Meta-Review of Recognition of Learning in LMSs and MOOCs

Cristina Alonso-Fernández
Computer Science Department
Autonomous University of Madrid
Madrid, Spain
cristina.alonsof@uam.es

Ruth Cobos
Computer Science Department
Autonomous University of Madrid
Madrid, Spain
ruth.cobos@uam.es

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***Abstract*—Recognition of learning techniques such as badges and micro credentials are broadly used in education. Both LMSs and MOOCs incorporate these techniques to inform learners of their achievements. This meta-review study aims to provide an overview of recognition of learning in both LMSs and MOOCs, by gathering previous literature reviews and overview studies in this field. The studies reviewed show multiple applications, mainly using badges and gamification in MOOCs. Results of the studies have been broadly positive and, together with the recommendations and lessons learned in previous research, encourage the future research in recognition of learning.**

Keywords—badges, recognition of learning, gamification, LMS, MOOC

I. Introduction

Recognition of learning is an important part of current education systems. With the digitalization of education, new techniques for digital recognition of learning are being developed and used in multiple educational environments. Badges [1], micro credentials [2], leaderboards, and other rewards for learning are different ways in which learners can obtain information about their achievements. The reasons to use recognition of learning techniques are multiple, including increasing learners' motivation, identifying their progress, and providing credentials or their learning and achievement.

Educational platforms also include possibilities for digital recognition of learning. Both Learning Management Systems (LMSs), commonly used in traditional formal education, and Massive Open Online Courses (MOOCs), widely used in distance education, incorporate some techniques to provide learners with information about their learning process and progress. LMSs such as Moodle manage and distribute learning activities for an institution or school, and they include the possibility to integrate recognition of learning such as badges [3]. MOOC platforms like edX or Coursera also include the possibility to issue badges as part of their online courses [4], [5].

While recognition of learning techniques are being applied in many educational contexts, the variety of techniques (digital badges, micro credentials, etc.) and platforms (LMSs, MOOCs) that provide recognition of learning limits the generalization of research and results in this area. The purpose of this study is to bring together the research carried out in recognition of learning with different techniques and in different contexts, to try to obtain some general overview of the field, and draw some conclusions, limitations, and areas of future work.

The rest of this paper is structured as follows: Section II summarizes some of the background of recognition of learning, particularly related to LMSs and MOOCs; Section III states the research questions of our meta-review work; Section IV describes the methodology followed; Section V presents the findings of our meta-review, which are then discussed in Section VI; finally, Section VII provides the main conclusions of our work, its limitations and future research areas.

II. Background

Digital techniques to report learning have been gradually integrated in educational scenarios. One of the most used is the issue of digital badges. A digital badge is "a representation of an accomplishment, interest or affiliation that is visual, available online, and contains metadata including links that help explain the context, meaning, process and result of an activity" [1]. These badges include data from learners that can potentially be used to prove that they have acquired certain skills, as such badges must have been issued after some expert validation [6], [7].

Initiatives like the Open Badges Project by Mozilla [8] provide a format for digital badges so that users can issue, earn, and manage badges through their platform. These open badges can be integrated and issued in multiple contexts including LMSs [3] and MOOCs [9].

Other approaches to recognition of learning have also been developed, such as the MoodleBadges Free library [10], to issue badges for the Moodle LMS. Researchers have also integrated recognition of learning approaches in MOOCs: for instance, [11] integrated Mozilla Open Badges in Google's massive open online course platform Course Builder.

Regarding research that gathers multiple experiences in LMSs or MOOCs, some authors have carried out systematic reviews focusing on different aspects of the learning process. For MOOCs, the systematic review of [12] focuses on learner experiences and perspectives of MOOC students, focusing on four main themes: motivation, engagement, satisfaction, and achievement. The authors found that these overlapping themes affect learners' experiences in MOOCs and should be considered by researchers, instead of simply focusing on completion rates. Another literature review [13] particularly focuses on methods to improve retention and completion rates. In their review, they found that the main

reasons for dropout include learner's insufficient time or motivation, low interactivity opportunities in MOOCs, or insufficient previous skills. We argue that recognition of learning techniques can be a way to tackle some of these issues, particularly low motivation, and engagement with MOOCs.

The purpose of this study is to conduct a meta-review on recognition of learning techniques in both LMSs and MOOCs. For that, we have searched for and reviewed works that contain systematic reviews, systematic mappings, or overview of challenges or experiences in the field. We expect works containing literature reviews or challenges/experiences to be focused on a specific recognition of learning technique and/or on a specific LMS or MOOC or sets of the same type. Therefore, to aggregate results concerning multiple types of recognition of learning and both LMSs and MOOCs, we decided to move a step upwards and conduct a meta-review of such works.

III. Research Questions

To guide the meta-review, we stablished the following research questions:

- RQ1: What literature review or overview works exist regarding recognition of learning in LMSs and/or MOOCs?
- RQ2: Which platform (LMS or MOOC) do the reviewed works focus on?
- RQ3: Which techniques do the reviewed works use for recognition of learning?
- RQ4: What are the conclusions drawn from the reviewed works?
- RQ5: What are the limitations and future areas of work pointed out by the reviewed works?

IV. Methods

The process carried out in this meta-review follows the PRISMA 2020 protocol [14] for literature reviews. This protocol specifies a list of items to verify in all steps of the process: title, abstract, methods, results, and discussion.

A. Search Process

The study focuses on literature review or overview works regarding recognition of learning in LMSs and/or MOOCs. To search for relevant papers, the IEEE, SCOPUS, and Web of Science databases were selected. Searches were not restricted by publication year. In each of the databases, searches were performed following a predefined set of terms, and were restricted to title, abstract and author keywords.

The search terms used are included in Table I.

The search query was linked using AND and OR operators to include at least one term of each category (platform, recognition of learning, and study type). The asterisk (*) wildcard was used in both MOOC and LMS terms to include both singular and plural words. The complete search query was:

TABLE I. Terms used in search grouped by category

Category	Search terms
Platform	MOOC, Massive Open Online Course, LMS, Learning Management System, Moodle, edX
Recognition of learning	Badges, Microcredentials, Micro credentials, Rewards for learning, Recognition of learning
Study type	Systematic mapping, State of the art, Systematic review, Literature review, Research review, Research synthesis, Challenges, Experiences

("MOOC" OR "Massive Open Online Course*" OR "LMS*" OR "Learning Management System*" OR "Moodle" OR "edX")*
AND
("badges" OR "microcredentials" OR "micro credentials" OR "rewards for learning" OR "recognition of learning")
AND
("systematic mapping" OR "state of the art" OR "systematic review" OR "literature review" OR "research review" OR "research synthesis" OR "challenges" OR "experiences")

B. Inclusion and Exclusion Criteria

To determine if the results of the database searches were relevant to the study, we stablished the inclusion and exclusion criteria stated in Table II.

TABLE II. Inclusion And Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
1. Journal and conference articles	1. Articles that present a single case study analyzing some recognition of learning in a single MOOC course or LMS
2. Articles that perform a literature review about recognition of learning in LMSs and/or MOOCs	2. Articles that have not been peer-reviewed
3. Articles that aggregate multiple experiences, challenges or provide a general overview of recognition of learning in LMSs and/or MOOCs	3. Articles whose full text is not available
	4. Articles not written in English

C. Selection Process

The studies obtained from the searches in the defined databases with the pre-defined set of terms were revised in a two-step selection process:

1. The title, abstract and keywords of each study were scanned to determine if they met the inclusion / exclusion criteria. Studies whose abstract clearly showed that they were not relevant for this meta-review were excluded. All other studies were marked as possible and moved to the second step.
2. For all remaining studies, their full text was retrieved, if available, and read in detail. Studies that did not meet the inclusion / exclusion criteria were excluded at this point. All remaining studies were marked as selected and moved to the quality assessment.

Both authors participated in the selection process and revised all articles to ensure the criteria were followed. All studies whose inclusion was doubtful were discussed by both authors until an agreement was reached.

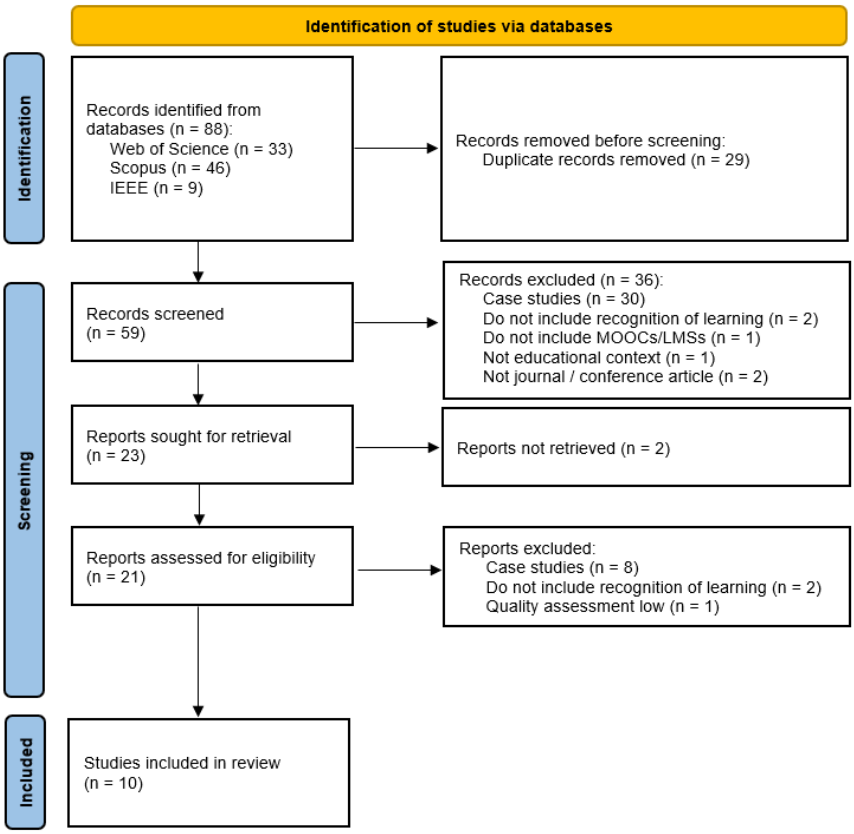

Fig. 1. Flow diagram of the meta-review. Figure adapted from the PRISMA 2020 flow diagram for new systematic reviews, available at https://prisma-statement.org/prismastatement/flowdiagram.

TABLE III. SUMMARY OF STUDIES INCLUDED IN THE META-REVIEW

Study	Publication year	Publication type	Country of authors	Platform	Recognition of Learning	Study Type
[15]	2017	Conference	Portugal	MOOC/LMS	Badges	Review/Experiences
[16]	2018	Conference	Jamaica, Netherlands	LMS	Badges	Challenges/Experiences
[17]	2017	Conference	USA	LMS	Badges	Challenges/Experiences
[18]	2021	Journal	Turkey	MOOC/LMS	Badges	Review
[19]	2018	Journal	USA	MOOC	Badges	Challenges
[20]	2017	Journal	Austria	MOOC	Badges	Challenges/Experiences
[21]	2018	Conference	Austria, Polonia	MOOC	Micro credentials	Review
[22]	2018	Conference	Austria, Netherlands	MOOC	Badges	Review
[23]	2019	Journal	Mexico	MOOC	Badges	Experiences
[24]	2020	Conference	Germany, Italy	MOOC/LMS	Badges/Micro credentials	Experiences

D. Quality Assessment

For the remaining studies, a quality assessment was performed. The assessment tool was based on the JBI checklist for systematic reviews and research syntheses3. The checklist includes 11 questions to be assessed on a yes-no-unclear-not applicable scale. All studies remaining at this point of the process were assessed with that questionnaire. If a study obtained more "no" and "unclear" answers than positive answers, the study was excluded for the meta-review due to poor quality.

E. Data Extraction

For all selected studies, a set of data was extracted to be analyzed:

- Type of publication: journal or conference
- Year of publication
- Country of authors
- Type of article: literature review, systematic mapping, etc.
- The platform (LMS or MOOC) center of the study
- The recognition of learning technique they focus on
- For literature reviews, characteristics of the search (databases, search terms, etc.) and final number of works analyzed
- Main findings stated in the study
- Main limitation stated in the study
- Main areas of future work stated in the study

V. Findings

A. Results Overview

Fig. 1 describes the flow process carried out in the meta-review. The initial search in the databases yielded 88 articles, out of which 29 were duplicates. The title and abstract of the remaining 59 studies were scanned for inclusion. Most excluded articles were due to exclusion criterion "Articles that present a single case study analyzing some recognition of learning in a single MOOC course or LMS". The remaining articles were read in detail, if their full text was available, and their quality assessed. When the process was completed, the final 10 articles were read in detail to extract the data stated in Section IV E.

A summary of the final ten studies included in review is presented in Table III. Column "Study type" aggregates the results based on the "Study type" term (see Table I) under which they appeared in the search: particularly, studies using the terms "systematic mapping", "state of the art", "systematic review", "literature review", "research review", or "research synthesis" are categorized under the term "Review" while "challenges" and "experiences" are categorized under the terms "Challenges" and "Experiences", respectively.

B. RQ1: What literature review or overview works exist regarding recognition of learning in LMSs and/or MOOCs?

As we can see in Fig. 2, in four of the studies in review (see Table III) their authors present a systematic review, a literature review or a state of the art related with the recognition of learning in LMSs and/or MOOCs. Four of them the studies present which were the challenges treated in this area. And in six of them several experiences are presented.

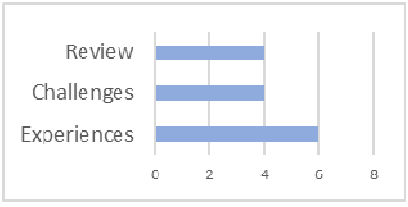

Fig. 2. Number of studies in review of each type.

C. RQ2: Which platform (LMS or MOOC) do the reviewed works focus on?

As we can see in Fig. 3., almost all studies in review are related to the recognition of learning in MOOCs. Moreover, in three of them the studies are presented both for MOOCs and LMSs. On the one hand, there are experiences in different MOOC platforms such as MexicoX platform at Latinoamerica, iMOOX and OpenVM Hub at Europe. On the other hand, most of the experiences present in LMSs are carried out in the Moodle platform.

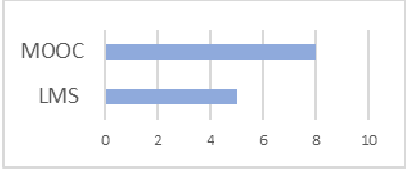

Fig. 3. Number of studies in review in MOOCs and LMSs.

D. RQ3: Which techniques do the reviewed works use for recognition of learning?

As we can see in Fig. 4., almost all studies in review present the use of badges as the way to recognize learning; from these studies six of them present the use of leaderboards, too. Only two of the studies present the use of micro credentials.

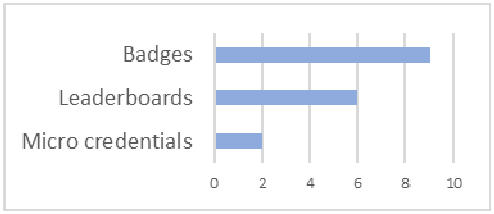

Fig. 4. Number of studies in review on each way of recognizing learning.

E. RQ4: What are the conclusions drawn from the reviewed works?

As stated in RQ2 results, 5 studies address recognition of learning in LMSs (3 of which also mention MOOCs), while the remaining 5 studies focus on MOOCs.

For the studies of LMSs, [15] focuses on badges, reviewing their evolution in history until they became digital and used in education. It explores the uses of badges in education and some of the tools currently available online to issue and save badges. As such, authors mention digital badges initiatives (e.g., Mozilla Open Badges, Digitalme, GO2B, EBA, Badge Alliance, OBN, LRNG, LearningTimes), Open Badges infrastructures (e.g., Credly, BadgeOS, Badge List, Canva Badges, Badgr), badges repositories (e.g., Mozilla's OpenBadges Backpack, Open Badges Passport), and educational platforms which include the possibility of issuing Open Badges (e.g., Makewav, Edmodo, SAPO Campus, Moodle, Canvas network). Authors review the classification made by [1] of the purposes of badges in education: (1) motivation, to attract interest, or guide action; (2) recognition and credentialing, of accomplishment or skill revealed; (3) evidence of achievement, to use the badge outside school; and (4) research in education. Finally, the study reviews 84 recent international projects that focus on badges, including "Cities of Learning" (USA) and "Open Badge Network" (EU). Results of that analysis show that around 30% of projects focus on students, around 10% on teachers, and around 20% on both. The main categories of badges used are for award and motivation (around 30%) and for credentialing (around 20%), with less common badges used for authority, sequence and orientation, recognition, evidence of achievement and experience. As final recommendations, authors state that badges must have clear goals for students to understand how to earn them. And for teachers to use badges in classrooms, they should carefully choose the platform to issue badges, and use repositories to keep them. It should also be considered that badges can be used in multiple educational contexts (formal, information, non-formal) and for different stakeholders (students, teachers, communities, etc.)

The second LMS-centered study focuses on badges in Moodle. Study [16] discusses technological and implementation issues associated with a Moodle-based badge system designed to motivate introductory programming

TABLE IV. SUMMARY OF STUDIES INCLUDED IN THE META-REVIEW

Study	Topic	Conclusions	Recommendations
[15]	Badges in education	Badges mainly used for motivating students	Clearly define purpose and use of badges
[16]	Badges in Moodle	Importance of technology in isuing badges	Plan and map learning activities with badges
[17]	Gamification in Moodle	Gamification used to increase motivation	Include immediate feedback and possibility to repeat tasks
[18]	Gamification in flipped learning	Positive effects of including gamification	Include game element in flipped learning
[19]	Assessment in MOOCs	Importance of including assessment	Peer assessment is the most adequate approach
[20]	Certification in MOOCs	Collecting badges impacts motivation	Include participation badges for motivation
[21]	Microcredentials for entrepreurship education	Microcredentials offer is rapidly increasing	Evaluate MOOCs for EU consistency
[22]	Gamification in MOOCs	Badges and leaderboards most used	Studies needed on gamification in MOOCs
[23]	Gamification in MOOCs on energy sustainability	Positive effect on engagement and completion	MOOCs should include storytelling elements
[24]	Gamification in mini-MOOCs	Positive effect of some design elements on engagement	Include flexible learning pathways, self-assessment, and learning supports

learners. The study presents four experiments carried out from 2015 to 2017 in several editions of a course at Moodle platform with students who were pursuing a bachelor's degree in Computing. In each experiment the badge system contained a set of badges, that could be different form one experiment to another considering five factors primarily adopted from the IT implementation framework to supports the badge system: assessment of needs, choice of technology, technological infrastructure, system and environmental factors and evaluation. After the analysis of these experiments the authors proposed these recommendations: (1) carefully plan and map learning activities associated with badges or other gamification elements, (2) choose a technological platform according to needs and learning activities, (3) important implementation factors include how learners interact with the badge environment to achieve learning objectives and how the system supports badge success, (4) monitor and evaluate system performance continuously and obtain early, periodic feedback from potential badge awardees and (5) establish and maintain good relationships with support teams, instructors, technological units, technical administrators etc., and seek out expert users of badge systems.

Study [17] analyzes gamification in LMSs (particularly Moodle). It describes how various engineering course activities were modified to incorporate game-like elements. Then, a survey was conducted to analyze how students perceived that gamification impacted their motivation and learning. In detail, game-like elements were added into five electrical and computer engineering (ECE) courses offered on Moodle in 2016. The gamification elements were experience points (XP), badges, levels, leaderboards, and quizzes that could be taken multiple times. Initially, in spring 2016 only badges were used as the reward system, later with the advent of new Moodle plugin 'Level-up!', all the elements mentioned above were able to be incorporated. From the study survey, in the opinion of the students, their main barrier to learning was lack of time. Most of the students identified that increasing the motivation to learn is a goal of gamification. Most of them play a game to win and to a lesser extent explore and socialize. The aspect that students thought was most helpful was when immediate feedback was provided, and they confirmed that repeating questions was deemed the most helpful activity.

Another study focusing on LMSs addressed the scenario of using gamification in flipped learning. The study [18] conducted a systematic literature review of 22 journal articles (from 2010 to 2019) on the use of gamification in flipped learning. The purpose of the literature review was to verify if adding game elements to learning activities increases the motivation of the non-motivated students in flipped classrooms, as flipped learning works better for self-motivated students. The study focuses on LMSs as they are often used for the out-of-class part of flipped learning, so adding gamification in LMSs may increase student engagement and motivation. The main research questions of the literature review were to determine the characteristics and methods used in research on gamified flipped learning, the environments and tools used, the game elements used, and variables studies and effects of gamified flipped learning. Their findings suggested that adding game elements into a flipped classroom has positive effects: increases motivation, participation and learning performance. Most studies obtained such results comparing their gamified group with a non-gamified flipped learning control group, over short periods of time (less than 4 months). Doing so, all but one study reported positive impact. Moodle and Kahoot were the preferred platforms for gamified flipped learning; while only one study used gamification in MOOCs [25] Points, badges and leaderboards were the game elements most used for gamification, and most studies included more than one game element.

The other set of studies focused on MOOCs, particularly addressing assessment [19], certification [20], micro credentials [21], and gamification [22]–[24]. Notice that the last study proposes MOOCs but implemented on the LMS Moodle.

Study [19] focuses on assessment in MOOCs, particularly xMOOCs, from two perspectives: formative assessment (to evaluate students' current progress) and summative assessment (to record students' cumulative progress). The article first discusses the importance and challenges of implementing assessment in MOOCs, stating different methods for formative assessment (e.g., machine grading, peer feedback) and for summative assessment (e.g., awarding certificates and badges). Regarding assessment format, for formative assessment, discussion forums, Q&A sessions, or peer assessment are common options; while for summative assessment, formats are more limited including machine grading and peer assessment. Therefore, authors conclude that peer assessment is the only approach that can be applied in MOOCs for both types of assessment (summative and formative) and for different assignment formats. Finally, the study discusses challenges about

implementing peer assessment in MOOCs, mainly the fact that only motivated learners are likely to participate. For that, it needs to be ensured that those who give the assessment understand all rubrics, guidelines and processes, and that competent raters are selected to give those credible assessments.

Study [20] explores certification in MOOCs. As certificates can motivate students to complete MOOCs, authors explore aspects of certification (focusing on PDF certificates and electronic badges), and provide insight based on the Austrian MOOC platform iMooX. This platform was founded by the University of Graz and Graz University of Technology in 2014 and offers xMOOCs, awarding PDF certificates. A system to award two types of badges (*Quiz-Mastery-Badges* and *Certificate-of-Participations-Badges*) was later incorporated. The study explores both certifications in several courses. PDF certificates were used in two MOOC courses: in one of them, most participants were students that did not need the certificate, so they were not motivated to complete course, while in the other, the certificate was mandatory for completing the lecture, so they were motivated. Badges were explored in seven MOOC courses, offering 44 different badges to learners (37 Quiz-Mastery-Badges, 7 Certificate-of-Participations-Badges). However, as issuing badges was not mandatory, around 80% of participants did not issue them. Among those students who issue badges, their dropout rate was significantly lower than that of those students who did not issue badges. Authors conclude that collecting badges seems to have a clear impact on learners' motivation to continue in the MOOC. Therefore, while traditional certification (i.e., PDF certificates) strongly bases on extrinsic motivational factors, participation badges seem more motivating, but only for a smaller group.

Study [21] evaluates the state of the art on the developments of MOOCs and Micro-credentials dedicated to entrepreneurship education. In the case of MOOCs, two MOOC aggregators Class Central and MOOC List as well as five MOOC platforms, Coursera, edX, Future-Learn, Udacity and Kadenze, have been used to identify the 238 existing courses (study conducted in 2018). In the case of Micro-credentials, two MOOC platforms Coursera and edX lead at this early development stage of Micro-credentials. This study presents a list of Micro-credentials on the market [26] and an overview of 11 entrepreneurship micro-credentials on the above-mentioned platforms. The Micro-credential offer is growing rapidly, responding to the learner preferences of modularity, stackability and competence-based education. Both in the case of entrepreneurship MOOC offer that in the case of micro-credentials, most of them are focusing on how to start your own business and teaching universal entrepreneurial skills. Authors recommend evaluating existing MOOCs against the EU EntreComp Framework to recognize the consistency and reliability of entrepreneurship MOOCs and Micro-credentials for EU learners, educators, and policy makers.

Gamification in MOOCs is studied in three of the articles included in the meta-review. The first of which [22] conducts a review of the state of the art of 18 articles from conferences proceedings and journals indexed in Web of Science (from 2013 to 2017) on research on the combination of gamification and MOOCs. The purpose of this review was to provide an overview of studies on gamification in MOOCs, types of research studies, theories applied, gamification elements implemented, methods of implementation, the overall impact of gamification in MOOCs, and the challenges faced by researchers and practitioners when implementing gamification in MOOCs. This review revealed that most of the studies were conceptual and theoretical, the low number of empirical studies made suggested that there is a need to empirically examine the effect of gamification in MOOCs. The use of gamification was mainly on web browsers, and the most used elements in the application of gamification in MOOCs are badges, leaderboards, progress, and challenges. Gamification was mainly used to enhance motivation followed by enhancing student engagement, and most of the empirical study publications have shown a positive impact on motivation and engagement when using gamification in MOOCs. In general, there is lack of using well-defined theories in the use of gamification elements in MOOCs. And the most reported challenge was that gamification approaches were applied for a certain type of learners and not generalized.

Study [23] analyzes the application of gamification strategies in 12 x-MOOCs on energy sustainability, to extract findings about how it affects participants' engagement and seeks to identify what types of interactive gamification media are more useful in generating interest and motivation in students. These 12 MOOCs were offered on the MexicoX platform [27] and on edX [28] from January 2017 to September 2018. The courses at MexicoX platform included a panel or gamification board with challenges, badges, and leaderboards. This board manages to create competition among MOOC participants in a particular manner, which can influence the creation of learning communities. The authors presented in this study that the use of gamification in MOOCs positively affects engagement and completion rates. The gamified platform was analyzed using the integrated theoretical gamification model in e-learning environments called E-MIGA [29]. The authors extracted that traditional xMOOC models, keeping users as passive learning entities, can be monotonous and decrease users' attention. Moreover, the students' engagement is affected if there is no human intermediation between users and platforms. Finally, users with very heterogeneous profiles and levels enroll these courses, the E-MIGA model recommends that MOOC platforms have narrative and storytelling that allows evaluation and personalization of levels by users through certain exercises, which would somehow even out the different enrollment profiles.

Finally, study [24] presents a meaningful gamification approach applied to the design and facilitation of a series of eight mini-MOOCs in a learning environment called Open Virtual Mobility Learning Hub (OpenVM Hub [30]), which is based on LMS Moodle with integrated badging and e-portfolio systems. OpenVM mini-MOOCs are designed following the principles of micro-learning and aim to provide alignment of micro-learning objectives, micro-learning activities and micro-learning assessment with micro-credentials based on the Open Badges metadata standard. The study examines learner experience in meaningfully gamified MOOCs in the OpenVM Learning Hub by analyzing data from the evaluation survey answered by 945 learners. The results indicated that especially five design elements have most positively impacted learner engagement in OpenVM MOOCs, these elements were: (1) multimedia OERs, (2) flexible learning pathways, (3) opportunities for self-assessment, (4) support of learning and (5) digital

credentials (Open Badges). Elements such as e-portfolios, peer-assessments and communication forums have been viewed as less helpful for learning.

F. RQ5: What are the limitations and future areas of work pointed out by the reviewed works?

Several authors have pointed out that more work is needed, as so far research has insufficient evidence to generalize results [18], [20] more research needed over longer periods of time [18], and more research needed with larger sample size [18]. Also, insufficient empirical studies have been conducted, for instance, there is a need to empirically examine the effect of gamification in MOOCs [22]. Results also show mixed effects of recognition of learning in studies: e.g., some students can have negative reactions to badges or leaderboards [18].

For the implementation of gamification elements in MOOCs, particularly: researchers should consider a multidisciplinary approach by collaborating among researchers in education, psychology, design, user experience and learning analytics [22]. To know how learner engagement can be enhanced by gamifying MOOCs in a meaningful way could be useful to combine other sources of data including qualitative data (e. g. from interviews) and learning analytics [24]. There is problem of consistency and standardization of MOOCs, making it possible to evaluate their significance and compare them [21].

Authors further recommend allowing evaluation and personalization of levels by users through certain exercises, which would somehow even out the different enrollment profiles [23]. It is needed to study whether gamification in some courses adversely affects non-gamified courses [17]. It is recommended to have activity log reports and solicit class feedback on badge achievements during an experiment [16].

VI. Discussion

The studies reviewed have provided several indications and results on how recognition of learning techniques affect learners in both LMSs and MOOCs scenarios. However, such impact is not generalized, and results tightly relate to the context. Authors argue that effectiveness of some digital recognition of learning varies depending on the learner and the context: for instance, [31] found that different types of badges had different impact on students' motivation and that also depends on learners' characteristics (e.g., prior knowledge, performance). Overall, the results of the studies show that adding gamification elements has positive effects (increases motivation, participation, engagement, learning performance, course completion rates). As such, some authors have pointed out that adding recognition of learning (e.g., badges) may help to tackle some issues such as low retention rates in MOOCs, by motivating learners to continue the courses.

Despite these results, the limitations pointed out by the authors of the studies, mainly the need of further research over longer periods of time and with larger sample sizes, clearly restricts the generalization of the results obtained so far in the field. Nevertheless, most studies adding recognition of learning (e.g., badges) or gamification techniques to MOOCs and LMSs courses have reported positive results, so future research on the impact of these techniques is clearly encouraged.

To conduct such future research, recognition of learning needs to be considered from the early design of MOOCs and LMSs. Authors argue that the effective design of MOOCs is essential to face the challenges of recognition of learning [32]. For that, authors recommend including design elements that positively impact engagement, for instance flexible learning pathways, self-assessment, support of learning and digital credentials (Open Badges). More in detail, it is recommended to analyze the specific function of badges, the structure of badge systems, and the different types of design and interaction features used with badges [6].

When adding badges, information needs to be provided to students so that they can clearly understand how to earn them; while teachers should carefully choose the platform to issue badges and use repositories to keep them. It should also be considered that badges can be integrated in different educational contexts (formal, information, non-formal) and for different stakeholders (students, teachers, communities, etc.). The learning activities associated with such badges or other recognition of learning tools should be carefully planned, and feedback should be given to students on their performance.

VII. Conclusions, Limitations and Future Research

The meta-review conducted has revised 10 overview or literature review studies of recognition of learning techniques in LMSs and MOOCs. The variety of platforms and goals of these studies clearly restricts the extraction of overall conclusions and generalization; however, these studies provide an overview of this broad field that could be used for future research on the area.

The studies reviewed include different types of gamification and recognition of learning techniques, with more studies focusing on MOOCs than in LMSs (mainly Moodle). Badges are the preferred way for recognition of learning in the studies. Results show that the addition of these techniques positively impacts learners' motivation and engagement.

The meta-review is limited by the search terms used, and the variety of the field of study. In the future, more databases and terms may be included to expand the search scope. Nevertheless, the studies included in the meta-review have in turn provided a broad overview of their respective fields. Taking them together, we have grouped several initiatives including badges and gamification in MOOCs and LMSs.

The positive outcomes gathered in this field so far encourage future research, that should consider the recommendations made by authors, studying applications in longer periods of time and sample sizes, and combining different data types (e.g., learning analytics [33]). These applications may also consider different stakeholders and learning environments, all of which can benefit from the use of recognition of learning techniques.

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* Studies marked with asterisk indicate the studies included in the meta-review.

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