

Digital Badge Use in Specific Learner Groups

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ABSTRACT

As educational technology continues to advance, new technologies continue to enter the scene that seek to enhance the delivery and reception of learning in both academic and industry settings. Digital badges are a recent educational innovation that has unique characteristics and capabilities that can allow for individualized pathways for learning and are being implemented in a variety of settings and for multiple purposes. This article reviews the literature on digital badges and four of their core theoretical underpinnings – behaviorism, goal-setting, constructivism, and gamification theory – as well as empirical studies that highlight the contexts and specific learner groups in which digital badges are being utilized. This review contributes to both scholarly research and practical applications of digital badges and offers potential directions for future research involving digital badges.

KEYWORDS

Behaviorism, Constructivism, Digital Badges, Educational Technology, Game Theory, Gamification Theory, Goal-Setting Theory, Groups of Learners

INTRODUCTION

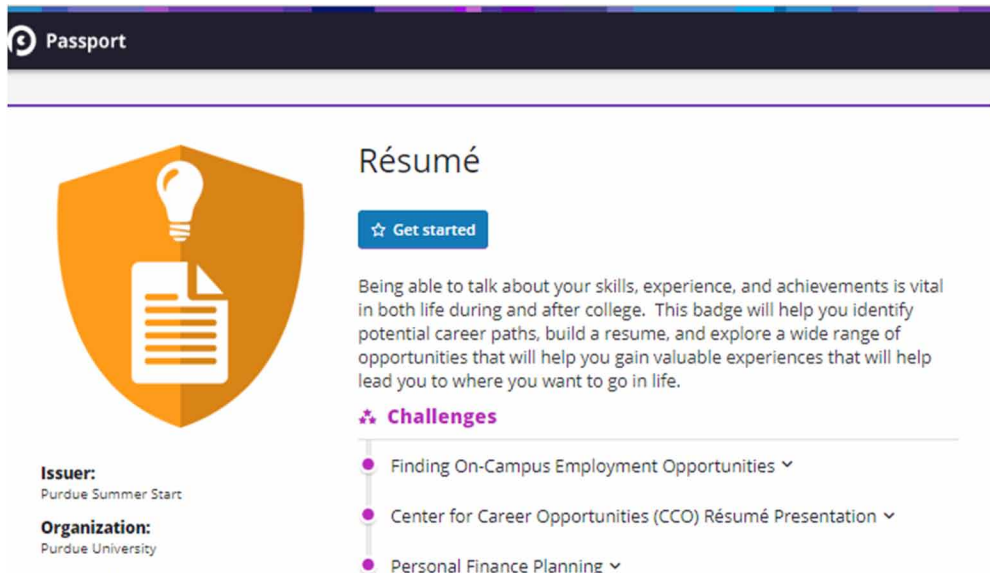
Educational technology's impact on how instruction is delivered is ever-changing as new technologies enter the academic and industrial scene on a seemingly regular and consistent basis (Mah, 2016), prompting ongoing evolutions to how education is delivered but also how it is assessed and awarded. Some research identifies current and upcoming shifts in the occupational landscape that call for new educational models (UPCEA, 2017). Digital badges are one educational technology tool with unique characteristics and capabilities that make them “well suited to foster the pursuit of individualized pathways for learning” (Finkelstein, Knight, & Manning, 2013, p. 3; see also Põldoja, Jürgens, & Laanpere, 2016) and can meet the evolving needs of learners.

A digital badge is a web-based visual graphic that represents a skill or competency earned by a learner who successfully completes a set of tasks or criteria outlined by a credible issuer. Figure 1 provides an example of a digital badge used by Purdue University for a summer program for incoming undergraduate students issued using the University's internal digital badge platform known as Open Passport in 2016. Due to their digital format, a digital badge also contains information regarding the requirements of the learner in order to earn the badge (Glover, 2013a; Grant, 2014;

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Figure 1. Example of digital badges used by Purdue University's Division of Summer Session's Summer Start program in 2016 (Source: Open Passport, Purdue University)



Erickson, 2015; Mah, Bellin-Mularski, & Ifenthaler, 2016; Mah, 2016). Learners are able to display and share these badges via online portfolios with peers, current or potential employers, and on social networks (Hope & Jones, 2016). Digital badges and their systems have multiple inherent affordances, many of which can provide motivation to learners, and offer an alternative way to recognize, credential, and assess learning (Ellis, Nunn, & Avella, 2016; Fanfarelli & McDaniel, 2017; Jovanovic & Devedzic, 2015). Moreover, digital badges provide a shareable portfolio of visual representations for both credentials and skills to communicate individual competency (Cheng, Watson, & Newby, 2018; Finkelstein et al., 2013).

Digital badges may never fully replace the traditional academic transcript, which only show the name of courses (often abbreviated) and the grades earned therein by the learner. However, digital badges can show a more detailed and arguably more complete picture of what the individual knows and can do (Matkin, 2018) that can be easily communicated through shareable platforms at the discretion of the learner (Bowen, 2014; Hope & Jones, 2016; Ostashewski & Reid, 2015) and can also recognize prior learning (Educause, 2014). With a wide range of application, many institutions and organizations are using digital badges in multiple industries as they gain traction in both formal and informal educational settings. Open Badges by Mozilla appears to be the digital badging platform most widely used by a variety of organizations (Open Badges, n.d.), but the complete list of digital badge-issuing platforms and the organizations that utilize and display them is not entirely clear (Badge Alliance, n.d.; IMS Global Learning Consortium, n.d.). Some institutions, like Purdue University and University of California-Davis, have developed their own digital badge issuing platforms for internal use (Fain, 2014).

Gibson, Ostashewski, Flintoff, Grant, and Knight (2013) conclude that “research implications are quite broad and varied” (p. 409). While the utilization of digital badges is on the rise (Blumenstyk, 2018; Gamrat, Zimmerman, Dudek, & Peck, 2014), the number of institutions and organizations that formally employ them remains relatively small. While the empirical investigation of the use of digital badges in educational contexts among special learner groups in the literature continues to increase with time, the use of digital badges within educational contexts and specific groups is still in its infancy (Law, 2015). This literature review will consider the following questions: 1) what are

the underlying learning and motivation theories that inform or influence the employment of digital badges, and 2) how have digital badges been utilized as both a means of credentialing as well as instruction among various educational contexts and specific learner groups? To this end, the nature, definitions, theoretical underpinnings, and findings of empirical studies related to these questions within the literature will be reviewed, discussed, and synthesized. Recommendations regarding future research will also be offered.

Conducting this review of the theoretical underpinnings as well as empirical research within the literature contributes to both the scholarly research of digital badges as pedagogy as well as best practices for implementation among learner populations. While digital badges have been and are being used in a wide range of learner contexts, such as industry, business, education, sports, and even entertainment (Ellis et.al, 2016), this literature review will focus primarily on specific learner groups within educational settings, specifically higher education, K-12, and adult education.

BACKGROUND

Recent advances in information technology have created a new paradigm (Reigeluth, Watson, & Watson, 2012) for how people obtain skills and knowledge and afford individuals access to education without passing through a traditional, residential college or university experience (Matkin, 2018; Voorhees, 2001). The increase in the population of learners who are attracted to the conveniences these new technologies offer and the creation of an alternative “ecosystem” of credentialing (Olneck, 2012; Clayton, 2014; Halavais, 2013) have been the impetus for institutions of higher education in considering ways to adjust current systems to allow for use of new educational technologies (Reigeluth et al., 2012). Voorhees (2001) speaks of a developing connection between traditional educational paradigms and “the learning revolution can be found in competency-based approaches” (p. 5). One new competency-based curriculum and an example of open educational technology gaining momentum and popularity is the digital badge.

A digital badge is a visual, online representation of the earning or accomplishment of a skill or competency by a learner, containing optionally visible metadata to give context to what was required to earn it (Finkelstein, Knight, & Manning, 2013; Gamrat, et al., 2014; Gibson et. al, 2013; Glover, 2013a; Grant, 2014; Morrison & DiSalvo, 2014; Erickson, 2015; Mah, Bellin-Mularski, & Ifenthaler, 2016; Mah, 2016). Just as many cultures have had long-standing customs of awarding physical tokens such as medals and ribbons to represent accomplishment of some skill or feat, digital badges offer online evidence of knowledge, competencies and skills (Ostashewski & Reid, 2015).

Digital badges create a gamified system that motivates and allows learners the ability to advance through challenge levels in formal and informal learning environments (Alliance for Excellent Education & Mozilla Foundation, 2013; Carey, 2012; Reigeluth et al., 2012; Sullivan, 2013). The use of digital badges is gradually becoming more prolific and more mainstream in higher education as well as professional and workforce development audiences (Ahn, Pellicone, & Butler, 2014; Goligoski, 2012; Phelan, 2012; Jovanovic & Devedzic, 2014; Matkin 2018). Ostashewski and Reid (2015) note that, “[digital] badges allow users to selectively display badges on websites, social media pages, online profiles and resumes as claims of achievement...,” which contributes to them “quickly becoming a new method of validating and representing learning” (p. 187).

It is significant that there has been less than a decade of research on digital badges, making it still a nascent field of study (Cheng et al., 2018). Within the current body of research in the literature, digital badges occupy three main roles: motivating learner behavior, serving as a pedagogical tool, and serving as a form of credentialing (Ahn et al., 2014; Cheng et al., 2018). This literature review will consider four major theoretical underpinnings or frameworks of digital badges: behaviorism, goal-setting theory, constructivism, and gamification theory. Synthesis of scholarly work will demonstrate connections and foundations within these theories. Following the theoretical research review, this

paper will review empirical research as it relates to specific learner groups in educational contexts, specifically higher education, K-12, and adult education.

REVIEW OF THE LITERATURE

Underlying Learning and Motivation Theories of Digital Badges (Theoretical Research)

The use and implementation of digital badges within educational contexts merits consideration of the theoretical frameworks upon which they are based. A review of empirical research regarding these contexts will be reviewed and discussed later. This literature review will first consider the underlying learning and motivation theories and frameworks of digital badges. While other theories may also be utilized by digital badges, the primary learning and motivation theories that will be of focus are behaviorism, goal-setting theory, constructivism, and game theory or gamification.

Behaviorism

Within the context of learning, behaviorism focuses on strategies that reinforce and build responses to stimuli (Ertmer & Newby, 2013). According to Blackburn, Porto and Thompson (2016), behaviorism is at the cornerstone of competency-based curriculum. Digital badges are an educational tool that represents the achievement of certain and specific competencies and skills. Digital badges in educational settings employ behavioristic strategies (Kappes & Berto, 2015), among other learning and motivation theories, to provide motivation, positive reinforcement and extrinsic rewards for accomplishment (see also Abramovich, Schunn & Higashi, 2013).

There are several characteristics of digital badges that exemplify behaviorism. A specific behavior is more likely to reoccur if it has been rewarded and reinforced (Driscoll, 2005). Digital badges serve as a credential or evidence-based documentation that is earned when specific criteria, levels, and requirements are achieved (Ostashewski & Reid, 2015). This aligns with behaviorism in that digital badges are structured around a target stimulus for the learner, providing “opportunities for the learner to practice making the proper response” (Ertmer & Newby, 2013, p. 50) to meet the criteria in order to earn the badge. Moreover, learner motivation and positive reinforcement by way of external rewards can be essential to learning (Ray, 1992). One learning-related motivation framework that is helpful to understand the foundations of badges is Elliot’s (1999) achievement goal theory (Abramovich et al., 2013), which explains the different types of motivation as a result of desire to master a new skill, to demonstrate one’s ability, and to avoid exposing one’s lack of ability or underperforming.

Although there have been debate and controversy over the use of external rewards in educational contexts, such strategies are commonly used to support achievement and appropriate behavior (Denny, 2013; Filsecker & Hickey, 2014). In the case of digital badges, a learner progresses towards earning a reward for the completion of tasks or skill competency. The establishment and awarding of these rewards promote learning in significant ways (Ostashewski & Reid, 2015). Dweck (1986) noted that adaptive learners are motivated to and “appear to enjoy exerting effort in the pursuit of task mastery” (p. 1040), incrementally motivating learners to complete tasks or challenges until ultimately earning the full badge. Motivation to learn through a digital badge is often the result of flexibility, autonomy, and access that a learner may have to attain relevant and applicable skills to their individual learning goals (Acclaim, n.d.; Glover, 2013a; 2013b; Goligoski, 2014). Additionally, there are other external indicators such as incentives for the pursuit of the completion of a task through a gamified platform (Zimmerman & Cunningham, 2011; Ahn et. al, 2014) afforded in digital badges can influence learner motivation.

Some scholars within the literature have found drawbacks to the use of external motivators via digital badges. Skeptics of digital badges see rewarding students for learning as cheapening the learning process by removing intrinsic rewards that sustain learning as the end goal (Reid, Paster,&

Abramovich, 2015; Rughinis & Matei, 2013). By giving experimental participants external rewards at different times in a study, Deci (1971) found that if intrinsic motivation is the goal, then the nature of the external rewards matter. Additionally, employing digital badges may not have the same outcome for all learners, as found by Abramovich, Schunn, and Higashi (2013) who identified differential relationships to the motivation of learners with varying skill sets and abilities.

Goal-Setting Theory

Though developed in the research realm of industrial and organizational psychology (Locke & Latham, 1990, 2002), many researchers on digital badges have argued goal-setting theory to motivate learners in educational contexts as being a foundational component to digital badges (Antin & Churchill, 2011; Chou & He, 2017; Gamrat et al., 2014; McDaniel & Fanfarelli, 2016; Randall, Harrison, & West, 2013). Furthermore, the strong relationship between goal setting and digital badges also positions digital badges as being able to expand their impact as a pedagogical tool due to inherent goal setting and achievement aspects (Cheng et al., 2018).

According to Locke and Latham (2006), goal-setting theory “implies discontent with one’s present condition and the desire to attain an object or outcome” (p. 265), and motivates a person to achieve the desired object or outcome. Extrinsically- or intrinsically-motivated goals can be both present in the design and administration of digital badges for educational or training purposes (Reid et al., 2015). While digital badges are often thought to provide extrinsic motivation (Cucchiara et al., 2014; Rughinis & Matei, 2013), digital badges can also be used for achievement of intrinsic and learning goals as long as they are not too heavily focused on or encouraging of the mere collection of badges (Rughinis, 2013). In addition, the completion of each activity and digital badge can serve as a pathway of steppingstones, completing sub-goals along the journey to larger educational goals (Cheng et al. 2018).

Motivation to engage in or complete digital badges can also increase commitment to goal attainment in a variety of ways. Two ways in particular include the fostering of self-efficacy and the shareable and publicity affordances of digital badges. For example, digital badges have the potential to enhance goal commitment as they facilitate recognition of each learning milestone achieved, encouraging learners to continue to set new and challenging goals (Randall et al., 2013).

Constructivism

While behavioral theories are based on the philosophy that knowledge and the world are tangible and external to the learner, “constructivism is a theory that equates learning with creating meaning from experience” (Ertmer & Newby, 2013, p. 55). Constructivism’s main premise is that knowledge is continuously constructed by learners as they make sense of what they experience (Driscoll, 2005; Schunk, 2000), resulting in learning being a life-long process that evolves as the learner experiences and acts in various situations (Brown, Collins, & Duguid, 1989; Ostashewski & Reid, 2015). Digital badges also embody some attributes of constructivist theory.

Instructional and educational strategies that allow the learner to be more self-directed and autodidactic (Phelan, 2012) constitute a form of constructivism. Digital badges can be designed in ways that offer multiple learner pathways with real-world application (Ostashewski & Reid, 2015), which can enable learners to select skills and competencies that are relevant to their individual goals, learning styles, and circumstances (Driscoll, 2005, Kappes & Betro, 2015; Põldoja, et. al, 2016). Moreover, digital badges are also influencing and changing the structures and parameters by which people have grown accustomed to thinking about education, that traditional, formal educational settings are the gatekeepers authorized to grant access to learning (Duncan, 2011; Phelan, 2012). The opening of educational access via digital badges is reflective of constructive processes. Learners given the autonomy over their own learning process are more likely to “engage in meaningful learning activities and ultimately achieve favorable development and learning outcomes” (Furtak & Kunter, 2012, p. 285).

Individuals who learn through e-learning media, such as digital badges, can often have more control over or customization abilities regarding when and what they learn (Gamrat, et al., 2014). Self-regulated learners must also be self-motivated to make the connections between what they already know and can do with the expected or new experience, knowledge and behavior (Clayton & Saravani, 2014). In other words, they must continue to build on their constructive scaffolding, which also can be inherent in digital badge systems as learners progress through task completion and advancing to more complex challenges.

Social constructivism, or social learning, places emphasis on the importance of culture and context (McMahon, 1997) and views meaningful learning as a social process that occurs when learners engage in social activities (Kim, 2001; Lave & Wenger, 1991; Vygotsky, 1978). Vygotsky's theories of development include social constructivism as being focused on how the environment and interactions with others, along with support and scaffolding in the instruction, can influence the individual learning process (Lave & Wenger, 1991; Toven-Lindsey, Rhoads, & Lozano, 2015). Digital badge platform affordances often include the technology that can provide opportunities and spaces wherein meaningful learning through social activities occur (Herrington & Oliver, 1999) by way of discussions, sharing, and viewing the achievements and digital badges of other learners.

Gamification Theory

In addition to a basis in behavioral and constructive learning theories, digital badges operate similarly as video-game models (Abramovich et al., 2013; Shields, R., & Chugh, R. (2017), often referred to as game theory or gamification. Though a formal definition remains to be contested, Deterding, Khaled, Nacke, and Dixon (2011) define gamification as the use of game design elements of which possibilities are unlimited, in a non-game environment or context, which may often be manifested when the game elements are used for a different purpose than their typical expected use, such as video games. Gamification as a motivation learning theory is closely linked with behaviorism and its use is beginning to emerge in education as a means to motivate and rewards learners (Delello, Hawley, McWhorter, Gipson, & Deal, 2018; Hamari, Koivisto, & Sarsa, 2014).

Easley and Ghosh (2016) noted a proliferation of game-theoretic approaches being used in the design of digital badge systems in many contexts for instructional and learning purposes. Furthermore, Ostashewski and Reid (2015) identified three intended outcomes of digital badges as a gamified framework for accomplishment and achievement. First, digital badges act as a source of positive feedback and reward for when learners accomplish particular tasks. Second, digital badges possess a social component in that learners can compete against one another in pursuit of badge achievement and evidence of learning are shareable with others via social networks. Third, digital badges are designed to foster a sense of accomplishment, motivating learners to progress toward advanced learning materials. Similar to video games and other games used primarily for entertainment, digital badges reward the learners as they meet certain criteria or requirement, demonstrate mastery of skills to complete tasks, and progress in complexity (Kappes & Betro, 2015; Phelan, 2012).

The four theories discussed are not exhaustive as it could be argued that other theories are also foundational to digital badge use. These learning and motivation theories discussed here share many connections or areas of overlap, as seen in the context of digital badges. Some examples of these intersections include:

- Reflection of how digital badges and gamification are tools for motivating learners (Glover, 2013a);
- External rewards are especially important when elements of self-direction and autonomy are required of the learner (Glover, 2013b);
- Investigation of the effects that external rewards have on motivation, engagement and learning while playing an educational game (Filsecker & Hickey, 2014);

- A Self-Regulated Learner is an “[individual] who actively and consciously controls [his or her] own learning from cognitive, affective [(constructivist)], motivational and behavioral [(behaviorist)] points of view” (Cucchiara, et. al., 2014, p. 134);
- In some instances, giving the learner greater autonomy can serve as the reward that motivates them to increase engagement and participation (Furtak & Kunter 2012).

Table 1 briefly summarizes and identifies how elements or characteristics unique to digital badges connect to the theories that have been discussed. These theories also inform the empirical studies of digital badges among specific learner groups that will now be reviewed in this paper. The theoretical frameworks for such studies have guided the research questions and analysis of findings to coalesce into increased understanding of digital badge effectiveness and viability as a means of instruction and credentialing.

Digital Badges in Specific Learner Groups (Empirical Research)

The versatile and widely applicable capabilities inherent in digital badges give it substantial potential for application and use in a multitude of formal and informal educational settings (Davies, Randall & West, 2015; Glover & Latif, 2013; Glover, 2013b; Gibson et al., 2013; Ostashewski & Reid, 2015) such as higher education, K-12 and adult education. Digital badges “provide a learning ‘map’ to [learners to]... tailor their learning experiences, seek learning opportunities, and receive badges that align with what employers are seeking” (Alliance for Excellent Education & Mozilla Foundation, 2013, p. 7; see also Ruff, 2016).

Higher Education

Recently, digital badges have begun to be utilized and examined among specific learner groups within higher education settings (Delello, et al., 2018; Diaz, 2013, Law, 2015). Some studies, for example, have seen increases in learner participation and contributions as well as enjoyment in the

Table 1. Summary of digital badge elements present in key learning and motivation theories

Digital Badge Elements	Behaviorism	Goal-Setting Theory	Constructivism	Gamification/Game Theory
Motivating and rewarding learners for achievement	When specific criteria, levels, and requirements are achieved, the learner is rewarded	Badge design can include both extrinsically- or intrinsically-motivated goals	Learners are more likely to engage in and achieve learning outcomes when given autonomy over their own learning process	Designed to foster a sense of accomplishment, motivating learners to progress and continue to advanced learning materials
Shareable on professional and social networks	Learners complete tasks or challenges until ultimate earning of the full badge that can be visible to others	Fosters goal commitment by publicly recognizing achieved learning milestones and encouraging learners to set new goals	Meaningful learning is a social process that occurs when learners engage in social learning activities	Learners can compete against peers in pursuit of badge achievement and evidence of learning can be easily shared with others
Visual representation of achievement, knowledge, skill, or competency	Badges can contain optionally visible metadata to give context to what was required to earn it	Earning visual graphics of badges promote the continued pursuit of extrinsic and intrinsic goal achievement	Learners can select skills and competencies that are relevant to their individual goals, learning styles, and circumstances	Badges reward the learners with visual graphic as they meet criteria, demonstrate mastery of skills, and progress to tasks with increased complexity

learning process through using digital badges (e.g. Denny, 2013). When Glover and Latif's (2013) pilot study explored Open Badges at City University of London, they found students were enthused by the possibilities and applications of Open Badges and initially skeptical students developed favorable attitudes once they obtained a full conceptual understanding. Such is likely to be, and has been, the case as the benefits and uses of digital badges and other educational technologies for educational purposes become more sophisticated and embraced by educators (Groves & Zemel, 2000). Further evidence can be found at Purdue University, where the institution has not only developed its own internal, standalone badging system, but has also significantly integrated competency-based curriculum in one of its colleges to the extent of having digital badges included on students' transcripts (Purdue Polytechnic Institute, n.d.).

Digital badges are also being used at colleges and universities for less formal, non-academic purposes. For example, Ippoliti (2014) highlighted an initiative that incorporated the creation of a digital badge to provide just-in-time customer service training to library employees at the University of Maryland. Other universities are using digital badges to help enhance students' resumes for when they enter the job market (Rubin, 2018).

Other research and scholarly work suggest that the implementation of digital badges in higher educational settings can have other, perhaps less obvious impacts on learners. For example, Mah (2016) purports that a systematic synthesis of digital badges and learning analytics or learning management systems "both show promise for enhancing student retention in higher education" (p. 285). Mah's model can, in short, help higher education officials use learning analytics to identify generic academic skills in which learners are deficient or in need of remediation. It is possible that deficiencies could be improved through administering digital badges specific to the competencies most needed by the student. This model, however, has yet to be tested in an empirical study among a learner group.

K-12

In addition to learner groups in higher educational contexts, digital badges have also been implemented in younger groups in the K-12 settings (Shields & Chugh, 2017). The findings from a study of digital badges used in a high school program by Davis and Singh (2015) studied the use of digital badges among a group of high school students in an afterschool program. Their case study used focus groups and interview methodology to understand the experiences and perspectives of learners, teachers and staff involved in this program. The study provided new insights into "factors affecting the success or failure of implementing a digital badge system in an informal context" (p. 73). Interestingly, participants described perceived credibility of the content and platform as a concern or challenge. For example, while many participants recognized the value of being able to share and communicate learning and competency attainments, these learners also worried whether or not that learning would be viewed as credible to important external audiences, such as college admissions committees and employers. It is difficult to predict how acceptance of digital badges by external audiences in terms of credibility may result in the future. Using 305 students in a primary school in Singapore as a specific learner group, Boticki, Baksa, Seow, and Looi (2015) "presented a mobile learning platform that utilizes contextual question prompts, virtual badges and allows for collaborative learning" (p. 136). Their findings included a prediction of student's end-year assessment score on a science examination that was linked to the students' completion of digital or virtual badges.

Research on the use of digital badges in educational contexts has produced mixed results among various learner populations. In a study of over 50 middle school students in a low-income city in North America, Abramovich, Schunn, and Higashi (2013) found badge acquisition patterns varied based on learner types and different badge types seemed to appeal to or motivate learners differently. Furthermore, Abramovich et al., (2013) found "evidence that earning various badges can be associated in increases in expectations for success but also increases in counter-productive educational goals" (p. 229).

Adult Education

Digital badges have great potential and use among adult learner groups as well. Adult learners are typically understood to be 25 years or older and not pursuing a traditional, residential college degree (National Center for Educational Statistics, n.d). Finkelstein, Knight, and Manning (2013) highlight the capability of digital badges as a “potentially powerful and efficient tool to bring meaning to datasets that reflect individuals and their achievements” (p. 3) that can be used as a way to educate and document professional development (Educause, 2014) and non-credit learning accomplishments (Dyjur & Lindstrom, 2017). In addition, digital badges as a form of alternative credentialing can help meet the major shift in the market of adult learners for continuing education “toward shorter, more focused, and intense courses” (Matkin, 2018, p. 3) allowing them greater flexibility and more options that result in immediate value (UPCEA, 2017).

One example where digital badges have effectively been used is seen among a specific learner group with unique needs: refugees. The Chronicle of Higher Education (Ruff, 2016) reported that “for many college graduates who are migrants, documentation has been lost or simply doesn’t translate to a European degree, so the program is using digital badges to fill in the gaps and provide them with evidence of their applicable skills in information technology.” The wide-ranging application of digital badges, particularly among adult learners, shows promise and potential.

Digital badges have also been used at the university level but in an informal learning setting. Law (2015) conducted multiple studies in 2013 and 2014 in an open learning online space that involved a wide range of learners, though the majority were adult learners (age 25 and older), who participated in a digital badging pilot study offered by the Open University in London, England. The findings from Law’s studies show that learners do seek out acknowledgement of learning achievement for informal learning activities. While no formal recognition was given for badge completion, such as a degree or certificate, the digital badges provided a way to motivate and reward this specific learner group.

CONCLUSION

This review of the literature has considered both the theoretical underpinning and multiple empirical investigations of the use of digital badges. The majority of research on digital badges used in the field in specific learner groups tends to focus more often on higher education. However, it appears that given the characteristics and affordances of digital badges, specifically with regard to flexibility and motivation, that digital badges are well suited to serve adult learner populations in less formal or informal educational settings, as some studies have shown (Diamond & Gonzales, 2014; Law, 2015; Ruff, 2016).

It is also important and not surprising to note that throughout the empirical investigation among various learner groups, outcomes from digital badge use are not always positive. While badges have an array of benefits and characteristics that yield positive learning outcomes, there are also shortcomings. The benefits of motivating learners through a gamified system that promotes flexibility and autonomy may only have short-term effects. To continue to understand in what context and among which groups digital badges can best be utilized, additional research and consideration among a wider range of specific learner groups is recommended. The perceptions of digital badges among instructors and learners have been found to be polarizing (Foli, Karagory, & Kirby, 2016) as it relates to their ability to motivate learners to learn; this makes it difficult to recommend that digital badges be used in all contexts and with all learner groups. The instructional design of digital badges will also influence the actual and perceived effectiveness (Finkelstein et al., 2013; Shields & Chugh, 2017).

Given that digital badges are still new and gaining adoption within educational contexts (Gamrat, et al., 2014), there is a substantial amount of future research needed that can go in multiple directions (Gibson et. al, 2011). After having reviewed much of what has already been studied and published in the literature on digital badges, there are several implications for future research:

1. Digital badges are becoming increasingly embraced and integrated within traditional educational structures (Gamrat et al., 2014). However, additional studies on the organizational strategies and changes that are required by institutions of higher learning that want to integrate the use and credentialing of digital badges into pedagogy and curriculum would contribute greatly to the literature. If digital badges are to become more mainstream, what are the key organizational and institutional changes that must take place in order to make this transition successful?
2. Further emphasis and study should be done in K-12 contexts;
3. Additional case studies of specific learner groups and learning contexts that use digital badges and identification of perceptions that exist within those milieus. The results of such research could provide an ability to identify the groups and contexts in which digital badge use has been perceived to be successful and viewed in a favorable light as well as those that are skeptical;
4. Research that explores, analyzes and identifies best practices for digital badge integration as perceived by instructors would also greatly contribute to the expansion of digital badges. For example, do faculty members tend to embrace digital badges in their pedagogical approaches for a course or do they view their use as inferior to more traditional instructional strategies?
5. With regard to student retention, it would be valuable for the literature educational practice to better understand how digital badges and learning analytics, using Mah's model, for example, could be leveraged to improve student outcomes.

This literature review contributes to a greater understanding of digital badges, the learning and motivation theories upon which they are based, and the wide range of formal and informal educational setting in which they can be utilized to enhance access to and efficiency in demonstrating competency-based learning. Further studies and investigations regarding the use and implementation of digital badges in educational contexts among higher education, K-12, and adult learner groups are needed. Additional investigation would be beneficial in enhancing the understanding and application of digital badge use and design, providing greater insight into yet another viable technological tool through which learning is delivered and verified.

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REFERENCES

- Abramovich, S., Schunn, C., & Higashi, R. M. (2013). Are badges useful in education?: It depends upon the type of badge and expertise of learner. *Educational Technology Research and Development*, 61(2), 217–232. doi:10.1007/s11423-013-9289-2
- Acclaim. (n.d.). Open Badges for Higher Education. Retrieved from <https://www.pearsoned.com/wp-content/uploads/2013/12/Open-Badges-for-Higher-Education.pdf>
- Ahn, J., Pellicone, A., & Butler, B. S. (2014). Open badges for education: What are the implications at the intersection of open systems and badging? *Research in Learning Technology*, 22. doi:10.3402/rlt.v22.23563
- Alliance for Excellent Education & Mozilla Foundation. (2013). Expanding education and workforce opportunities through digital badges. Retrieved from <http://all4ed.org/wp-content/uploads/2013/09/DigitalBadges.pdf>
- Antin, J., & Churchill, E. (2011). Badges in social media: A social psychological perspective. *Proceedings of CHI 2011 Gamification Workshop*. Canada. ACM 978-1-4503-0268-5/11/05
- Ash, K. (2012, June 13). Digital Badges Would Represent Students' Skill Acquisition. *Edweek*. Retrieved from <http://www.edweek.org/dd/articles/2012/06/13/03badges.h05.html>
- Badging Alliance. (n.d.). Badge Issuing Platforms. Retrieved from <http://www.badgealliance.org/badge-issuing-platforms/>
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *The American Psychologist*, 37(2), 122–147. doi:10.1037/0003-066X.37.2.122
- Blackburn, R. D., Porto, S. C., & Thompson, J. J. (2016). Competency-Based Education and the Relationship to Digital Badges. *Digital Badges in Education: Trends, Issues, and Cases*, 30. doi:10.1080/00091383.2014.969177
- Blumenstyk, G. (2018). With Employers in the Mix, Can Badges Become More Than a Fad? *The Chronicle of Higher Education*. Retrieved from <https://www.chronicle.com/article/With-Employers-in-the-Mix-Can/244322>
- Boticki, I., Baksa, J., Seow, P., & Looi, C. K. (2015). Usage of a mobile social learning platform with virtual badges in a primary school. *Computers & Education*, 86, 120–136. doi:10.1016/j.compedu.2015.02.015
- Bowen, K., & Thomas, A. (2014). Badges: A common currency for learning. *Change: The Magazine of Higher Learning*, 46(1), 21–25. doi:10.1080/00091383.2014.867206
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32–42. doi:10.3102/0013189X018001032
- Carey, K. (2012, November 2). Show me your badge. *The New York Times*. Retrieved from NYTimes.com.
- Cheng, Z., Watson, S. L., & Newby, T. J. (2018). Goal Setting and Open Digital Badges in Higher Education. *TechTrends*, 62(2), 190–196. doi:10.1007/s11528-018-0249-x
- Chou, C. C., & He, S. J. (2017). The Effectiveness of Digital Badges on Student Online Contributions. *Journal of Educational Computing Research*, 54(8), 1092–1116. doi:10.1177/0735633116649374
- Clayton, J., Iwata, J., & Saravani, S. J. (2014). Designing e-learning environments to encourage learner autonomy: Creating a framework for development. Retrieved from <http://researcharchive.wintec.ac.nz/3208/1/ISSEPSS.pdf>
- Corbeil, M. E., Corbeil, J. R., & Rodriguez, I. E. (2015). Digital badges in higher education: A three-phase study on the implementation of digital badges in an online undergraduate. *Issues in Information Systems*, 16(4).
- Cucchiara, S., Giglio, A., Persico, D., & Raffaghelli, J. E. (2014). Supporting self-regulated learning through digital badges: A case study. In *New Horizons in Web Based Learning* (pp. 133–142). Springer International Publishing. doi:10.1080/03075070600572090
- Davies, R., Randall, D., & West, R. E. (2015). Using open badges to certify practicing evaluators. *The American Journal of Evaluation*, 36(2), 151–163. doi:10.1177/1098214014565505
- Davis, K., & Singh, S. (2015). Digital badges in afterschool learning: Documenting the perspectives and experiences of students and educators. *Computers & Education*, 88, 72–83. doi:10.1016/j.compedu.2015.04.011

- Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, 18(1), 105–115. doi:10.1037/h0030644
- Delello, J. A., Hawley, H., McWhorter, R. R., Gipson, C. S., & Deal, B. (2018). Gamifying Education: Motivation and the Implementation of Digital Badges for Use in Higher Education. *International Journal of Web-Based Learning and Teaching Technologies*, 13(4), 17–33. doi:10.4018/IJWLTT.2018100102
- Denny, P. (2013). The effect of virtual achievements on student engagement. *Proceedings of the SIGCHI conference on human factors in computing systems* (p. 763-772). ACM. doi:10.1145/2470654.2470763
- Deterding, S., Khaled, R., Nacke, L. E., & Dixon, D. (2011, May). Gamification: Toward a definition. In *CHI 2011 Gamification Workshop Proceedings* (p. 12-15). Academic Press.
- Diamond, J., Gonzalez, P. C., & Education Development Center, I. T. (2014). Digital Badges for Teacher Mastery: An Exploratory Study of a Competency-Based Professional Development Badge System. CCT Reports. Center For Children And Technology, Education Development Center, Inc.
- Diaz, V. (2013). Digital badges for professional development. *EDUCAUSE Review*. Retrieved from <http://www.educause.edu/ero/article/digital-badges-professional-development>
- Driscoll, M. (2005). *Psychology of learning for instruction* (3rd ed.). Boston: Pearson Allyn and Bacon.
- Duncan, A. (2011). Digital badges for learning. *MacArthur Foundation*. Chicago. September 15, 2011. Retrieved from <http://www.ed.gov/news/speeches/digital-badges-learning>
- Dweck, C. S. (1986). Motivational processes affecting learning. *The American Psychologist*, 41(10), 1040–1048. doi:10.1037/0003-066X.41.10.1040
- Dyjur, P., & Lindstrom, G. (2017). Perceptions and uses of digital badges for professional learning development in higher education. *TechTrends*, 61(4), 386–392. doi:10.1007/s11528-017-0168-2
- Easley, D., & Ghosh, A. (2016). Incentives, gamification, and game theory: An economic approach to badge design. *ACM Transactions on Economics and Computation*, 4(3), 1–26. doi:10.1145/2910575
- Educause. (2014). Educause 7 things you should know about ... Badging for Professional Development. Retrieved from <https://library.educause.edu/-/media/files/library/2014/8/est1402-pdf.pdf>
- Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, 34(3), 169–189. doi:10.1207/s15326985ep3403_3
- Ellis, L. E., Nunn, S. G., & Avella, J. T. (2016). Digital Badges and Micro-credentials: Historical Overview, Motivational Aspects, Issues, and Challenges. In *Foundation of Digital Badges and Micro-Credentials* (pp. 3-21). Springer International Publishing. doi:10.1007/978-3-319-15425-1_1
- Erickson, C. C. (2015). Digital credentialing: A qualitative exploratory investigation of hiring directors' perceptions (Doctoral dissertation, Capella University).
- Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly*, 26(2), 43–71. doi:10.1002/piq.21143
- Fain, P. (2014). Badging from Within. *Inside Higher Ed*. Retrieved from <https://www.insidehighered.com/news/2014/01/03/uc-daviss-groundbreaking-digital-badge-system-new-sustainable-agriculture-program>
- Fanfarelli, J. R., & McDaniel, R. (2017). Exploring digital badges in university courses: Relationships between quantity, engagement, and performance. *Online Learning*, 21(2). doi:10.24059/olj.v21i2.1007
- Farmer, T., & West, R. E. (2016). Opportunities and Challenges with Digital Open Badges. *Educational Technology*, 56(5), 45–48. Retrieved from <https://lidtfoundations.pressbooks.com/chapter/open-badges/>
- Filsecker, M., & Hickey, D. T. (2014). A multilevel analysis of the effects of external rewards on elementary students' motivation, engagement and learning in an educational game. *Computers & Education*, 75, 136–148. doi:10.1016/j.compedu.2014.02.008
- Finkelstein, J., Knight, E., & Manning, S. (2013). The potential and value of using digital badges for adult learners. American Institutes for Research. Retrieved from https://lincs.ed.gov/publications/pdf/AIR_Digital_Badge_Report_508.pdf

- Foli, K. J., Karagory, P., & Kirby, K. (2016). An exploratory study of undergraduate nursing students' perceptions of digital badges. *Journal of Nursing Education, 55*(11), 640-644. doi:<http://dx.doi.org.ezproxy.lib.purdue.edu/10.3928/01484834-20161011-06>
- Furtak, E., & Kunter, M. (2012). Effects of Autonomy-Supportive Teaching on Student Learning and Motivation. *Journal of Experimental Education, 80*(3), 284–316. doi:10.1080/00220973.2011.573019
- Gamrat, C., Zimmerman, H. T., Dudek, J., & Peck, K. (2014). Personalized workplace learning: An exploratory study on digital badging within a teacher professional development program. *British Journal of Educational Technology, 45*(6), 1136–1148. doi:10.1111/bjet.12200
- Gibson, D., Ostashewski, N., Flintoff, K., Grant, S., & Knight, E. (2013). Digital badges in education. *Education and Information Technologies, 20*(2), 403–410. doi:10.1007/s10639-013-9291-7
- Glover, I. (2013a). Open badges: A visual method of recognising achievement and increasing learner motivation. *Student Engagement and Experience Journal, 2*(1).
- Glover, I. (2013b). Play as you learn: gamification as a technique for motivating learners. In *EdMedia+ Innovate Learning* (pp. 1999-2008). Association for the Advancement of Computing in Education (AACE).
- Glover, I., & Latif, F. (2013). Investigating perceptions and potential of open badges in formal higher education. In *EdMedia+ Innovate Learning* (pp. 1398-1402). Association for the Advancement of Computing in Education (AACE). Retrieved from <http://shura.shu.ac.uk>
- Goligoski, E. (2012). Motivating the learner: Mozilla's open badges program. *Access to Knowledge: A Course Journal, 4*(1).
- Grant, S. (2014). Badges: Show what you know. *Young Adult Library Services, 12*(2), 28.
- Groves, M. M., & Zemel, P. C. (2000). Instructional technology adoption in higher education: An action research case study. *International Journal of Instructional Media, 27*(1), 57.
- Halavais, A. (2013). Microcredentials on the Open Web. *Selected Papers of Internet Research, 3*.
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification. *Proceedings of the 2014 47th Hawaii International Conference on System Sciences* (pp. 3025-3034). Academic Press.
- Hensiek, S., DeKorver, B. K., Harwood, C. J., Fish, J., O'Shea, K., & Towns, M. M. (2016). Improving and Assessing Student Hands-On Laboratory Skills through Digital Badging. *Journal of Chemical Education, 93*(11), 1847–1854. doi:10.1021/acs.jchemed.6b00234
- Hope, S., & Jones, W. (2016). Developing a Digital Badge Platform for a Teacher Training Program. In *Society for Information Technology & Teacher Education International Conference* (pp. 930-935). Association for the Advancement of Computing in Education (AACE).
- IMS Global Learning Consortium. (n.d.). Product Certifications. Retrieved from https://site.imsglobal.org/certifications?refinementList%5Bstandards_lvx%5D%5B0%5D=Open%20Badges#backpacks
- Ippoliti, C. (2014). Are you being served? Designing the customer service curriculum. *Public Services Quarterly, 10*(3), 177–192. doi:10.1080/15228959.2014.914864
- Jovanovic, J., & Devedzic, V. (2014). Open badges: Challenges and opportunities. In *Advances in Web-Based Learning-ICWL 2014* (pp. 56–65). Springer International Publishing. doi:10.1007/978-3-319-09635-3_6
- Jovanovic, J., & Devedzic, V. (2015). Open badges: Novel means to motivate, scaffold and recognize learning. *Technology, Knowledge and Learning, 20*(1), 115–122. doi:10.1007/s10758-014-9232-6
- Kappes, S., & Betro, V. C. (2015). Using Mozilla badges to certify XSEDE users and promote training. *Proceedings of the 2015 XSEDE Conference: Scientific Advancements Enabled by Enhanced Cyberinfrastructure* (p. 14). ACM. doi:10.1145/2792745.2792759
- Law, P. (2015). Digital badging at The Open University: recognition for informal learning. *Open Learning: The Journal of Open, Distance and e-Learning, 30*(3), 221-234.
- Locke, E., & Latham, G. (1990). *A theory of goal setting and task performance*. Englewood Cliffs, NJ: Prentice-Hall.

- Locke, E., & Latham, G. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *The American Psychologist*, 57(9), 705–717. doi:10.1037/0003-066X.57.9.705 PMID:12237980
- Locke, E. A., & Latham, G. P. (2006). New directions in goal-setting theory. *Current Directions in Psychological Science*, 15(5), 265–268. doi:10.1111/j.1467-8721.2006.00449.x
- Mah, D., Bellin-Mularski, N., & Ifenthaler, D. (2016). *Foundation of digital badges and micro-credentials: Demonstrating and recognizing knowledge and competencies*. Springer.
- Mah, D. K. (2016). Learning Analytics and Digital Badges: Potential Impact on Student Retention in Higher Education. *Technology, Knowledge and Learning*, 1-21.
- Matkin, G. W. (2018). Alternative Digital Credentials: An Imperative for Higher Education. *CSHE Research & Occasional Paper Series: CSHE. 2.18*. Center for Studies in Higher Education.
- McDaniel, R., & Fanfarelli, J. (2016). Building better digital badges: Pairing completion logic with psychological factors. *Simulation & Gaming*, 47(1), 73–102. doi:10.1177/1046878115627138
- Morrison, B. B., & DiSalvo, B. (2014, March). Khan academy gamifies computer science. In *Proceedings of the 45th ACM technical symposium on Computer Science Education* (p. 39-44). ACM. doi:10.1145/2538862.2538946
- National Center for Educational Statistics. (n.d.). Nontraditional Undergraduates/Definitions and Data. Retrieved from <https://nces.ed.gov/pubs/web/97578e.asp>
- Open Badges. (n.d.). Who's Issuing Open Badges? Retrieved from <https://openbadges.org/about/participating-issuers/>
- Ostashewski, N., & Reid, D. (2015). A History and Frameworks of Digital Badges in Education. In *Gamification in Education and Business* (pp. 187–200). Springer International Publishing. doi:10.1007/978-3-319-10208-5_10
- Phelan, L. (2012). Politics, practices, and possibilities of open educational resources. *Distance Education*, 33(2), 279–282. doi:10.1080/01587919.2012.692070
- Põldoja, H., Jürgens, P., & Laanpere, M. (2016). Design Patterns for Badge Systems in Higher Education. *Proceedings of the International Conference on Web-Based Learning* (pp. 40-49). Springer International Publishing. doi:10.1007/978-3-319-47440-3_5
- Purdue Polytechnic Institute. (n.d.). Transdisciplinary Studies: Competency-based Education. Retrieved from <https://polytechnic.purdue.edu/blog/badges-of-competence>
- Randall, D. L., Harrison, J. B., & West, R. E. (2013). Giving credit where credit is due: Designing open badges for a technology integration course. *TechTrends*, 57(6), 88–95. doi:10.1007/s11528-013-0706-5
- Ray, N. L. (1992). *Motivation in Education*.
- Reid, A. J., Paster, D., & Abramovich, S. (2015). Digital badges in undergraduate composition courses: Effects on intrinsic motivation. *Journal of Computers in Education*, 2(4), 377–398. doi:10.1007/s40692-015-0042-1
- Reigeluth, C. M., Watson, W. R., & Watson, S. L. (2011). Personalized integrated educational systems: Technology for the information-age paradigm of education in higher education. In *Teaching, Learning and the Net Generation: Concepts and Tools for Reaching Digital Learners* (pp. 41-60). Hershey, PA: IGI Global.
- Rubin, C. (January 11, 2018). Colleges Offer Resume-Boosting Digital Badges. *US News & World Report*. Retrieved from <https://www.usnews.com/education/best-colleges/articles/2018-01-11/colleges-offer-resume-boosting-digital-badges>
- Ruff, C. (2016). Online Badges Help Refugees Prove Their Academic Achievements. *The Chronicle of Higher Education*. Retrieved from <http://www.chronicle.com/article/Online-Badges-Help-Refugees/236278>
- Rughinis, R. (2013). Talkative objects in need of interpretation. Rethinking digital badges in education. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems* (pp. 2099–2108). Academic Press. doi:10.1145/2468356.2468729
- Rughinis, R., & Matei, S. (2013). Digital badges: Signposts and claims of achievement. *Proceedings of the International Conference on Human-Computer Interaction* (pp. 84-88). Springer. doi:10.1007/978-3-642-39476-8_18

- Schunk, D. (2000). *Learning theories: An educational perspective* (3rd ed.). Upper Saddle River, NJ: Merrill.
- Shields, R., & Chugh, R. (2017). Digital badges -- rewards for learning? *Education and Information Technologies*, 22(4), 1817–1824. doi:10.1007/s10639-016-9521-x
- Sullivan, M. (2013). New and alternative assessments, digital badges, and civics: An overview of emerging themes and promising directions. *The Center for Information & Research on Civic Learning & Engagement*. (77). Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.406.5622&rep=rep1&type=pdf>
- UPCEA. (2017). Changes in labor statistics signal major occupational shifts and impact to higher education credentials. Retrieved from <http://upcea.edu/changes-labor-statistics-signal-major-occupational-shifts-impact-higher-education-credentials/>
- Voorhees, R. A. (2001). Competency-Based learning models: A necessary future. *New Directions for Institutional Research*, (110), 5–13. doi:10.1002/ir.7

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