A scoping review towards the conceptualization of a digital Open Badges ecosystem in South Africa

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Abstract: A scoping review was conducted towards supporting the conceptualization of a Digital Open Badge Ecosystem for South Africa. The scoping review intends to address the conceptualization of a digital Open Badges ecosystem for South Africa by: (1) Identifying the scope and range of available literature, and (2) summarizing and disseminating research findings. This paper argues that a digital badge ecosystem can accommodate, recognize and accredit all contexts of learning and learning outcomes to offer relevant and rewarding pathways for learners. Open Badges can provide the infrastructure to facilitate this recognition of skills and achievements. In the absence of specific skills accreditation for informal skills and small scale competency development that falls outside the formal recognized structures, a need to develop an ecosystem for South Africa that leverages Open Badges is identified. Albeit an emerging field, the identified studies addressed all the research questions and the authors developed a feel for the main areas of interest and range of available literature. A need to conduct a full systematic review has been identified.

Introduction

This paper presents a scoping review towards the conceptualization of a Digital Open Badges ecosystem in South Africa. The pursuit of knowledge and skills has steadily grown with vigour, forcing pedagogies to follow in its progressive footsteps (Mayrath, 2012). The learning environment is no longer limited to a classroom or governed by seat time (Hess, 2011; Morrison and DiSalvo, 2014). Knowledge and skills are created, shared and valued in various different ways that breach the context in which the current education system was developed and standardized (The Mozilla Foundation, Peer 2 Peer University and The MacArthur Foundation, 2012). Alternate learning opportunities include internet-based projects, self-directed tinkering, community participation and on-the-job experience (The Mozilla Foundation et al., 2012). The knowledge, achievements and skills earned outside the traditional South African formal education system are often, either overlooked or not accredited (Mudavanhu, 2015; Rooyen, 2011). Outcomes, such as achievements in after-school classes, extra-curricular activities, work based experience and mentoring, to name a few, are often not recognized in formal education accreditation and therefore seldom acknowledged as a valuable accomplishment.

Badges are often used to recognize learning (what an individual knows), skill (what an individual can do), or a role in an organization or community (what an individual has become) (Randall et al., 2013). David Gibson et al (2015) indicated that badges and badging systems are emerging to incentivize learners to engage in positive learning behaviours, identify progress in learning and content trajectories, and, to signify learning and achievement. Digital badges are icons and image files that serve as a visual metaphor for a skills, role, accomplishments, experiences and interests (Gibson et al., 2015) and have been touted as a common currency to signify learning outcomes across all contexts (Bowen and Thomas, 2014).

In 2011, the Mozilla Foundation with the support of the MacArthur Foundation launched the Open Badges Project ("Mozilla Launches Open Badges Project," 2011). Open Badges offers a free, open-source digital badge infrastructure to allow institutions, endorsers and learning provides to issue badges and for job seekers and leaners to collect and display badges (Muilenburg and Berge, 2016). The Open Badges project provides an accreditation system that intends to unlock new career and education opportunities by promoting the recognition of skills and achievements earned through formal and informal learning (Knight et al., 2014).

This scoping review intends to address the conceptualization of a digital Open Badges ecosystem for South Africa by:
1. Identifying the scope and range of available literature
2. Summarizing and disseminating research findings

This exploration is guided by the following research question:

What are the components of a digital Open Badge ecosystem in South Africa?

The following investigate questions contribute in the main exploration outlined:
- What is a digital badge?
- What is Open Badges?
- What are the Digital Open Badge Ecosystem Elements?
- What are the existing implementations of Digital Open Badges?

Having provided the research purpose and research question the following section offers an overview of the methodology followed.

Method

A scoping review is broad in coverage (breadth) and varies in depth depending on the focus and sensitivity of the research area (Arksey and O'Malley, 2005). A scoping review shares a similar methodological approach to a systematic review and is conducted in a systematic, transparent and reproducible manner to maintain methodological rigour. A scoping review identifies all relevant research but, unlike a systematic review, does not include a quality appraisal of the literature. This introduces a limitation in rigour when selecting research. A scoping review, therefore, is biased and inadequate for the recommendation of policies or practices, but provides the preliminary mapping of literature which can be used towards assessing the feasibility of a full systematic review (Arksey and O'Malley, 2005; Grant and Booth, 2009)

The scoping review was performed by adapting the frameworks described by Arksey and O'Malley (2005) for a scoping review and by Okoli and Schabram (2010) for a systematic literature review: (1) identify the purpose, scope, goal, and research questions, (2) develop a protocol with specific steps and procedures to be followed, (3) search and identify relevant studies, (4) eliminate studies that do not address the research questions and do not meet a defined set of inclusion criteria, (5) charting the data, and (6) collate, summarize and report the results. To ensure that the literature was covered comprehensively, the steps of the framework were performed iteratively and not linearly. The scope, research questions and search terms were redefined as the authors developed their familiarity with the research area.

Search strategy

We undertook to keep our search as comprehensive as possible and searched electronic databases, reference lists and academic citation applications for published and unpublished studies to address our research questions. We did not place strict limitations on search terms and aimed to generate breadth of coverage. The search strategy was applied iteratively and the search terms were reassessed when the authors expanded their knowledge of the scope and gained a sense of the volume of studies available. We derived the following search terms from the research questions: "digital badges", "digital badge ecosystem", "open badges".

When the keywords were explored in Google Trends (Figure 1), the results displayed a shared spike in interest from April 2011.The keywords were used as a selection criterion and a search was performed to identify studies, articles and books published between 2011 and 2016. This date range was selected based on Google Trends search results and to ensure the relevance of the returned articles. The keyword search strategy used the following search terms: ("digital badges" OR "badge ecosystem" OR "digital badges ecosystem" OR "open badges") AND ("framework" OR "implementation").

Table 1: Framework to conduct a scoping review

Step	This study	Section
(1) identify the purpose, scope, goal and research questions	The purpose of this paper is to present a scoping review towards the conceptualization of a digital Open Badges ecosystem in South Africa. **Research Questions:** What is a digital badge? What is Open Badges? What are the Digital Open Badge Ecosystem Elements? What are the existing implementations of Digital Open Badges?	Introduction
(2) develop a protocol with specific steps and procedures to be followed,	A 6 step framework to perform a scoping review was adapted from Arksey and O'Malley (2005) and Okoli and Schabram (2010)	Method
(3) search and identify relevant studies	Keyword search of electronic databses, reference lists and citation engines	Method – Search Strategy Results – Search strategy, study selection and charting the data
(4) eliminate studies that do not address the research questions and do not meet a defined set of inclusion criteria	All studies were screened for eligibility using assessment questions (Table 2)	Method – Search Strategy Results – Search strategy, study selection and charting the data
(5) charting the data	Data was extracted from the studies and rearranged according to the context of the research questions	Method – Search Strategy Results – Search strategy, study selection and charting the data
(6) collate, summarize and report the results	Summaries of the studies were produced based on the research questions	Results –Digital Badges Results – Open Badges Results – Digital Open Badges Ecosystem Elements Results – Existing Implementations of Digital Open Badges

We searched the educational databases ERIC (via EBSCOhost), Professional Development Collection, Professional Development Collection and Academic Search Premier, all of which gave results that had more of a pedagogical implementation in professional practice and were deemed unsuitable to answer the research question. As such, the search was extended by not

limiting it to specific discipline or database and using frequently cited publications as a measure of credibility.
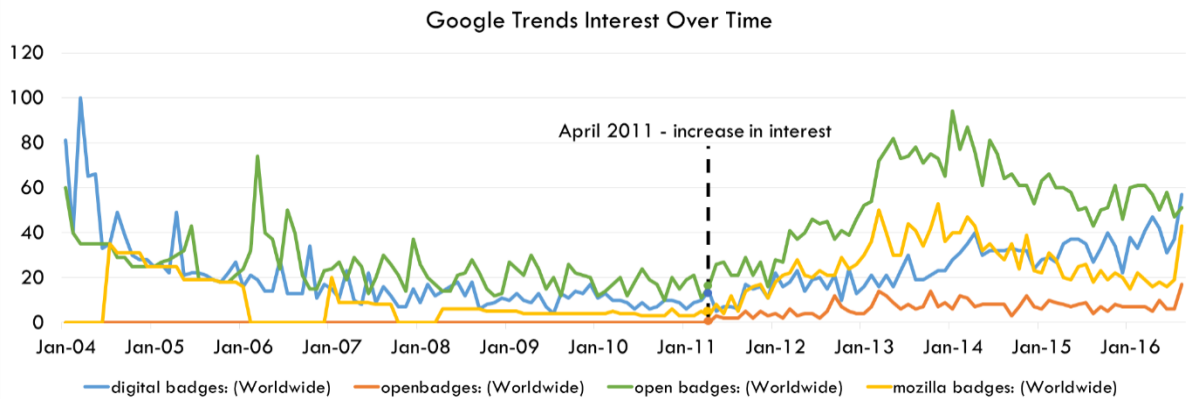

Figure 1: Google Trends Search Results for Key Words

The keyword search was performed of Thompson's Web of Science and Harzing's Publish or Perish (Harzing, 2007) and returned a substantial set of publications. Harzing's Publish or Perish searched Google Scholar and Microsoft Academic Search and retrieved and analysed academic citations. A high number of citations suggests that a publication has made a significant impact on the field. A low number of citations may, but not necessarily, suggest a lack of impact on the field. A low citation per publication metric can be attributed to a limited or recently developed working field, or the restricting the publication audience by publishing in a language other than English (Harzing, 2007).

Study Selection

After duplicate studies were removed, the remaining studies were screened for eligibility, using similar methods of a systematic review. Studies were assessed for eligibility according to the responses to the questions detailed in Table 2. It was decided to limit the study language to English because it is the home language of all three authors and the cost implication of translating a paper exceeded the budget and time constraints. If the publication was not written in the English language and the response to question 1 was "No", it was immediately excluded. If the response to any of the questions 2 to 5 was "Yes", the publication was deemed relevant and shortlisted for quality appraisal.

Table 2: Table of Eligibility Assessment Questions

#	Eligibility Assessment Question	Response
1	Is the study written in the English language?	☐Yes ☐No (Exclude)
2	Does the study explain what a digital badge is?	☐Yes (Include) ☐No
3	Does the study explore a digital badge ecosystem?	☐Yes (Include) ☐No
4	Does the study explain what Open Badges is?	☐Yes (Include) ☐No
5	Does the study explore the components of an Open Badges ecosystem?	☐Yes (Include) ☐No
6	Does the study provide examples of implementations of an Open Badges ecosystem?	☐Yes (Include) ☐No

Charting the data

The next step involved the abstractions of the full-text of the studies and sorting then into key issues and themes. Data was extracted data from the original context and rearranged according to the context of the research questions. Descriptive information was sifted from the studies and a table was used to classify and chart the publications according to the investigative questions:

- What is a Digital Badge?
- What is Open Badges?
- What are the Digital Open Badges Ecosystem Elements
- What are the existing implementations of Digital Open Badges?

as studies pertaining to (see Table 4):

- Digital Badges
- Open Badges
- Digital Open Badges Ecosystem Elements
- Existing Implementations of Digital Open Badges

Collating, summarizing and reporting the results

This scoping review presents an overview of all the studies examined. Unlike a systematic review, a scoping review does not present a synthesised review of the studies and findings because the quality of the studies is not appraised and there is, therefore, no basis to provide generalized findings or assertions. Mind maps were used to organize and summarize the relevant research. We produced summaries of the studies and hinged the summaries on the research questions.

Results

Search strategy, study selection and charting the data

The search strategy and flow of information is illustrated in Figure 2. The keyword search yielded 1586 results, shown in Table 3. After duplicate studies were removed, the titles and abstracts of 1455 studies were screened for eligibility and relevance.
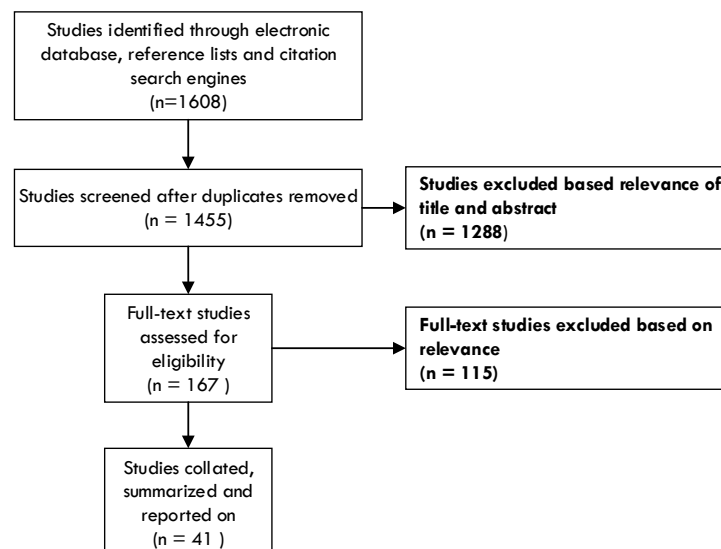
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┌─────────────────────────────┐
│ Studies identified through  │
│ electronic database,        │
│ reference lists and         │
│ citation search engines     │
│ (n=1608)                    │
└─────────────────────────────┘
              │
              ▼
┌──────────────────────────────┐      ┌──────────────────────────────┐
│ Studies screened after       │─────▶│ Studies excluded based       │
│ duplicates removed           │      │ relevance of title and       │
│ (n = 1455)                   │      │ abstract (n = 1288)          │
└──────────────────────────────┘      └──────────────────────────────┘
              │
              ▼
┌──────────────────┐                  ┌──────────────────────────────┐
│ Full-text studies│─────────────────▶│ Full-text studies excluded   │
│ assessed for     │                  │ based on relevance           │
│ eligibility      │                  │ (n = 115)                    │
│ (n = 167 )       │                  └──────────────────────────────┘
└──────────────────┘
              │
              ▼
┌──────────────────┐
│ Studies collated,│
│ summarized and   │
│ reported on      │
│ (n = 41 )        │
└──────────────────┘
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Figure 2. Search Strategy Flow Diagram

Table 3: Table of Search Terms used in Keyword Search Strategy and Returned Results

Search Terms		+ "framework"	+ "implementation"
"digital badge"	466	4	3
"badge ecosystem"	84	1	0
"digital badge ecosystem"	7	0	0
"open badges"	1000	18	3

The keyword search returned many publications, approximately 58%, related to Bio Med Central (BMC) Public Health which presented no relevance to the research questions. Studies were excluded if they were not written in the English language, if they fell in the BMC Public Health field, and if the content was not pertinent to the research questions (see Figure 3).
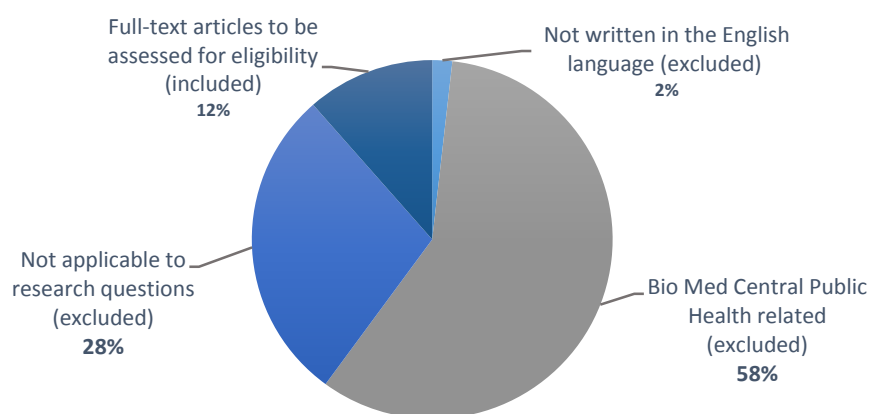
Figure 3: Results of Eligibility Assesment

The full text of the remaining 167 eligible studies were examined. The quality of the publication was not used as an inclusion criterion, however, the publications were broadly assessed for relevance. Researcher bias is acknowledged in this step of the process as the researcher had to make judgement calls on the relevance of specific articles.

Of the 167 studies, 41 studies were chosen for inclusion in this scoping review and charted in Table 4 according to their focus areas.

Table 4: Summary of Publications and Focus Areas

Publications	Digital Badges	Open Badges	Ecosystem Elements	Existing Implementations/ Case Studies
(Devedžić and Jovanović, 2015) [1]	✓	✓	✓	✓
(Gibson et al., 2015) [2]	✓	✓	✓	✓
(Muilenburg and Berge, 2016) [3]	✓	✓	✓	✓
(Ifenthaler et al., 2016) [4]	✓	✓	✓	✓
(Randall et al., 2013) [5]	✓	✓	✓	✓
(Anne Hole, 2014) [6]	✓	✓	✓	✓

Table 5: Summary of Publications and Focus Areas

(The Mozilla Foundation et al., 2012) [7]	✓	✓	✓	✓
(Jovanovic and Devedzic, 2015) [8]	✓	✓	✓	✓
(Pedro et al., 2015) [9]	✓	✓	✓	✓
(Gamrat et al., 2014) [10]	✓	✓	✓	✓
(Haaranen et al., 2014) [11]	✓	✓	✓	✓
(Grant, 2014) [12]	✓	✓	✓	✓
(Hickey et al., 2015) [13]	✓	✓	✓	✓
(Rosewell, 2012) [14]	✓	✓	✓	✓
(Mewburn et al., 2014) [15]	✓		✓	✓
(Law et al., 2015) [16]	✓		✓	✓
(Tran et al., 2014) [17]	✓	✓	✓	✓
(Masura, 2013) [18]	✓		✓	✓
(Davis and Singh, 2015) [19]	✓		✓	✓
(Law, 2015a) [20]	✓		✓	✓
(Ma, 2015) [21]	✓	✓		
(Felicia M. Sullivan, 2013) [22]	✓	✓	✓	✓
(Ahn et al., 2014) [23]	✓	✓	✓	
(Myllymäki and Hakala, 2014) [24]	✓	✓	✓	
(Law, 2015) [25]	✓		✓	✓
(James Buckingham, 2014) [26]	✓		✓	✓
(Anderson et al., 2013) [27]	✓		✓	✓
(Rughinis, 2013) [28]	✓	✓	✓	
(McDaniel et al., 2012) [29]	✓			✓
(Halavais, 2012) [30]	✓		✓	
(Ash, 2012) [31]	✓		✓	✓
(Raish and Rimland, 2015) [32]	✓			✓
(Goligoski, 2012) [33]	✓	✓	✓	✓
(Santos et al., 2013) [34]	✓			✓
(Bowen and Thomas, 2014) [35]	✓		✓	✓
(Fain, 2014) [36]	✓		✓	✓
(Frederiksen, 2013) [37]	✓			✓
(Glover and Latif, 2013) [38]	✓	✓	✓	✓
(Glover, 2013) [39]	✓	✓		
(Carey, 2012) [40]	✓			✓
(Hickey et al., 2013 [41])	✓	✓		✓

Reporting of Results

The following section presents an overview of the literature identified through the scoping literature review towards investigating the four research questions:

- What is a digital badge? (see Digital Badges)
- What is Open Badges? (see Open Badges)
- What are the digital Open Badges ecosystem elements (see Digital Open Badge Ecosystem elements)
- What are the existing implementations of digital badges? (see Existing Implementations of Digital Badges)

Digital Badges

Devedžić and Jovanović (2015) argue that a badge is an image that serves as an indicator of skills, competencies, interests, achievements, or hierarchy acquired over time and across all contexts. The affordances of digital badges can be categorized into four key areas:

- Motivation – to foster discovery, promote engagement, drive the acquisition of knowledge, and incentivize learning (Gibson et al., 2015; Muilenburg and Berge, 2016; Randall et al., 2013; The Mozilla Foundation et al., 2012; Tran et al., 2014),
- Recognition and credentialing – to validate, measure, and accredit knowledge and skills gained across all contexts of learning, to build and formalize an identity and reputation, to symbolize an association with a community or group (Davis and Singh, 2015; Gibson et al., 2015; Law et al., 2015; Pedro et al., 2015)
- Evidence of achievement – by linking a digital badge with metadata containing evidence of skill, accomplishment or knowledge, creating a granular representation of capabilities, to map an individual's progress (Anne Hole, 2014; Ifenthaler et al., 2016; Pedro et al., 2015)
- Research – to form a pathway model for achievement, to make learning more transparent and accessible (Davis and Singh, 2015; Felicia M. Sullivan, 2013; The Mozilla Foundation et al., 2012)

Figure 4: Digital Badges issued by Chicago Summer of Learning ("Connected Learning," 2014)

Digital Badges can be embedded with metadata that provide information about the issuer, the recipient, and a description of the why the badge was awarded with the associated evidence. The granularity associated with awarding badges for competencies creates a broader representation of an individual's capabilities allowing the individual to tell a more complete picture of his/her competencies by signaling specific critical skills.

The value of the digital badge is backed by the issuing authority and the decided assessment of recognition. A competence/educational based assessment must be linked with evidence of activities, learning, experiences, artefacts and skills development (Gibson et al., 2015, p. 404; Mayrath, 2012, p. 346), Badges are issued according to success criteria which vary in definition, levels, weight, quality, rigor, motivation and reward. A single badge may be designed and issued by more than one authority making the badge achievable via multiple paths and assessment options.

In conclusion, this study will adopt the following definition for a digital badge: A digital badge is a validated representation or indicator of an accomplishment, competency, interest, affiliation, experience or skill that is visual and available online. (Gibson et al., 2015; Jovanovic and Devedzic, 2015).

Open Badges

Building on the merit and potential of digital badges and badging systems, Mozilla and the MacArthur Foundation further developed the Open Badges project; a badge system with the following key elements: badges, assessment, collecting and sharing tools, and criteria and evidence . Mozilla Open Badges have refined the concept of the digital badge, as a static image, by hard-coding metadata on the badge that communicates the specific skill or achievement. (Erin Knight and the Mozilla Foundation, 2012, p 8) and provides a level of security and reliability (Randall et al., 2013). This metadata (Figure 5) details: the badge name, the issuer, the endorser, the competency statement, the performance criteria, the method of assessment, the evidence of performance, the date issued and the standards with which the badge is aligned ("Badges/FAQs - MozillaWiki," 2014).
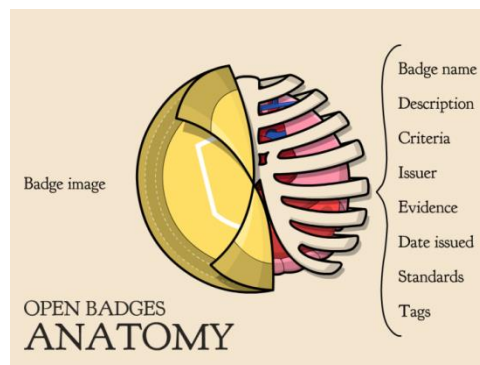

Figure 5: Open Badges Anatomy – Badge Metadata ("Badges/FAQs - MozillaWiki," 2014)

Although learning is similarly validated via standards, evaluation and evidence, in contrast to the current top-down and closed accreditation system, the Open Badges accreditation system uses a bottom-up, open, and distributed approach (The Mozilla Foundation et al., 2012). The Open Badges badging process is outlined below ("Badges/Onboarding-Issuer - MozillaWiki," 2014):

- A *badge issuer creates a certifiable badge* and makes it available online to their audience of earners
- When an *earner meets the defined criteria* of a badge, the badge is awarded to an earner, the earner can choose to store the badge in their Backpack
- The *Backpack* is used to accumulate and manage badges, allowing earners to select privacy and publishing preferences (Goligoski, 2012)
- Earners can *share and display* authenticated badges publically on social network sites, blogs, profiles and resumes
- Potential employers, recruiters, organizations and peers can *view badges* that are displayed publically and click on the badges to view to the badge metadata (Ifenthaler et al., 2016)

The following definition is adopted for an open badge: Open Badges are standards based badges that have hard-coding metadata on, reliability and securely communicating a specific skill or achievement. (Erin Knight and the Mozilla Foundation, 2012; Randall et al., 2013)

Digital Open Badge Ecosystem Elements

The literatures documenting digital badge ecosystems are relatively scarce, and with the exception of the Mozilla Open Badges ecosystem, consist mainly of single institutionally localized ecosystems. These seem to function within a single institution, enabling the use and application of open digital badges for the institutional consumption.

A digital badge ecosystem allows tertiary institutions and employers to bridge the identified skills-shortage-gap with badge ecosystems that are developed around higher education outcomes (Pearson Education, 2013). Universities and higher education institutions can leverage the connected learning outcomes to contextualize an individual's achievements and readily demonstrate the return on investment and economic impact of their programs (Jovanovic and Devedzic, 2015). Universities and education providers who endorse badges will acknowledge and credit the learner's soft-skills and job ready competencies, and hence, increase the transparency of learning pathways (Glover and Latif, 2013). A badge ecosystem can help students make better-informed decisions through connected learning pathways between tertiary education providers and the career-specific skills required by employers (Ito et al., 2013). For employers and advanced education providers, the required skills, competencies, and outcomes articulated through badges will simplify the communication of changing needs to the learners, tertiary institutions and training providers (Pearson Education, 2013). As a result, curricula can easily be tailored to suit the market needs and afford learners the opportunity to better equip themselves with a more market-responsive skill-set.

The Mozilla Foundation, Peer 2 Peer University and MacArthur (2012) have identified a conceptual framework for a digital badge ecosystem, consisting of three elements: badges, assessment and infrastructure. The infrastructure of a digital badge ecosystem needs to provide an online, open and decentralized vehicle to issue, collect and display badges online. This is operationalized as a badge backpack.

The infrastructure must accommodate: the issuing of badges from all contexts of learning environments, e.g. schools, universities, online learning, professional bodies, employers, non-formal education and learning providers; badge display management to afford the learner the power to control what badges are publically displayed, the metadata attached to a badge, badge authentication to verify validity; interfacing to external websites to support badge display; the endorsement of badges to signify the weight and value of a badge.

The OBI defines three user roles for the Open Badges Ecosystem ("Badges/Onboarding-Issuer - MozillaWiki," 2014) as the badge earner, the badge issuer and the badge displayer.

From the above literature overview, the following components are identified for an Open Badge Ecosystem:
- The badge issuer
- The badge (badge metadata)
- The badge earner
- The badging infrastructure (that can facilitate the badging process)
- The badge displayer

Existing Implementations of Digital Badges

There is several small scale, mostly institutional initiatives which have already implemented Open Badges to incentivize learning and introduce micro-credentialing to increase the scope of learning recognition:
- Makewaves is a safe, social learning platform for schools that provides social media for education to develop digital literacy skills, learn about internet safety and learnt how to use social media responsibly. Makewaves has formed a community of thousands of schools sharing their creativity and raising achievement with badges ("Makewaves | Free school blogs and secure social learning platform | Share what you make," 2016)
- Kent University has used badges to validate and capture the competencies gained through workshops for faculty professional development.(Nestor, 2014)

- Aurora Public Schools (APS) are working with community colleges and regional employers in the state of Colorado to award badges for 21st century skills and gain endorsement for these badges. ("Digital Badging," 2016)
- DigitalMe is using the Open Badges platform to work together with teachers, charities and employers to transform the learning landscape and prepare young people with the skills and competencies to enable real world opportunities. Current badge programmes include "Badge the UK" which allows learners to showcase all the achievements using digital badges and "Young Carers in Focus" which empowers young carers to share stories and campaign for change. ("Projects - DigitalMe," 2016)
- Newport City (Wales) Homes provides community service to residents and have created a set of badges for key competencies that are tied to industry standards, to develop and reward employee skills. (Price, 2014)
- The University of California at Davis, aware that traditional testing and grading would not accurately reflect the outcomes of their agriculture and food systems curriculum, linked competency badges to the outcomes defined in collaboration with targeted employers. (Muilenburg and Berge, 2016)
- The Grading Soft Skills (GRASS) project develops innovative pedagogical approaches to support and represent the soft skills of learners. GRASS is investigating the idea of digital badges and Open Badges to formally measure, validate and recognize these skills. ("Project description - The GRASS project," 2016)
- Providence After School Alliance launched a badge system targeted at the Providence youth to expand and improve learning opportunities by motivating, tracking, recognizing and validating learner interests to create connected learning pathways. ("Case Study," 2014)
- Badge Europe! is an international initiative working towards promoting Open Badges as the infrastructure to provide formal and informal learning recognition, to increase the transparency and quality of learning outcomes, and to create opportunities for learning, employment and social inclusion. ("About Badge Europe! | Badge Europe!," 2016)

Digital Open Badges Ecosystem in South Africa

In addition to the above literature summaries on the elements of a digital Open Badges ecosystem, the case studies of the many of Open Badges implementations are relevant to the conceptualization of an ecosystem for South Africa. The experiences, merits, and challenges documented have valuable lessons which can be applied to conceptualizing a digital Open Badges ecosystem for a resource constrained environment like South Africa and the following should be considered:
- Randall et al. (2013) expressed that using expert assessment before a badge is awarded, albeit a reliable evaluation of high quality, comes at a high price and the financial sustainability as a major concern. Rosewell (2012) proposed partnering with existing Open Educational Resource (OER) providers and using existing evaluation models to obviate the cost implications of designing a robust validation and assessment rubric.
- The design of the digital Open Badges ecosystem needs to stimulate and sustain motivation in badge earners. Haarenen at al. (2014) attested that a simple design reduced the learning curve for student badge earners and encouraged learning, however, providing more statistics for earners (e.g. leader boards, notifications about badges earned) might increase motivation. In a pilot test, Pedro et al (2015) discovered that users of the SAPO Campus badging systems felt more engaged and motivated during participatory learning exercises as a group or community.

- Learners embrace informal learning and value a paid for certification and recognition from a Massive Open Online Learning (MOOC) provider. As experienced by Law et al. (2015a), a challenge exists with demonstrating digital badges as a currency of achievement and credibility and not just a motivational tool. On the contrary, Davis and Singh (2015) reported that the credibility of the badge metadata and the gaining of recognition for skills earned across contexts was met with enthusiasm and is a major draw card for badge adoption.
- A shared challenge concerns the assessment element of a badging system, specifically the success criteria for conceptual learning, critical thinking, creativity and other soft skills (Mewburn et al., 2014; Myllymäki and Hakala, 2014; Randall et al., 2013; Rosewell, 2012). Abramovich et al. (2013) claimed that the "potential benefit of an assessment is determine by its ability to both maintain learning motivation and accurately communicate a student's learning".
- The ability to set an expiration date on a badge has been beneficial for badges that are awarded for the mastery of skills in a field that is rapidly changing. The badge expiration date, if not carefully determined, can result in a lack of interest, making earners less likely to collect this badge because of its lack of longevity (Myllymäki and Hakala, 2014; Randall et al., 2013).

Conclusion

Erin Knight, the senior director of learning at Mozilla, describes our current accreditation systems as a "shared monopoly across education where you have to go down a very prescribed path to get learning that quote-unquote counts" and that Mozilla wants to "open that up". Digital badges can advance the reimagining of accreditation practices by measuring competencies accurately and with a finer granularity than seat time and formal degrees do. Mozilla's Open Badges offers the infrastructure to create and develop a digital badge ecosystem that incentivizes and recognizes accomplishments and experiences in all learning contexts.

This paper presented a scoping review which was applied to inform the conceptualization of a Digital Open Badges Ecosystem in South Africa. The preliminary mapping of studies confirm that a digital Open Badges ecosystem can potentially create a connected learning environment for South Africa which affords the accreditation of skills, achievements and competencies across various learning contexts. There is a need to conduct a full systematic literature review to provide a synthesis of quality literature towards the conceptualization of a digital Open Badges ecosystem in South Africa.

This conceptual ecosystem will be instantiated in South Africa through various implementations aiming to support a badging system to issue, earn, collect and display badges. The infrastructure will be developed by adapting and adopting the existing digital badges and Open Badges ecosystems, case studies and relevant learning from the literature overview using the Design Science Research (DSR) methodology.

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