each learner based on subjective experiences and abilities (Jih, 1996). Applying this idea to the badging system helps to understand the value of open pathways.

IMS Global (2018c) explains that open pathways consist of taking a competency framework or set of learning standards and converting it/them into a pathway, or a series of pathways, to guide learners while earning badges and stacking them into more substantial credentials. IMS Global's vision is for learners to be able to stack badges across platforms and institutions to allow greater flexibility in attaining one's educational goals. This concept aligns well with Knowles' (1990) adult learning theory given adults are self-directed, understand their learning needs, and are motivated based on their unique circumstances. The pathway would be shared in a digital portfolio showing earned badges as well as uncompleted badges.

The pathway in Figure 3 consists of badges from 10 different issuing agencies using three different badging platforms (Acclaim, Credly, and Badgr) (Skipper, 2018). The curriculum in the pathway shown aligns to California's Career Technical Education (CTE) Model Curriculum Standards for Biotechnology. Students earn the Biotech Lab Assistant Certificate using badges issued from a variety of sources. The application of this certificate towards the Associate Degree demonstrates the cross-in-

stitutional stacking capability of the open pathway system. An interactive example of the open pathway shown in Figure 3 exists at: https://pathways.badgr.io/public/pathway/5ad8eee4c9494851f4893554.

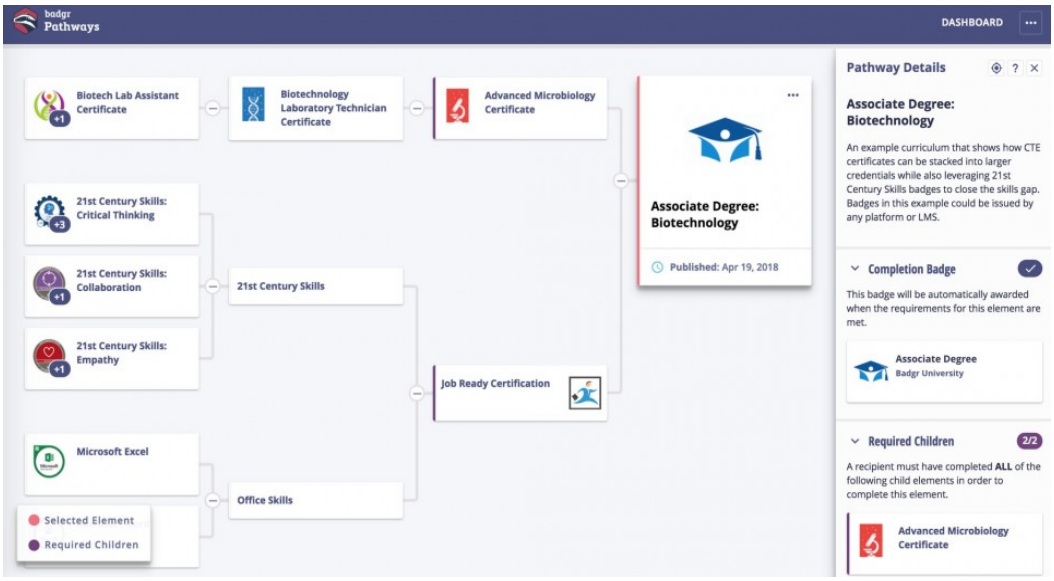

Figure 3: Open pathway example (Skipper, 2018)

Given the plethora of experiences, achievements, formal and informal learning activities that are documented securely through a badging system, earners can create unique, personalized pathways. One goal of the pathway system is to highlight more substantial credentials available to earners once they earn a badge. For example, referring to the open pathway shown in Figure 3, once a student earned the 21st Century Skills: Critical Thinking badge, several pathways could appear on that student's pathway dashboard, including the pathway to an associate degree in biotechnology. Such a system also allows for the potential push-pull signaling to employers once a learner earns a high-demand credential. BeCode, a Belgian non-profit that offers a no-cost six-month coding boot camp for those with no coding or developer background, is working towards such a push-pull badging system.

BeCode requires potential students to complete 25 badges related to code and web development from the Codeacademy's free online platform (International Telecommunication Union [ITU], 2018). The Chief Operating Officer (COO) of BeCode, Cedric Swaelens, envisions using badges to push a signal to employers when a student has mastered a high-demand programming skill and has begun beta-testing such a system (C. Swaelens, personal communication, July 2018). This system may allow students, most of whom are either unemployed or under-employed, to gain employment as a software developer while enrolled in BeCode's boot camp, before completing the boot camp. For example, if a student earns her HTML5-programming badge while enrolled in the boot camp and employers are looking for HTML5-trained developers, once the student earns the badge, BeCode's system automatically notifies employers, which may lead to an employment outcome. Likewise, in a badging system, an employer or potential employer could pull skillset data, based on earned badges, to match employees for specialized jobs or projects. A similar open pathway system could add value to U.S. higher education institutions.

Using badges as prerequisites for college programs or *badging-out* college courses by breaking the course content into a series of badges allows prerequisites more tailored to specific program requirements and greater transparency regarding the specific course outcomes as well as the student's progress. Wayne State University Graduate School has added badges to its Graduate and Postdoctoral Professional Development program (Mathur et al., 2018). The Wayne State badges are focused on

skills determined desirable by employers of doctoral graduates. Wayne State uses pathways to scaffold subskills into larger competencies. For example, the Interpersonal Awareness competency consists of subskills such as negotiation, conflict management, empathy, and perspective taking. Badging a course also allows greater customization with the curriculum for each student which again aligns with Knowles (1990) adult learning theory. For example, an adult student enrolled in a business operations course who works full time might choose to tailor his operations management course with more focus on project management and less on inventory management if his full-time job requires him to manage projects, not inventories. This student's business operations pathway might look different than a student more engaged with logistics or supply chain management.

Likewise, the operations management course badges may offer lessons more industry specific than the general approach used by most business programs. Hence, a healthcare worker completing a business degree may opt to earn healthcare related operations badges while a different student who works in retail may desire badges centered on retail operations. Both students will stack their badges to fulfill the credits in operations management as required by their degree program.

Another advantage of badged courses is they allow students to stop a course mid-way, then begin at a different time without having to repeat the entire course. Badged courses also allow older workers to take focused lessons to update their skills instead of having to take an entire course. Additionally, open pathways allow for more flexibility with transfer students.

Prior Learning Assessments (PLA), where adult students earn academic credit based on lived experiences, has become commonplace for university admissions programs. However, PLAs are a challenge to manage. For a student who wants to earn credit for prior experiences, the school requires the student to submit a portfolio of evidence. Building such a portfolio is onerous for the student while verifying the evidence is time-consuming for most universities. Organizations recognizing experiences using badges could make the PLA process more efficient with the metadata and verification baked into the badge. The student could share the badges with the university admissions department, and the department could verify the named agency issued the badges.

Consider a student who wishes to study in an engineering program that specializes in additive manufacturing (e.g., 3D printing). A student may include badges on her college resume that she has earned through volunteer work related to 3D printing, such as those offered by the E-Nable Community. E-Nable (2019a) describes itself as "…an amazing group of individuals from all over the world who are using their 3D printers to create free 3D printed hands and arms for those in need of an upper limb assistive device" (para. 4). Volunteers can earn a range of badges (see Figure 4), including unique badges for fabricating each of the various hand designs, and distinctive badges for assembling each hand design (a different badge for each different design) (E-Nable, 2019b). Also, E-Nable offers badges for performing roles within the E-Nable community, forming an E-Nable chapter or working group, participating in community activities, completing design challenges for generating new assistive designs, and learning about the E-Nable community (E-Nable, 2019c). This type of flexibility and access in a badging system may prove useful to a wide range of learners and educational administrators.

Kazin and Clerkin (2018) posit badges could play an essential role in military members transitioning into the private sector and note the U.S. Army's proto-type testing of such a system, MIL-CRED in 2017. A link to MIL-CRED information provided by Kazin and Clerkin takes one to the Department of Defense's Advanced Distributed Learning (ADL) Initiative webpage. According to an ADL message, the webpage no longer exists. Additional searches of the internet and academic databases did not locate any information regarding the progress of the MIL-CRED or whether the program still exists. While an open pathway demonstrates some potential with digital badges, such as stacking, personalizing, and streamlining the PLA process, it also highlights a challenge: where to store the thousands of badges a learner collects over a lifetime of learning, experiencing, and achieving? The digital backpack is such a device.

Figure 4: Examples of E-Nable badges (E-Nable, 2019a)

Digital badge backpacks

Mozilla released its backpack feature in 2013 with the Open Badges 1.0 release (Thompson, 2013). The backpack serves as a visual record of the student's badges. Mozilla created its backpack as a digital storage area for learners to house the various badges they were earning from a wide range of open badging sites. The badge earner decides which badges to share with the public and which to keep private. Since its original release, most badging platforms offer some type of backpack feature, and many individual platforms work with Mozilla's backpack, allowing badge earners to import/export badges seamlessly from Mozilla's backpack to their platform backpack. However, Mozilla no longer manages its backpack feature.

In August of 2018, recognizing that IMS' work with badging standards marks the next phase in the evolution of the badging ecosphere, Mozilla announced it was stopping its role as a direct service provider in the badging sector and migrating its Mozilla Backpack to Concentric Sky's Badgr platform (Surnam, 2018). The backpack migration followed an earlier press release that the Instructure's

Canvas Learning Management System (LMS) would offer Open Badges through Badgr's platform as a native feature within its LMS (Canvas, 2018). Badgr allows users to store any open badge in its backpack, not just those issued by Badgr (Badgr, n.d.). Several other badging platforms have partnerships with Canvas, including Accredible, Credly, Canvasbadges, BadgeSafe, and Open Badge Factory (Heppenstall, 2018). Nearly all these other platforms have some kind of backpack feature and integrate with the original Mozilla backpack that is managed by Badgr. Developers at IMS Global recognize that not all achievements, experiences, knowledge, and skills will be badges, hence the need for the Comprehensive Learner Record (CLR).

Comprehensive learner record

Traditional academic transcripts, rooted in the 20th Century, paper-based information systems, provide limited information, such as course title and grades earned, about a student's learning. These transcripts fail to reflect the wide variety of knowledge, learning experiences, competencies, and achievements of the learner. Conventional transcripts designed for one-time learning periods, such as four years at a university, do not work well for the modern world's rapid pace of change and need for life-long learning. With support from the Lumina Foundation, the National Association of Student Personnel Administrators, and the American Association of Collegiate Registrars and Admissions Officers (AACRAO), IMS Global is advancing the CLR as the 21st-Century educational record (Shendy et al., 2019).

The genesis for the CLR started in 2015 at an IMS Global CBE (Competency Based Education) Workgroup that included 35 C-BEN (Competency-Based Education Network) institutions. This group recognized higher education record-keeping must change to support the evolving educational landscape (IMS Global, 2019a). IMS Global created a vision of the CLR, formerly referred to as Extended Transcripts, as a secure, verifiable, learner-centered digital record. This digital record requires a standardized format that captures a more granular picture of a learner and supports a broad range of educational activities, including traditional educational courses, competency-based education, badges, technical skills, soft skills, experiential learning, achievements, and co-curricular activities. IMS launched its first version of the CLR in August of 2019 (Shendy et al., 2019); examples of versions uploaded by institutions can be viewed at http://projects.imsglobal.org/clr-viewer/. The CLR is designed to work with open badges and open pathways, allowing for a record of learning that is easier to understand and more detailed for human educational stakeholders who read them. The Competencies and Academic Standards Exchange (CASE®) extends access further by putting educational information in a format that is read easily by software.

Competencies and academic standards exchange

The IMS is developing the Global CASE,® a set of technical requirements designed to make it possible to electronically transmit learning standards in a constant, referenceable manner by IT applications, tools, and systems (IMS Global, 2019b). Using common identifiers published in a dynamic database allows for the easy sharing of evidence between a range of educational systems, including learning management systems, rubrics, and curriculum management applications. This system allows for the more efficient and comprehensive development of badge pathways. To do this, IMS proposes a framework for CASE® that includes four items, 1) competency documents, 2) competency items, 3) competency associations, and 4) competency rubrics. The specifications for the CASE® framework were released in version 1.0 in July of 2017 (IMS Global, 2017) (See Figure 5).

CASE® aims to transform static documents, typically formatted in HTML, .pdf, or print format and designed to be read by humans, into a universal format compatible with a range of educational software to ensure the proper interpretation of learning standards by various educational organizations (IMS Global, 2017). Competency documents act as the container for a group of learning standards, usually arranged hierarchically or by the classification system, which indicates expectations of a stu-

dent's competencies within a subject area comprised of one or more levels. Competency items include a statement linked with other statements or documents to form a construct. Items include things such as academic standards, competencies, sub-competencies, goals, skills, learning outcomes, objectives, etc. Competency associations indicate the relationship between competency documents or competency items delineated by being a precise match of the source, related to, part of, replaced by, precedes, or as a prerequisite. A competency rubric expresses the expectations of excellence regarding an assignment, artifact, or act to define consistent grading benchmarks. IMS Global (2017) notes four pilots involving machine-readable standards occurred in Texas, Georgia, and Wisconsin.

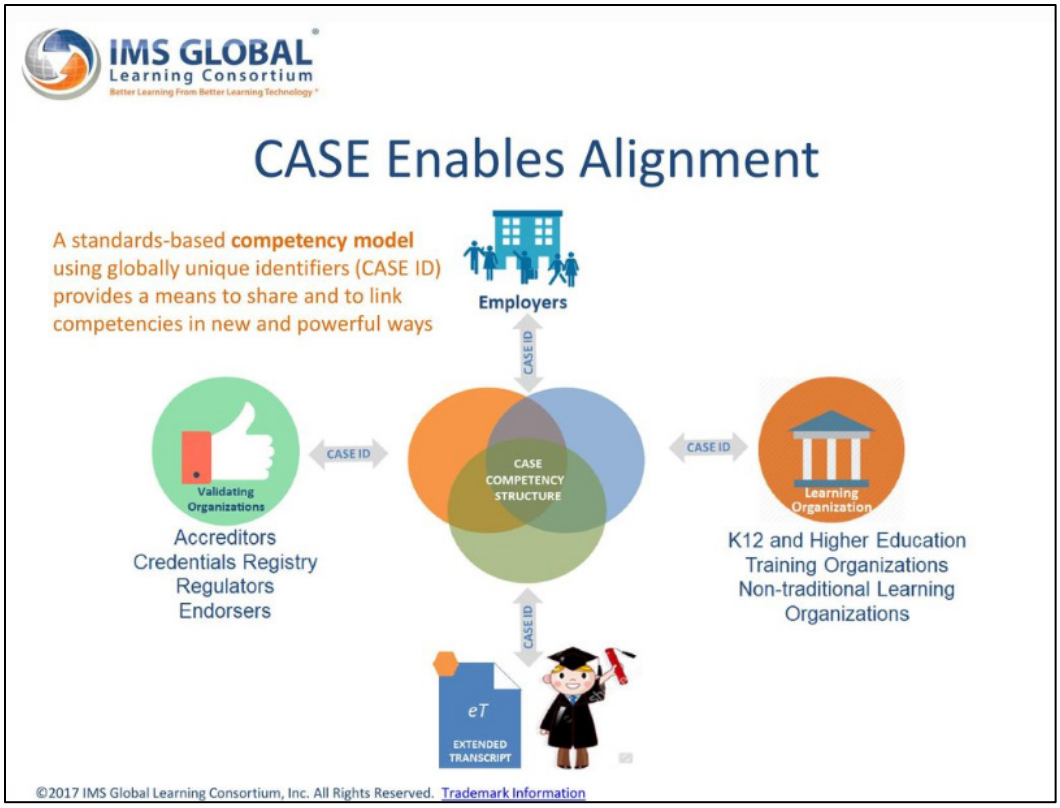

Figure 5: CASE® conceptual diagram (https://slideplayer.com/slide/13620038/)

CONCLUSION

The development of the badging ecosphere presents many areas where research is needed. Research aligned to key badging stakeholders such as issuers, earners, and consumers of digital badges is essential. For issuers, research associated with badging strategies, costs, design, and associated best practices is needed. For faculty utilizing digital badges, research into their perceptions of how the technology impacts curriculum design and execution for adult learners is vital. Likewise, case studies of faculty implementation into curriculum and focus on personalized learning is also desirable. For badge earners, research that provides insights as to badge value in the job market, utility in terms of knowledge, skills, and ability development, as well as usefulness of the credential as a signaling device is needed. In terms of consumers, employer perceptions of badges, as well as insights from college admissions professionals that are seeing badges as examples of prior learning, is also appropriate to understand this educational innovation better. Theoretical research associated with badging is needed to determine how this new approach aligns with theory. Understanding how badging supports or refutes theory related personalized learning, scaffolding, experiential learning, credentialing, and adult learning theories is also useful in creating better learning systems, more useful credentials, and developing life-long learners.

The goal of this exploratory study centers on making known the developing digital badge system and how such a system might be of value to adult learners. IMS Global is leading the development of the open educational badging standards for the system. This system consists of badging platforms that bake badges to ensure they are secure and verifiable. The baked badges become stackable when placed in a badging pathway. Badge earners store their badges in digital backpacks retaining the right regarding which badges are or are not made visible. In a formal setting, the badges are recorded in a CLR (Comprehensive Learner Record) designed to provide human readers much more granularity of detail than traditional transcripts regarding the learner's knowledge and skills. Finally, the CASE® (Competencies and Academic Standards Exchange) is an effort to develop machine-readable competency specifications that support digital standards to allow seamless interoperability between educational software. CASE® allows learners to customize their badging pathway independently through machine-enabled support. The overarching goal of the badging system is to capture all learning, achievements, and experiences throughout a person's life into a secure, verifiable digital record maintained by the student. This allows for the stacking of micro-credentials from a wide range of trusted issuers into advanced credentials using an integrated data exchange system. Understanding the badging system provides a useful foundation for educational professionals considering employing a badging strategy.

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APPENDIX A: GLOSSARY OF TERMS

Badge: A digital representation of a skill, learning achievement or experience. Badges can represent competencies and involvements recognized in online or offline life. Each badge is associated with an image and some metadata. The metadata provides information about what the badge represents, and the evidence used to support it. (Mozilla, 2014).

Badge backpack: Digital storage area for learners to house the various badges they were earning from a wide range of open badging sites. Badge earners decide which badges to make public.

Badge Baking: The process of embedding verifiable information about a recipient's achievement into a badge image so when a user shows a badge on a website, software which is Open-badges ready and automatically extract the data and verify the badge's authenticity. A baked badge image must be either PNG or SVG format. (IMS Global 2018f).

Badge Stacking: The process of combining two or more badges to create a greater credential such as a certificate, license, college course, or degree program. Badge stacking is made visible via Open Pathways.

Competency-Based Education (CBE): An educational construct that allows for greater student flexibility by permitting students to advance as they exhibit proficiency in the academic subject matter regardless of time, location, or rate of learning. This approach allows a range of ways that college credit can be earned or awarded which leads to customized learning opportunities (U.S. Dept of Education, n.d.). This approach arranges academic content and distribution based on competencies, that is what a student knows and can perform, rather than following a more conventional approach such as by a course; a CBE program measures progress using clock or credit hours (Mahaffie, 2014).

Comprehensive Learner Record (CLR): The aim of the CLR, formerly referred to as Extended Transcripts, is to create a standardized format that captures a more complete picture of a learner and supports a range of educational programs to include traditional educational courses, competency-based education, badges, skills, experiential learning, achievements, and co-curricular activities in a digital and verifiable format (IMS Global, 2019a).

Digital badge: A digital representation of a skill, learning achievement or experience. Badges can represent competencies and involvements recognized in online or offline life. Each badge associates with an image and some metadata. The metadata provides information about what the badge represents, and the evidence used to support it. (Mozilla, 2014).

Direct Assessment Competency-Based Education: Another form of CBE that measures progress exclusively based on a student demonstrating mastery of a competency (knowledge or skill related to a specific subject); a direct assessment CBE program does not use credit hours to stipulate the amount of instructive activity is expected to complete in order to finish an academic program. The direct assessment program, however, must offer students educational resources, which involves substantive interaction with instructors, for students to demonstrate command of each competency required for program completion (Mahaffie, 2014).

Learning Pathway: A learning pathway is a course of learning, chosen by the learner, that includes a series of stages from pre-conception to targeted outcomes, where learning transitions are unique to each learner based on personal experiences and abilities (Jih, 1996; Scott, 1992).

Open Badges: A unique type of digital badges that follows OBI standards maintained by the IMS Global Consortium. Earners control these badges in claiming and displaying them across a range of online sites. These badges are verifiable and transportable (rather than proprietary to one single system) and contain metadata about the issuing institution, the earner of the badge, and evidence that supports the person earning the badge (IMS Global, 2018b).

Open Pathways: A competency framework or set of learning standards and converted into a pathway, or a series of pathways, that a learner would use as a guide while earning badges and stacking them into more considerable credentials. The vision is for learners to be able to stack badges across platforms, across institutions, to allow greater flexibility in attaining one's educational goals. The pathway can be shared in a digital portfolio that shows earned badges as well as uncompleted badges. (IMS Global, 2018c).

APPENDIX B: IMS GLOBAL LIST OF CERTIFIED OPEN BADGES V2.0 PRODUCTS

1. Acclaim v20190925 by Credly
2. Accredible v1.1 by Accredible
3. AEFIS v3.53 by AEFIS
4. Badgewell 2.0 by Badgewell
5. Badgr v3 by Concentric Sky
6. Bestr v2.16 by Cineca
7. C-box v1.2 by Italian Quality Company IQC Srl
8. CanCred Factory v2019.01 by CanCred
9. CanCred Passport v2.8.1 by CanCred
10. Credly v20190925 by Credly
11. iQualify LMS v2019-02-21 by iQualify
12. LRNG v1.33 by Collective Shift/LRNG
13. Milestone v1.0 by Campus Labs
14. Moodle v3.8 by Moodle
15. Multiverse v3.0 by NetLearning Holdings, Inc
16. My Open Badges v1.2 by Reiss Romoli srl
17. MyMantl v1.0 by Campus Labs
18. Open Badge Factory v2019.09 by Open Badge Factory
19. Open Badge Passport v3.5.5 by Open Badge Factory
20. Openbadges.me v1.0 by MyKnowledgeMap Limited

BIOGRAPHY

Terry McGovern received his Doctorate of Business Administration from the University of South Florida's Muma School of Business and his Doctorate of Management from the University of Phoenix's School of Advanced Studies, his M.H.S. from Providence University and his M.S. from the Air Force Institute of Technology. He is currently an Assistant Professor of Business Management at the University of Wisconsin-Parkside. Dr. McGovern's areas of expertise include professional development and strategy. He is interested in case research and has been recognized by the North American Case Research Association as best new case writer and a Lawrence Case Writing Fellow. Dr. McGovern also has done consulting in the areas of strategic planning, leadership development, digital badging, family business succession planning, and multi-generational workplaces. He has authored numerous articles, presented in a wide range of settings including academic and industry conferences. His DBA doctoral dissertation included a résumé audit study that examined employer outcomes and digital badges. His DM dissertation investigated executive development in the United States Air Force. He currently teaches graduate and undergraduate courses in strategy and issues in management concerning multi-generational workforces. He teaches in various delivery formats, including face-to-face, blended, and online. Prior to his academic career, Dr. McGovern served for 20 years as a U.S. Air Force officer in the areas of nuclear missile operations, satellite operations, and staff positions including flag-officer speech writer, faculty member, and director of an enterprise-level research cell while stationed in the Pentagon. Dr. McGovern also served as the Program Manager of the University Learning Store, a digital badging consortium involving six major U.S. universities, while working with the University of Wisconsin's Extended Campus.