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June 20, 2018

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Abstract— Digital competence is a key and vital skill for academics connected and adapted to new technologies. Through its Tele-Education Office, the Universidad Politécnica de Madrid, offers members of the university’s educational community training in digital educational skills. Alternatives to traditional credentials will be required to accredit this type of skills by means of digital badges. Taking advantage of the opportunities offered by the Web, digital badges provide suitable support for this type of training. This article reports a proposal for implementing Open Badges for the accreditation of training courses and the results achieved over a one-year period.

Keywords— digital badges, credential, Open Badges, higher education.

I. INTRODUCTION

The 2011, 2012 and 2014 Horizon Reports [1], identifying and describing the six emerging technologies that will have a significant impact on higher education, refer to the use of credentials to accredit learning anytime and anywhere, whereas the 2017 Horizon Report [2] discusses digital badges within the integration of formal and informal learning.

New digital education initiatives are leading to innovative higher education marketing models and new needs for accreditation by different means [1]. It is acknowledged that some skills acquired in new contexts [3], such as e-learning, experiences, stays, services to the community, online work and participation in professional organizations, are complicated to accredit by traditional means. This type of training is directly related to skills-based learning and requires new forms of accreditation [1].

A commitment to digital accreditation systems will enable the assessment, recognition and communication of new forms of learning [4] in newer branches of knowledge like digital skills, which are variable and suit the dynamic needs of the business world. Due to their versatility and modernity, this calls for a different or alternative accreditation system to the conventional certification mechanism.

A digital badge is defined as a clickable graphic that contains an online record of 1) an achievement, 2) the work required for the achievement, 3) evidence of such work, and 4) information about the organization, individual, or entity that issued the badge [5]. They offer students greater control of their

learning [6] and increased visibility of the acquired knowledge [1].

In the process of the digitalization and integration of ICT into higher education within the new digital society [7], all higher education stakeholders, including academic and administrative staff, and students, will have to upgrade. To this end, universities organize seminars, courses or workshops teaching a number of digital skills needed to embrace these changes. Digital badges [8] can provide support for this type of short training courses taught as part of lifelong learning.

This article aims to report the experience gained by the Universidad Politécnica de Madrid during the year 2017 with digital badges used as an alternative credential for new digital skills acquired after participation in specialized training courses targeting university staff and students.

This article is structured as follows. We start by defining the theoretical framework underlying the research (Section II). Section III details the methodology applied to carry out the experience, which provides for replication. Finally, Sections IV and V outline the results and conclusions of the experience.

II. BACKGROUND

A. Digital badges

Badges are elements that serve to show an achievement, an acquired skill, progress of a learning or an interest in a certain subject [6]. By adding the adjective digital will be defined achievements or learning experiences in a virtual context, in the Web. [8], inking with the evidences of having obtained them.

After obtaining a digital badge may be displayed on their websites, blogs, social networking spaces [8]. These can also be stored in electronic devices or sent by email, so they highlight their portability characteristics.

Within any gamified system distinguishes between three protagonists or featured roles [9]:

- Issuer: person, entity or institution that issues the digital badge. It will be the one who verifies those competences or achievements acquired.
- Earner: student who acquires the knowledge and skills indicated by the digital badge after successfully passing a training process.

- Consumer: any person, in particular an employer, who views the badge and is the recipient of a job application (or responsible for some other selection process).

To successfully implement badges, it is important to take into account and not mix up the mission of the above roles.

A digital badge is composed of three main elements [9, 10, 11]:

- A PNG (Portable Network Graphics) image.
- Metadata, containing all the badge and earner information linked to the knowledge or skills acquired by the earner [6].
- A web page storing additional information about the badge (criteria for badge award, evidence and data on the issuer) to assure its credibility.

There are platforms that can be used to upload and display badges organized in collections on a website. Known as backpacks, the most popular is the Mozilla Backpack [11], although the Open Badges Infrastructure (OBI) includes other options, some of which are national efforts like the Spanish Ministry of Education, Culture and Sport's Mochila EducaLAB Insignias [9].

1) Digital badges for gamification or as a credential

There are two possible types of digital badges within the educational field depending on their purpose [9]: gamification and digital credentials.

Gamification badges are used within a gamified system, which applies game design features in non-game contexts like education. Components [12] are specific elements or instances associated with the dynamics and mechanics of gamification. This type of badge is commonly used in the field of social media or online games [8], and as part of educational approaches within platforms like the Khan Academy or Duolingo or collaborative forums like StackOverflow to enhance participation and contribution recognition [13, 14]. The prominent characteristics of this approach are [15]:

- Encourage desired behaviours
- Provide user status and recognition
- Promote loyalty and retention.

The second approach, which is the focus this research, addresses the use of digital badges for skills accreditation [1, 8, 9, 10] as an alternative to traditional credentials. Digital badge options are better adapted to the digitalization of the educational process. As credentials [6], digital badges offer students more knowledge and control of their learning process, providing a possible solution for the integration of formal training with the recognition of digital literacy, new skills emerging out of Web 2.0.

Massive Online Open Courses [9, 16, 17, 18] is one of the movements that have used digital badges as a credential since their inception through different course spaces such as edX, Coursera, Miriada X or MOOC INTEF. Like other online

training initiatives, this type of informal learning is a natural space for the use of digital badges.

Although digital badges are most commonly used for the recognition of professional skills acquired during informal learning as part of lifelong training programmes [19, 20], their use in the context of formal learning within higher education is growing [1, 16].

2) Standardization: Open Badges

Standardization is required to encourage adoption and ensure compatibility across organizations [11, 21]. Open Badges is a non-proprietary initiative associated with the 2011 Open Badges Infrastructure (OBI) project sponsored by the Mozilla Foundation to develop digital badge standards. Thanks to Open Badges, any organization can create, award and certify digital badges according to a fixed structure in order to recognize digital skills and achievements.

The prominent features of Open Badges are that they are free and open, based on evidence associated with certified, stackable and transferable learning [10, 11]. Thanks to these last two features, ecosystems of badges can be created and easily shared over the Internet (web pages, social networks, email, etc.). Open Badges are part of the credential approach which, if followed within a training process, can help to [22]:

- Recognize learning: skills, competencies, knowledge, achievements, experiences, practical assignments, memberships, etc.
- Assess learning
- Provide students with guidance with respect to their educational process
- Study the resulting learning based on the digital information offered by the badges and associated systems.

B. Digital teaching skills

Digital competence is one of the eight key skills that, according to European Parliament recommendations, every citizen should have and is defined as the "ability to access digital media and ICT, to understand and critically evaluate different aspects of digital media and media contents and to communicate effectively in a variety of contexts" [23].

The National Institute of Educational Technologies and Teacher Training (INTEF), an organization belonging to the Spanish Ministry of Education, Culture and Sport, has developed a Common Digital Competency Framework for Teachers [24], an adaptation of the European Digital Competency Framework for Citizens v2.1 (DigComp) [25] and the European Digital Competency Framework for Educators (DigCompEdu) [26]. The objective of this framework is to serve as a reference for the diagnosis and improvement of the digital skills of teaching staff [24].

Universities often offer, through different units, digital literacy training initiatives for academic staff that require these skills. It makes more sense to accredit this type of digital skills

through other means than traditional printed certificates or, at best, a digital PDF version. Digital badges are an adequate solution for this purpose.

C. Badge design and management

Anyone with programming skills could create a badge in the same manner as anyone can create a printed certificate. Apart from a database record, a traditional credential usually bears an official stamp or is printed on special certificate paper, without which it is not valid. The same thing applies to digital badges: even though anyone can create the badge, it will not be valid unless it meets certain criteria. Badge information that is linked to the issuer's official web site [9, 16] will be more credible than the information stored in the digital badge file alone.

There are numerous online platforms operating with digital badges that encompass the entire badge issue process from their design to their award to earners. Most of these platforms have a web space that specifies information on the issuer and each of the badges offered. This information should make the whole process more credible. Some platforms even have their own backpack. Most of these online solutions are based on the Open Badge standard. Open Badge Factory, Credly, Badgr or Mochila EducaLAB Insignias are some of these platforms that manage the process of issuing badges for a training process from start to finish [10], where badge value depends on their metadata and the training to which they refer.

On the other hand, the emergence of this phenomenon has led learning management systems (LMS) to adopt new functionalities like the management of digital badges delivered either automatically after completing a series of activities or manually.

III. METHODOLOGY

A. Tele-Education Office courses

One of the missions of the Vice-Rectorate of Technological Services at the Universidad Politécnica de Madrid is to introduce digital culture throughout the university and encourage its digital transformation. Through the Tele-Education Office (GATE), the unit responsible for managing the university's e-learning platform and educational technologies, the Vice-Rectorate of Technological Services offers ICT training, taking advantage of the direct contact between this unit and university staff and its knowledge of these technologies.

Table I shows the 19 face-to-face courses offered by GATE, broken down according to three main topics or categories: educational ICTs, digital identity and the Moodle platform. Except for the three digital identity courses which target undergraduate, master's and doctoral students, these courses are mainly designed for university staff (academic and administrative personnel).

TABLE I. COURSES OFFERED BY GATE

<i>Courses</i>	<i>Topic</i>
Augmented Reality in Education	Educational ICTs
Tools 2.0 for the Teacher: Content Creation and Publication	Educational ICTs
Tools 2.0 for Information Management	Educational ICTs
LinkedIn. Improve your Digital Identity and Know its Educational Use	Educational ICTs
Tools 2.0 for Student Assessment	Educational ICTs
Basic UPM Blogs Course [Blogs]	Educational ICTs
Advanced UPM Blogs Course [Blogs]	Educational ICTs
Introduction to Social Networks and their Application in Education	Educational ICTs
Digital Identity Workshop	Digital Identity
GATE-UPM Digital Identity Workshop	Digital Identity
Researcher Digital Identity	Digital Identity
Gamification	Moodle platform
Student Assessment	Moodle platform
Collaborative Work in Moodle	Moodle platform
Group Management in Moodle	Moodle platform
Communication in Moodle	Moodle platform
Grade Management in Moodle	Moodle platform
Continuous Assessment	Moodle platform
Basics of Moodle	Moodle platform

B. Description of experience

All GATE course participants receive a certificate of attendance at the end of their training course. As of 2015, GATE began to award badges for some educational ICTs courses. This practice was first systematized in 2017 and extended to all the training courses offered by the unit. The study reported here focuses on the year 2017.

There are two different options for badge award depending on the type of training:

- Badgr platform for educational ICTs courses.
- Digital badges created and managed through Moodle for courses taught on this platform and digital identity courses, except for the first digital identity workshop.

Different platforms are used to distinguish the types of training. It makes sense to use Moodle platform badges for training courses as participants use this platform to submit their practical assignments which are already loaded in this space.

The Educational ICTs courses and the GATE-UPM Digital Identity Workshop are taught face-to-face and do not require any type of submission. Therefore, the Moodle platform is not used in order not to confuse participants. We opted to use Badgr, which offers additional functions for future initiatives, such as the possibility of associating educational evidence or creating higher-level combined tracks and badges.

Finally, the Researcher Digital Identity courses and Digital Identity Workshops are assessed according to student submissions. As a result, Moodle was again chosen for badge management. Badges were automatically awarded when students passed the different activities which were set and assessed by teachers.

C. Results generation

GATE provides its teachers with an online enrolment form (Google Forms) for each course. All the course information is stored in an Excel file, including the participants that finally attended the course and qualified for their certificate. We used this file containing the information on course participants, as well as the information offered by either the Moodle or Badgr platforms, in order to retrieve all the information on attendance and badges earned by the participants.

Once they had completed all the training activities, all participants were sent a 22-item survey divided into three categories: general information, use and utility.

The items in the first category were used to characterize the sample (age, gender, etc.), organizing the responses according to the courses that they had attended.

The other items focused on issues such as badge and the backpack use, as well as respondent badge and backpack knowledge, and their perception of the usefulness of digital badges in this type of training activities.

IV. RESULTS

Throughout this section, we analyse the results of the application of digital badges in GATE digital competence training courses throughout the 2017 academic year.

A. Overview of participants and courses

Table II shows the results of participation in the different training activities broken down by categories, listing information about the number of courses, editions, issued badges and number of participants according to their role at the university (academic staff, administrative staff and students). The column labelled Singular refers to the total number of individual and separate participants, irrespective of course attendance.

TABLE II. COURSE INFORMATION

	Moodle	Educational ICTs	ID Workshop	Total	
Courses	8	9	3	19	
Editions	35	12	3	50	
Issued badges	164	171	97	432	
Acad. staff	329	93	0	422	Singular 278
Admin. staff	39	91	0	130	78
Students	13	3	122	138	129
Total (participants)	392	176	122	690	486

For the Moodle platform courses, we found that there are many more editions than courses, especially of the gamification course, which, in view of the interest that the subject matter attracted, was held 19 times throughout the year. The other courses are held on average twice a year.

Comparing the total number of participants in each course and the *singular* value for each role, both administrative staff and academic staff attended more than one course. This did not apply in the case of students, because, depending on their educational level, they were, in principle, only eligible for one course type. However, it did apply for students who were university department scholarship holders and participated in courses designed for staff.

Looking at Table II, we find that the number of issued badges is not consistent with the total number of course participants. The relationship between participants and badges issued for the two badge management platforms needs to be further analysed across different course editions (Table III). This table also includes two columns listing the number of people who attended (Started) and completed (Finished) training actions that involved the submission of some sort of activity and a passing grade. Finally, the column labelled Issued refers to the issued badges.

TABLE III. ISSUED DIGITAL BADGES AND PARTICIPANTS

Platform	Editions	Started	Finished	Issued
Badgr	13	217	217	208
Moodle	37	475	450	216

In Educational ICTs courses using the Badgr platform, 95.8% of participants received their badges, compared to the Moodle platform-based courses where only 48% of badges were awarded. This was mostly due to ignorance and forgetfulness on the part the trainers.

For badges managed using the Badgr platform, the values of the Started and Finished columns match as the passing criterion was course attendance. The two Digital Identity Workshops (Table IV) are exceptions, as they required an assessment process where badge issue was automated by means of the Moodle platform.

TABLE IV. DIGITAL IDENTITY WORKSHOP (PARTICIPANT INFORMATION)

Course	Started	Finished	Issued
GATE-UPM Digital Identity Workshop	61	39	39
Researcher Digital Identity	22	19	19

B. Digital badge perception survey

Of the 486 participants in at least one of the offered courses, 74 (15.22%) completed the administered survey.

1) Course participants

It is important to characterize the sample to ascertain (Fig. 1) what type of audience attended the training courses.

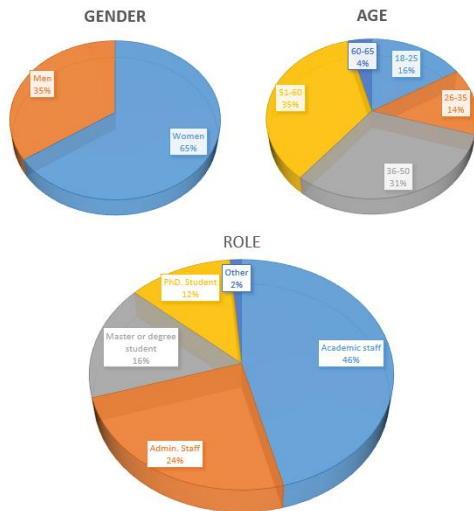


Fig. 1. Characterization of the course participants

Most respondents (66%) are aged from 36 to 60 years and are employed by the university in the capacity of academic staff, although there are some responses from all university roles.

2) Use of badges

The chart below (Fig. 2) analyses the badges earned by participants broken down by course type.

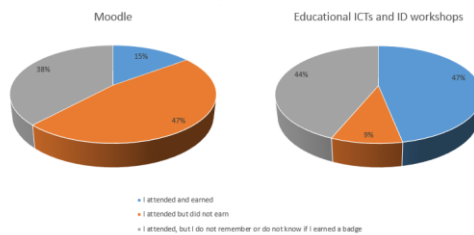


Fig. 2. Question: Which courses did you participate in?

Chart analysis confirms the results of Table III where Moodle course participants generally did not earn badges, whereas the participants in the Educational ICTs courses or the two Digital Identity Workshops did. Note that the course information shown in the right-hand chart suggests that 44% of participants did not know or did not remember whether they had earned a badge, even though badges were issued in the vast majority of cases.

The chart below (Fig. 3) refines the above question, showing the total number of badges earned by respondents according to their university role and their age.

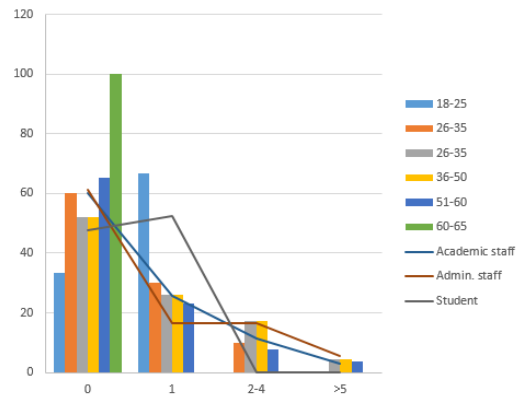


Fig. 3. Question: How many badges have you downloaded from the courses you attended?

Around 60% of respondents did not earn any badges, except the students who participated in the Digital Identity workshops that did obtain them mostly.

When asked if they had shared their badges on social networks (Fig. 4), it is noteworthy that students were the only ones to take advantage of portability, and 60% shared their badges.

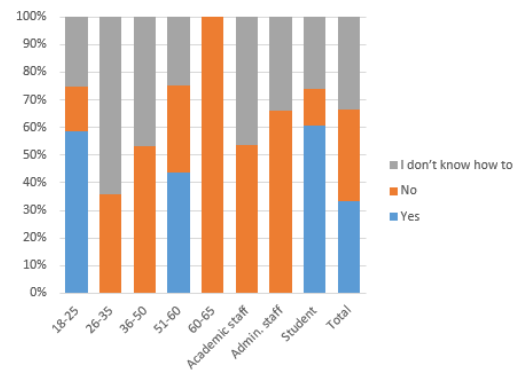


Fig. 4. Question: Have you shared any of your badges on social networks?

Following on from the previous question, users who earned badges were asked (Fig. 5) if they had embedded their badges into any web space: none of the respondents made use of this feature.

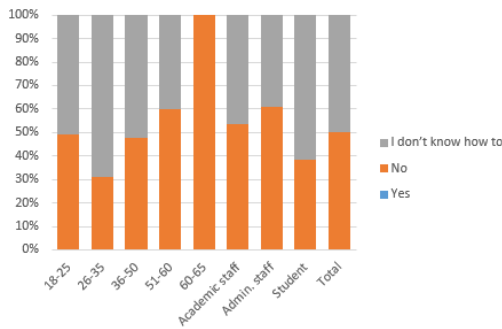


Fig. 5. Question: Have you embedded any digital badge into your website, portfolio or blog?

3) Use of backpacks

Backpacks are another key option for making the most of the use of digital badges. Backpacks enable badge earners to display their badges to any consumer interested in knowing what skills they have acquired throughout their academic life.

The chart below (Fig. 6) shows information about familiarity with backpacks broken down by respondent age and role within the university.

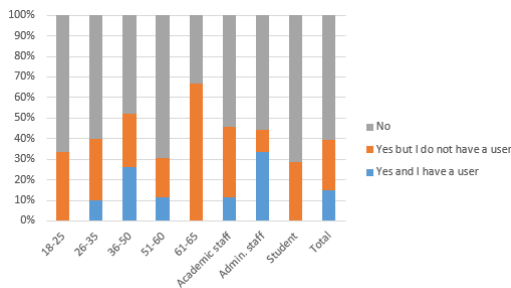


Fig. 6. Question: Do you know what a backpack or badge display is?

Generally, more than 50% of course participants were familiar with badge backpacks. Participants over 61 years old (only three) and aged between 36 and 50 years are most acquainted with backpacks, although it is the members of the latter age group that have a backpack user ID. Looking at the roles, more than 30% of administrative staff had a user ID for at least one of the existing badge storage and display platforms.

Respondents were first asked (Fig. 7) about the use of digital backpacks for uploading digital badges.

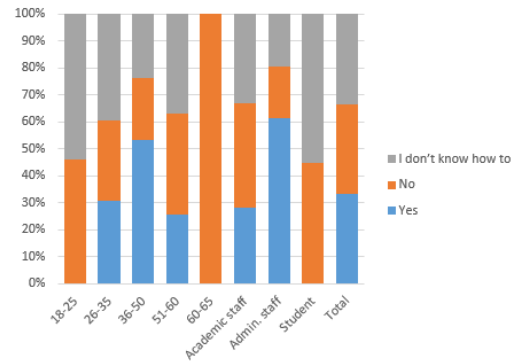


Fig. 7. Question: Did you upload any of your badges to a badge backpack?

More than 30% of all respondents, especially 35- to 50-year-old administrative staff used a backpack to upload the badges that they had earned.

V. CONCLUSIONS AND FUTURE WORK

Applying the digital transformation process will require new forms of accreditation, compared to traditional printed or scanned versions of certificates. Digital badges are a solution adapted to the needs of digital competence training offered in higher education.

Generally, the results suggest that respondents are largely unfamiliar with digital badges, and 44% did not even know or remember whether they had earned a badge.

One advantage of badges is the portability option, where digital backpacks constitute a perfect storage space. More than 50% of the respondents were unfamiliar with backpacks. None of the respondents embedded their badges into any kind of web platform, and only the members of the youngest age group, mostly students, shared their badges on social networks.

Raising badge earner awareness is not the only issue. The training staff that issue badges must also take responsibility for sending these credentials, as we have found that 52% of the Moodle platform course participants did not receive their digital badge.

After detecting the knowledge gap, our future lines of work will address actions to raise the awareness of university staff with regard to creating and issuing badges, as well as how to make better use of the badges that they earn from the training courses in which they participate, underscoring the benefits of displaying the badges that they have earned on backpacks and other web spaces.

During 2018, the Tele-Education Office is working on improving the information contained in each badge that it issues, detailing, according to the guidelines issued by the Common Digital Competency Framework for Teachers [24], the digital skills achieved after completing each training course.

ACKNOWLEDGMENT

GATE and the Vice-Rectorate for Technology Services are grateful for the support provided by the Vice-Rectorate for Academic Strategy and Internationalization.

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