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SELF-EFFICACY: A RATIONALE FOR BADGING IN LEARNING CONTEXTS

By

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ABSTRACT

Self-efficacy beliefs have proven to be an important influence on an individual's learning success. Badging is increasingly an element of innovative technologies for educational computing such as MOOCs, adaptive learning systems, smart learning environments, game-based learning, and gamification, among others. However, there is not strong evidence that a theoretical grounding drove the implementation of badging. In this paper, the authors provide self-efficacy as a rationale for implementing badges. The rationale includes a summary of learner self-efficacy, a description of current applications of badging, and potential applications and impacts of using badging for learning to enhance learner self-efficacy. Suggestions for further study are made and potential implications are discussed for the use of badges on learner self-efficacy in an educational context.

Keywords: Digital Badges, Open Badges, Learner Self-efficacy, Learner Motivation, Motivation, Emerging Learning Technologies, Microcredentials.

INTRODUCTION

Badging is frequently listed as a new technology to be used in K-12 schools (e.g. Johnson, Adams Becker, Estrada, & Freeman, 2015; Karaoglu, 2016). Teachers' decisions to implement a technology should be based on theory or established, research-based practice. What are the underlying, theory-based reasons for including badges in a learning environment? In this paper, the authors clarify the concept of learner self-efficacy, review the current information on using badges to validate achievement, and discuss potential implications for learner self-efficacy when badges are used in education. The purpose of this paper is to provide a theory-based rationale for including badging in education contexts, rather than the too often used, technocentric rationale, that an emerging technology is engaging or useful simply because it is new. The concepts presented in this paper could be vital to the educational system as the use of badges presents interesting opportunities for illustrating the learning process, verifying learned content, delineating or clarifying content between courses, and creating opportunities for learners to integrate personalized educational experiences into traditional learning environments. If badging can be integrated into learning environments in a way to enhance learner self-efficacy, that would lend greater support for the integration of badging as it applies to traditional education and motivating students in K-12, post-secondary educational settings, and in professional development.

An individual's "perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). An individual has self-efficacy beliefs about every area of functioning (e.g. athletic performance, problem-solving, conquering addictions, weight loss, etc.) and self-efficacy has consistently been observed to be an important construct for learning and academic achievement. These observations have been made over a period of several decades, through all levels of the educational process, with various student populations, and in varied domains of learning (Hodges, 2008).

Badging is the technological evolution of awarding physical badges to individuals marking new knowledge, skills, or roles (Randall, Harrison, & West, 2013). Digital badges first emerged in the education literature around 2010 (Gibson, Ostashewski, Flintoff, Grant, & Knight, 2015), or 2011 (Hickey, Willis, & Quick, 2015) but "[t]he practice of creating, awarding and displaying digital badges has emerged from the intersection of digital games practices, online reputation systems used in commerce (e.g. eBay, Wikipedia, and Amazon) and media culture as well as the historical custom of awarding recognition via physical status icons, such as ribbons, medals, and trophies" (Gibson, Ostashewski, Flintoff, Grant, & Knight, 2015, p. 404) in the early 2000s.

The New Media Consortium's Horizon Report (Johnson, Adams Becker, Estrada, & Freeman, 2015) listed badges as an emerging technology in K-12 education with an adoption window of four to five years, and they have been recognized as an important emerging trend for professional development (Hodges, 2015). In K-12 education contexts, badges are being used to recognize student achievements and teacher professional learning.

Self-efficacy is an integral and widely accepted component of an individual's motivation to learn. Many factors that have been proven to positively impact self-efficacy, like challenging negative thoughts, setting goals, celebrating successes, and using specific goals, are inherently involved in or can easily be incorporated within a digital badging-based educational program (Desrochers, 2010). Applying badging in education contexts provides an opportunity to increase learner self-efficacy and apply new information technologies to the educational experience.

Badging has been applied to many different contexts. It has been utilized to incentivize achievement in videogames, social media communities, and informal learning environments, but not widely in traditional K-12, post-secondary, or professional development contexts (Abramovich, Schunn, Higashi, 2013; Hamari, 2015; Kwon, Halavais, Havener, 2015; Love, Sanders, Turner, Maurange, Knott, Prinz, Metzler, & Ainsworth, 2016; Randall, Harrsion, & West, 2013; Waters, 2013). While a few brief studies have explored the possibility of implementing a badging system within traditional education; the implications of such a program have not been examined in regard to learner self-efficacy beliefs, but some components have been examined in other studies (Abramovich, Schunn, Higashi, 2013; Hamari & Eranti, 2011; Kwon, Halavais, Havener, 2015; Love, Sanders, Turner, Maurange, Knott, Prinz, Metzler, & Ainsworth, 2016; Randall, Harrsion, & West, 2013).

Badging originated in videogames, where it has been proven to encourage and improve participation, increase interest in, or motivation for, completion of a given task, and has been shown to foster success due to social comparison principles (Abramovich, 2016; Blair, 2012; Hamari & Eranti, 2011). Studies conducted to apply the use of badge systems to non-traditional learning environments have examined instructional effectiveness, how motivation is impacted, and the benefits of utilizing digital badging to encourage non-mandated engagement in educational programs (Abramovich, 2016; Hamari & Eranti, 2011; Kwon, Halavais, & Havener, 2015; Love, Sanders, Turner, Maurange, Knott, Prinz, Metzler, & Ainsworth, 2016; Desrochers, 2010). To date, a study on the interplay between badging and learner self-efficacy is not available based on the literature review conducted for this paper. Ambramovich's (2016) work reviewed similar material in reference to using badging for assessment in higher education, but had not expanded to discuss individual factors, such as self-efficacy.

With the exception of the few studies cited in the preceding discussion, research on badging in education has been described as "scant" (Lockley, Derryberry, & West, 2016, p. 67), but with notes that this emerging innovation has "a meaningful role to play in twenty-first century higher education" (Lockley, Derryberry, & West, 2016, p. 67). It is important to consider theory-based reasons for implementing badges in education contexts, as the theory will provide some confidence that badges will enhance learning in the long term, and not just in some brief period of novelty. While there are certainly many theoretical and philosophical perspectives in which to consider badges, the purpose of the current paper is to focus on self-efficacy.

The purpose of this paper is to explain how learner self-

efficacy is a valid theoretical rationale for implementing digital badges in learning contexts. This will provide insights into why digital badges may work to enhance learning. Directions for future research into the theoretical grounding of implementing badges in learning contexts also will be provided.

1. Background

1.1 Self-efficacy

Self-efficacy is a belief system introduced by Albert Bandura with his theory of Social-Cognitive Learning (Bandura, 1982). This theory posits that individuals learn through social interactions, and that an individual's self-efficacy beliefs are a compilation of environmental factors, personal beliefs, unique perceptions, and the behavior of both the learner and individuals whom the learner is able to observe. These behavioral, cognitive, and environmental factors all interact and impact each other to help an individual form their own self-efficacy beliefs. Developing self-efficacy beliefs is a progressive process (Bandura, 1982; Driscoll, 2005). This means that a learner's self-efficacy beliefs can be constructed by insuring that a learner experiences and observes a certain set of necessary conditions for forming positive self-efficacy beliefs, which are constructed through interaction, observation, experiential learning, and feedback (Bandura, 1982).

An example of the formation of learner self-efficacy could be how a student learns in a traditional, physical classroom. The environment is the classroom itself as well, as the other people in the room with the learner. The cognitive component would be comprised of self-talk, physiological conditions, and the mood of the learner while they are present, studying in the classroom. An additional component of this example is the behavior of both the learner and the people around the learner. As described, the learner is not only forming their self-efficacy based on themselves, but also the social factors that surround them. These factors taken together help the learner develop their own concept of self-efficacy, which is the learner's judgment of their skills and abilities as a learner (Bandura, 1982; Driscoll, 2005).

It has been found that self-efficacy beliefs are influenced by four central components: outcomes of previous experiences, vicarious learning, verbal persuasion, and physiological factors (Driscoll, 2005). While those components are listed here in their typical power of influence, from greatest (previous experience) to least (physiological), some researchers (e.g. Hodges & Murphy, 2009) have observed different orderings. Previous outcomes impact self-efficacy, because individuals will continuously learn from their experiences. Therefore, when a learner continuously scores high or low in academic experiences, they will begin to internalize and attribute those scores to themselves and identifying as a good student or bad student in that particular learning context. Social learning through vicarious experiences can have a similar effect on learners. This premise purports that learners also develop self-efficacy based on the experiences observing other learners. For instance, if a learner student were to observe multiple friends fail or succeed in a particular class, this would impact the learner's self-efficacy when they had to take the same class, or a similar class. Verbal persuasion is a similar concept. For instance, if a student is speaking to a peer and the peer comments that a particular class is easy, or that the student will do well, this would impact the learner's self-efficacy for successfully completing the class. Finally, a learner's physiological state is a very important factor in facilitating positive self-efficacy beliefs. If a learner feels ill, is in pain, anxious, depressed, or is experiencing other negative physiological sensations, these factors can all negatively impact learner self-efficacy. Conversely, if a learner feels physically well and mentally positive, these sensations can lead to an increase in positive learner self-efficacy beliefs (Driscoll, 2005). Each of these factors is important to consider when working to foster positive learner self-efficacy.

In some cases, classroom teachers are the learners. They are learning new teaching techniques, or they are learning how to integrate new technologies into their environment (e.g. Hodges, Gale, & Meng, 2016). A recent analysis (Zee & Koomen, 2016) of four decades of teacher self-efficacy research revealed several benefits of positive teacher self-efficacy. Zee and Koomen found that positive teacher self-efficacy "shows positive links with students' academic adjustment, patterns of teacher behavior and practices

related to classroom quality, and factors underlying teachers' psychological well-being including personal accomplishment, job satisfaction, and commitment". For example, addressing teacher self-efficacy for technology integration may help to alleviate or minimize some of Ertmer's (1999) second-order barriers to technology integration.

1.2 Badging

1.2.1 Current State of Digital Badging

Many who initially learn about badges compare them to memories from their childhood clubs and organizations such as the Boy Scouts of America. This is sometimes an initial barrier to digital badges as they are not considered tools for serious, or formal learning endeavors. Ellis, Nunn, and Avella (2016) provide a description of the evolution of digital badges from ancient symbol systems to the current time and the interested reader should consult their work for their wide-ranging perspective. Randall, Harrison, and West (2013) provide descriptions of the differences between types of badges like digital badges and open badges. Digital badges are more or less static images to be displayed on an online portfolio or social media profile, but open badges contain links to descriptions of what was required to earn the badge and metadata that can include digital artifacts such as videos or reports. For the purposes of the present discussion, the more general terms badge and badges will be used to refer to implementations of either digital badges or open badges which are displayed electronically. Badges are digital representations of achievement, knowledge, and/or experience. Waters (2013) described the use of badging as a tool to validate a learner's "accomplishment, skill, quality, or interest" within a specific learning environment, but there also is a necessary technological component involved in the process of participating in and completing the tasks associated to earn badges. As badges are earned, learners receive feedback on their progress while completing clearly outlined tasks associated with the badge on which they have chosen to work (Das & Lavoie, 2014). This feedback process is helpful within the learning process because it fosters a positive impression of the content being learned as well as bolstering the learner's view of their personal aptitudes and helping to construct positive self-efficacy beliefs (Abramovich, 2016; Hamari, 2015).

The process of continuous feedback, which is a central component of badging, has been suggested to help affirm learners' abilities and encourage learners to reach goals (Das & Lavoie, 2014; Randall, Harrison, & West, 2013). As noted by Gibson, Ostashewski, Flintoff, Grant, & Knight (2015):

"A series of badges, acting like signposts for potential achievements, can also provide users with information about further learning opportunities, forming a kind of pathway model for achievement and making that pathway more transparent and accessible for the learner. Each badge with its metadata, for example, can point to the next steps for progress and the requirements for success" (p. 407).

Over time many different institutions have been known to use badging to reward achievement and encourage engagement, some of these institutions include businesses, Massive Open Online Courses (MOOCs), K-12 schools, universities, videogame systems, and online communities just to name a few (Abramovich, Schunn, & Higashi, 2013; Goligoski, 2012; Hortz, Petosa, Grim, & Stevens, 2015; Jacobson & O'Brien, 2015). Mah, Bellin-Mularski, and Ifenthaler (2016) conclude that current literature on badges focuses on the themes of impact on learning and assessment, badge design and technology considerations, and acceptance of badges. The theoretical underpinnings and rationales for badges are conspicuously absent from the literature.

1.2.2 Badging as a Social Function

After completing the work to earn a badge, learners are then able to display the badge they have earned on portfolios or social media networking sites (e.g. LinkedIn.com). Displaying these badges symbolizes the learner's achievement and informs others of what they have accomplished (Hamari, 2015). This may help the individual whom shared the badge by reinforcing a positive self-concept, showing that you are achieving your goals (Abramovich, 2016; Jacobson & O'Brien, 2015). Some badges include features that allow the viewer to see

various metadata components of a badge. For example, you may be able to see an artifact or artifacts that was created to earn the badge, along with a description of the task or assignment used to produce the artifact, and the scoring rubric used to check the artifact for completion or competence.

The act of viewing other people's badges also can act as an encourager to strive more and complete similar or higher-level tasks in an effort to match or exceed others' achievements (Abramovich, 2016; Jacobson & O'Brien, 2015). Vicarious experience is noted as an important source of self-efficacy development, which has the potential to enhance or lower self-efficacy beliefs (Bandura, 1997, p. 86-87). Designers of badging initiatives should be aware that learners need to be able to make comparisons with peers of suitable congruence with their own abilities. Additionally, this could induce social persuasion of others by demonstrating that earning badges is a valuable and rewarded effort in which other learners also could engage and succeed (Hodges, 2008; Hortz, Petosa, Grim, & Stevens, 2015).

1.2.3 Impact of using Badging

Badging has been effectively applied in multiple formats to encourage goal setting and attainment, which has been shown to be positively correlated with increased student motivation to learn (Schunk, 1990). Goals within a badging system are explicitly identified by means of what the badge is for, what that means for the badge earner, and each step involved in attaining the badge (Hamari, 2015; Hamari & Eranti, 2011; Jacobson & O'Brien, 2015). Clear and structured goal attainment has been proven to increase interest and attainment in educational settings, while vague goals with indescript steps toward goal attainment have been shown to foster disinterest and even dislike among learners (Driscoll, 2005).

As individuals are engaged in a badging system, there are multiple motivators in play simultaneously. Social comparisons and social validation as described in Driscoll (2005) may encourage participants to want to earn more badges, based on the fact that they see others earning badges (Hamari, 2015). Therefore, the social aspect of badging may encourage individuals to engage in activities by reinforcing the social worth of earning badges (Hamari, 2015). Displaying these badges can engage learners in a novel way, which fosters further motivation for future badging activities by building an online identity through the sharing of their badges, which is a badging-specific instance of a cycle posited by Bandura (1993).

The assessment component inherently involved in badging also is an influential factor on the use and acceptance of attaining quality learning through the use of badging programs. For instance, when individuals earn badges in videogames they are provided with holistic assessment of how well the accomplished each task involved in earning said badge (Abramovich, 2016). Some studies on using badging for motivation have shown that systems that allow individuals to choose which badge they work on first helps to engage learners and increase motivation to learn (Goligoski, 2012; Randall, Harrison, & West, 2013). Goligoski (2012) suggests that when learners are given a choice as to which badge to work on within the discipline, it builds the learners' senses of agency and further motivates their learning.

2. Self-efficacy and Learning

Self-efficacy can be a pervasive concept to an individual, such as an individual who believes that she is a successful leaner, or individuals may have more specific self-efficacy beliefs, about their abilities in content areas such as learning English or mathematics (Bandura, 2012). We will target the more pervasive, general learner self-efficacy in reference to individuals' general beliefs about their abilities to learn.

The cognitive factors involved in self-efficacy also are strongly influenced by behavior and motivation. For instance, if an individual is being behaviorally rewarded or compensated with something meaningful for completing a task, this will increase their motivation toward the task (Bandura, 1993; Blair, 2012). In this instance, the behavioral reinforcement and motivation will combine with the individual's cognitive processes to develop their self-efficacy for the given task (Bandura, 1993). With regard to the present paper, the task itself could be any learning task, but the behavioral reinforcement of receiving a badge for successfully achieving their goals is anticipated to provide

positive emotions to the learner and subsequently increase learner motivation and foster positive self-efficacy in the learner (Blair, 2012; Hamari, 2015). Bandura (1993), before the existence of badging initiatives, noted this type of behavioral reinforcement in general as possible for fostering positive self-efficacy.

2.1 Promoting Positive Learner Self-efficacy

An individual's self-efficacy beliefs are a combination of behavioral experiences and outcomes received (Bandura, 1982; Driscoll, 2005). Traditionally, it is believed that individuals form self-efficacy beliefs from four primary sources: prior experience, vicarious experience, social persuasion, and physiological/affective factors (Bandura, 1997). This fosters positive self-efficacy by increasing student engagement with positive outcomes (Driscoll, 2005). This type of experience could be seen in a traditional classroom as well; for instance, a teacher will begin work by building on skills that students already possess. For a student, this approach fosters positive self-efficacy by engaging all four components of constructing self-efficacy beliefs in a positive context.

In addition to the four main components for developing positive self-efficacy beliefs, there are elements that can be added to a learning environment to increase the likelihood of developing positive self-efficacy beliefs. Challenging the learner's negative thoughts about themselves or their performance can help to combat negative self-efficacy beliefs (Randall, Harrison, & West, 2013). This technique is especially applicable if the negative thoughts are replaced by more positive ones by identifying why the learner's negative thoughts are inaccurate (Randall, Harrison, & West, 2013). The process of challenging negative thoughts can be facilitated in badging by the qualitative feedback that the badging process provides to the learner. Celebrating achievements is also a strategy to enhance positive self-efficacy (Randall, Harrison, & West, 2013). This enhancement can be done through the use of a badging system by the system acknowledging a learner's successes throughout the process of earning a badge as they come closer to achievement in addition to the act of being awarded the actual badge. This may be done through a series of smaller badges culminating in the award of a more comprehensive, or larger badge, or simply through feedback helping the learner to realize progress.

Receiving a badge to acknowledge and celebrate an accomplishment can be used to improve positive learner self-efficacy beliefs (Randall, Harrison, & West, 2013). Additionally, while accumulating badges, learners can display and share their accomplishments in the social context of the digital platform which will serve as a running list of the learner's accomplishments to encourage further achievement (Randall, Harrison, & West, 2013). A collection of related badges earned in specific area of performance is sometimes referred to as a microcredential. After a learner accomplishes a task, using qualitative feedback paired with praise can help to encourage further mastery of a skill while also improving the learner's positive self-efficacy beliefs (Randall, Harrison, & West, 2013). To accomplish this, the feedback must incorporate praise and constructive criticism to aid learners in bettering their skills and continuing to accomplish tasks (Randall, Harrison, & West, 2013). Finally, providing learners with the opportunity to make choices regarding their education and apply their current skills to novel concepts enables the learner to build upon their strengths, which will in turn increase positive self-efficacy beliefs (Randall, Harrison, & West, 2013). Thus, all the supportive practices proven to facilitate an increase in positive self-efficacy beliefs are easily transferable into a learning environment that incorporates badging.

Setting realistic, specific, and attainable goals also has been shown to increase an individual's positive self-efficacy beliefs (Randall, Harrison, & West, 2013; Schunk, 1990). Self-efficacy in learning has been significantly correlated with clearly-defined, attainable goals in many studies over time (e.g. Bandura, 1993; Hamari, 2015; Schunk, 1990). When learners are able to see explicitly what work is required from them in order to meet their goals, this fosters an increased sense of positive self-efficacy and feelings of personal satisfaction with the work (Hamari, 2015). These results are born out of learners self-identifying as capable, competent individuals in regard to the given task (Reid, Paster, & Abramovich, 2015). Badges can be

used to facilitate self-efficacy in many ways. Overall, the reward system included in the process of using badges could help to increase learner self-efficacy by providing components like clear goals, feedback, and positive reinforcement for working toward learning tasks.

2.2 Badges and Learning

Badging systems are a unique type of social media device. Recent studies have reflected that social media engagement is often inherently motivational due to the following components: recognition, networking opportunities, entertainment, emotional support, and social comparison and identity development (Kwon, Halavais, & Havener, 2015). For these reasons, social media learning formats also have been found to reinforce sustained development through follow-up periods ranging from six months to one year (Love, et al., 2016).

Some authors have reported similar findings, such as one with college students using badging. Kwon, Halavai, & Havener (2015) identified five specific motivations for using digital badging, which were: "self-efficacy, social incentives, networked support, passing time, and inattentive sharing." In this study, it was found that fitness and education badges were the two types of badges most strongly correlated with learner self-efficacy in the given task. Findings like these illustrate the pivotal opportunities that bringing digital badging into educational practices could provide in regard to improving learner self-efficacy (Randall, Harrison, & West, 2013).

2.3 Educational Applications

Abraomovich (2016) connected the links between videogames and gamified education to examine the relationship between education and badging. In this study, Abramovich found that similarly to videogaming environments, learners displayed their personal interests through the badges they chose to earn. Additionally, learners displayed selection preferences for badges created with a focus on assessment and feedback versus badges aimed purely at acknowledging task completion.

This trend for preference toward badging systems that support assessments which provide regular feedback to the learner also was found to be preferable to a system that only provides a conclusive evaluation according to a study conducted to examine student preference between the two formats (Abramovich, 2016). Abramovich found that student perspectives on the use of the badging system increased with continued use. These findings suggest that in an educational setting, students should be provided with a badging system that is utilized for an extended period of time and provides periodic, quality assessments throughout the course. The cycle of autonomy of badge choice and accessible feedback can help learners to improve self-efficacy in the task being learned (Randall, Harrison, & West, 2013).

2.4 Using Digital Badges to Impact Learner Self-efficacy

As previously discussed, self-efficacy is an individual's perception of their ability to effectively perform a given task. Self-efficacy is impacted by the following components: previous experience, vicarious experience, social persuasion, and physiological states (Driscoll, 2005). This connects to badging in the following ways. Vicarious experiences can be represented by the fact that badging environments are inherently social in nature (Hamari, 2015). Sharing and posting badges provides social validation that completing a badge is a valuable experience (Hamari, 2015). Since badging systems also provide clear, specific, and attainable goals they reinforce the self-efficacy component of previous, successful experience. These well-structured goals also have been found to foster positive emotions and satisfaction (Hamari, 2015). Recent studies have supported the development of self-efficacy beliefs while using a badging system. Kwon, Halavais, & Havener (2015) found that fostering self-efficacy was associated with activities that help express personal identity, foster a feeling of achievement, and promote an individual's concept of social identity.

The motivational component of badging is a substantial factor in implementing badging systems to foster learner self-efficacy. As previously covered in this paper, studies have found that fitness, education, and programming are the types of badging formats that foster the most self-efficacy and motivation from voluntary learners (Kwon, Halavais, & Havener, 2015). Specifically, fitness and education were shown to have the highest means for learner self-efficacy. In reference to social motivations

that foster self-efficacy beliefs, displaying the badges you have earned to a larger audience increases the feeling of gratification that is produced by earning a badge; which then increases motivation to continue earning more badges (Kwon, Halavais, & Havener, 2015). These findings are applicable to engaging learners in digital badging because it can be used as a tool to foster learner self-efficacy and improve motivation for learning (Blair, 2012).

3. Issues, Controversies, Problems

Some studies have found that students whom are motivated in different ways respond to digital badging environments differently as well. Differences in goal orientations resulted in different degrees of motivation using digital badging (Fanfareli, & McDaniel, 2012). These findings indicate that the application of a badging system may not be applicable to all students or the badging system may need to be altered to accommodate these different motivational orientations. While these limitations have been found, little research exists on the frequency of these different motivational orientations or how they specifically impact self-efficacy beliefs, separate from motivational belief.

The integration of badging into learning systems and the culture of expectations for artifacts of education attainment also are possible limiting factors that could negatively impact the broad acceptance of badges in education. Badging must be built into learning systems so that they are easy for instructors to implement. It must be easy for instructors to include badges in MOOCs, adaptive learning systems; smart learning environments, game-based learning, and gamification scenarios, or badges will not be used. Also, work must be done to gain broad acceptance of digital badges as valid proof of a meaningful learning experience; they are far different, though possibly far more meaningful, than traditional artifacts of learning such as diplomas, transcripts, or certificates. They are potentially more meaningful due to the metadata that can accompany a badge, thus showing artifacts of authentic learning experiences rather than static letter grades or statements of completion that diplomas, transcripts, and certificates usually provide.

4. Future Research Directions

Note that there are many other lenses through which one could examine badges. The purpose of this paper was to provide a theory-based rationale for badging from the perspective of self-efficacy theory. Other authors may wish to make examinations from other perspectives, motivational or otherwise. While there are many perspectives possible, behaviorism and social comparison theory, which postulates that individuals compare themselves to each other and essentially compete for superiority in one's peer group (Festinger, 1954), are natural choices that may provide other theoretical groundings for badging. Also, as badges are a relatively new innovation for K-12 learning environments, it is not clear what value the badges have for those who earn them, or why they choose to earn them. Do badge earners perceive some external reward beyond simply being able to display the badge? Are there broad examples where earning badges results in career advancement or monetary reward? The well-known literature on extrinsic motivation and sustained performance, remind us that the type of motivation for earning badges is important.

Conclusion

Badges are already a proven tool for assessing performance, motivating via social interaction, and increasing engagement in certain contexts (eg. games). While badging is not a widely applied tool in traditional, formal learning environments, the present paper describes how the implementation of badging can be leveraged to enhance learner self-efficacy. Thus, those designing learning experiences should consider if badges will be accepted by their target learners. This could be part of a learner or context analysis in the initial phases of instructional design.

As previously discussed in the present article, self-efficacy is influenced by outcomes of previous experiences, so using diverse badges to provide encouragement for students as they progress through a course has the potential to increase positive self-efficacy beliefs. Social learning also was discussed and as explained earlier, badging involves sharing and displaying the badges you have earned. Through the lens of social learning, this process inherently

validates the activities that students are completing while motivating them to earn more badges or complete badges based on principles of social comparison theory and the vicarious experience sources of self-efficacy development. Verbal persuasion also is an integral part of a badging system, as students can share their opinions via the social component of a badging interface as well as congratulate the accomplishments of their peers. Some researchers (Hickey & Soylu, 2012) have suggested that peer-assigned badges are worthy of exploration, which may contribute in some way to vicarious and verbal persuasion sources of self-efficacy beliefs. The only self-efficacy component not explicitly influenced by a badging system is physiological factors. These factors are largely out of the instructor's control regardless of the educational setting, however, the instructor should help facilitate a positive and supportive learning environment in order to facilitate a positive physiological state as much as possible.

Based on the studies reviewed for this paper, it can be inferred that incorporating badging into innovative learning environments potentially could be a useful tool to enhance learner self-efficacy beliefs, which are linked to improved learner achievement. Thus, beyond the novelty of incorporating an emerging technology, a self-efficacy theory based rationale for incorporating badges in learning environments has been provided. Studies applying and measuring these concepts are needed to further support the usefulness of implementing badging systems in these educational settings to further justify their implementation in education. There may be other theory-based rationales for incorporating badging in learning environments, but those are beyond the scope of the present discussion.

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