TÉCNICO LISBOA

# Gamification for MOOC online courses

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## Computer Science and Engineering

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## Resumo

Um dos principais problemas dos Massive Open Online Courses (MOOCs) é a baixa taxa de retenção de alunos e uma alta taxa de não comparecimento. Enquanto isso, na última década a gamificação tem ganho notoriedade na educação. Esta pesquisa começa com uma Revisão Sistemática da Literatura que explora o impacto que a gamificação teve nos MOOCs, como seu sucesso está a ser medido, quais são as teorias normalmente associadas a esses ambientes de aprendizagem gamificados e quais elementos de design de jogo são usados, bem como sua implementação e resultado. Revimos 22 artigos que datam de 2014 a julho de 2019. Os nossos resultados são positivos, com um aumento geral na participação e retenção nos MOOCs gamificados. A segunda parte desta pesquisa consiste na análise dos resultados e questionário de um MOOC não gamificado. Discutimos os diferentes identificadores de desempenho para identificar o sucesso do curso.



**Palavras-chave:** MOOC, Gamification, Motivação, Taxa de Retenção, Revisão Sistemática da Literatura

## Abstract

One of the main problems of Massive Open Online Courses (MOOCs) is the low retention rate of students and a high no-show rate. Meanwhile gamification has been gaining notoriety in the last decade within the education field. This research starts with a systematic literature review which explores the impact gamification has had in MOOCs, how their success is being measured, what are the theories normally associated with these gamified learning environments, and what game design elements are used as well as their implementation and outcome. We've reviewed 22 papers dating from 2014 to July 2019. Our findings are positive in terms of the outcomes, with a general increase in participation and retention on gamified MOOCs. The second part of this research consists of an analyzes of the results and questionnaire of a non-gamified MOOC. We discuss the different identifiers of performance to identify the success of the course.



**Keywords:** MOOC, Gamification, Motivation, Student Retention, Systematic Literature Review

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# Chapter 1

# Introduction

## 1.1 Topic Overview

Gamification as the use of game design elements in non-game contexts [1] has been researched in several domains such as Health/Exercise, Crowdsourcing and most notably Education/Learning. The latter corresponding to the 46.7% and 35.4% of empirical and non-empirical papers on gamification, respectively [2]. This rapid rise of academic literature on gamification started in 2011 [2] and gamification is becoming more mainstream and could be a potential strategy to apply to Massive Open Online Courses (MOOCs) and raise retention.

MOOCs showed up in the last decade, with 2012 being called by The New York Times as 'the year of the MOOC' [3]. They are *Massive*, meaning the number of people who can enroll is typically unlimited, only limited by the platform it is in. *Open*, meaning anyone can participate and it's usually free, sometimes including paid extra content or a paid certificate of participation. *Online*, meaning anyone anywhere with internet can participate and get an education even if unable to move around. And *Courses*, meaning a group of lessons in a particular subject, normally at a university level, leading to an examination or qualification. These qualities present a great potential to bring education to anyone with access to the internet.

By their very nature MOOCs offer a distance learning for all sorts of individuals, being especially beneficial for those who do not have access to a traditional higher education setting. Butcher and Rose-Adams [4] have found that in their study sample of part-time distance learners this type of distance education was at times their only option, making clear the need for further research in the area.

Retention Rates (RR) is the percentage of users having completed the course. MOOCs' low RR are a predominant problem with rates of less than 10% [5]. A low retention rates mean students have an investment but no true benefit (i.e. a certificate of participation). This is the main problem we'll be addressing, MOOCs' low retention rate. Although Jordan [5] was performed at the beginning of the study of MOOCs, a quick search of the literature shows that the problem persists.

A potential candidate to improving RR in MOOCs is gamification, this has been shown by the success of Vaibhav and Gupta [6] when applying game design elements in their MOOC. This highlights our first

motivator for this study, the impact that gamification has had on education already.

## 1.2 Motivation for Systematic Literature Review

We've found one existing literature review [7] and one Systematic Literature Review (SLR) [8] on gamification in MOOCs, both studies were not extensive and had a low number of empirical studies analyzed. Because of this short literature we decided to conduct a SLR as a way to concise the existing literature and examine how it's being studied.

Our SLR explores the impact gamification has had in MOOCs, how their success is being measured, what are the theories normally associated with these gamified learning environments, and what game design elements are used as well as their implementation and outcome. We've reviewed 22 papers dating from 2014 to July 2019. The findings of the SLR were positive in terms of the outcomes, showing a general increase in participation and retention on MOOCs with gamification elements.

With engagement in courses so low our goal is to see how gamification is implemented in MOOCs, and how it's impact is being measured. We'll look into the motivational theory used to support the choice of game design elements, to the objective behind it's implementation and later the effects it all had on users.

## 1.3 Motivation for Analyzes of a Non-Gamified MOOC

After the conclusion of the SLR we became interested in the different identifiers of performance which define success in MOOCs. Identifiers of performance are the methods used to evaluate MOOCs and their overall performance, with the most common being RR.

We looked into the different identifiers of performance and what each could tell. We studied a course at MOOC Técnico (`https://mooc.tecnico.ulisboa.pt/`) named *ISO27001*. This MOOC started on 9th November of 2020 and went on for four weeks.

## 1.4 Thesis Outline

To develop a solution first we did a systematic literature review as a way to concise the existing literature and to examine how it's being studied.

This is document is structured as follows:

- Chapter 2 explains the theoretical concepts useful for this research;
- Chapter 3 explains the two research methodologies followed, which influenced the structure of our research;
- Chapter 4 contains the first step of the SLR, planning the review;
- Chapter 5 contains the second step of the SLR, conducting the review;

- Chapter 6 the third step of the SLR, reporting the review;
- Chapter 7 discusses what identifiers of performance are used to evaluate MOOCs;
- Chapter 8 finally we'll discuss the final conclusions of this research, it's limitations and future works.

# Chapter 2

# Theoretical Background

In this section we'll explain the concepts useful for the rest of this research.

## 2.1 MOOCs and Gamification

Despite the promising qualities Jordan [5] who analyzed the initial trends in MOOCs showed averages completion rates of 9.8%, ranging from 1.4% to 50.1%, with average enrollments of 42,844 user.

Meanwhile gamification as the use of game design elements in non-game contexts [1] has been researched in several domains such as Health/Exercise, Crowdsourcing and most notably Education/Learning. The latter corresponding to 46.7% and 35.4% of empirical and non-empirical papers, respectively, on gamification [2] . This rapid rise of academic literature on gamification started in 2011 [2] and is becoming more mainstream and could be a potential strategy to apply to MOOCs.

Domínguez et al. [9] concluded that gamification in e-learning platforms has the potential to increase student motivation, when designed and implemented with thought. Dicheva et al. [10] came to the same conclusion. When conducting a literature review they found that most authors agreed gamification has the potential to improve learning, however they further explained that empirical evaluation is still scarce. But most importantly they emphasized the difficulty of correctly implementing gamification to increase motivation.

In a subsequent critical review Dichev and Dicheva [11] reported that the use of gamification in education studies lacks a theoretical background. This is in line with our own findings in section 6.3. Landers [12] too pointed out the need for a theoretical model that relates the game design elements to its learning outcomes.

## 2.2 Self-Determination Theory

*Self-determination theory* (SDT) was originally developed by Deci and Ryan, and it is an empirically derived theory of human motivation and personality in social contexts [13].

SDT distinguishes between intrinsic and extrinsic motivation. An intrinsically motivated individual will do an activity because it is inherently interesting or enjoyable, not because of an external source. While an extrinsically motivated individual will perform a task for an external outcome different from the task itself.

For Niemiec and Ryan [14] intrinsic motivation satisfies the need for competence, autonomy and relatedness. Students are *autonomous* when choosing to spend their time and energy on a class. Autonomy in this matter is not equal to independence or individualism [15]. *Competent* is present when an individual is able to do their work. If for example students are competent but not autonomous the state of intrinsic motivation will not be maintained.

Ryan and Deci [16] showed also that the more students were externally regulated (controlled) the less they showed interest, value, or effort. These findings agree with Landers et al. [17] who states that if users in areas like education only find external rewards to motivate them, their genuine interest in the activities may not be present. In fact an individual may shift intrinsic instincts to extrinsic ones if rewards are present [17]. For students many tasks are inherently interesting or enjoyable, and knowing how to promote more active (self-determined) forms of extrinsic motivation becomes an essential strategy for successful teaching [16].

It is important to emphasize that intrinsic motivation although important is not the only type of self-determined motivation [18] (see figure 2.1).

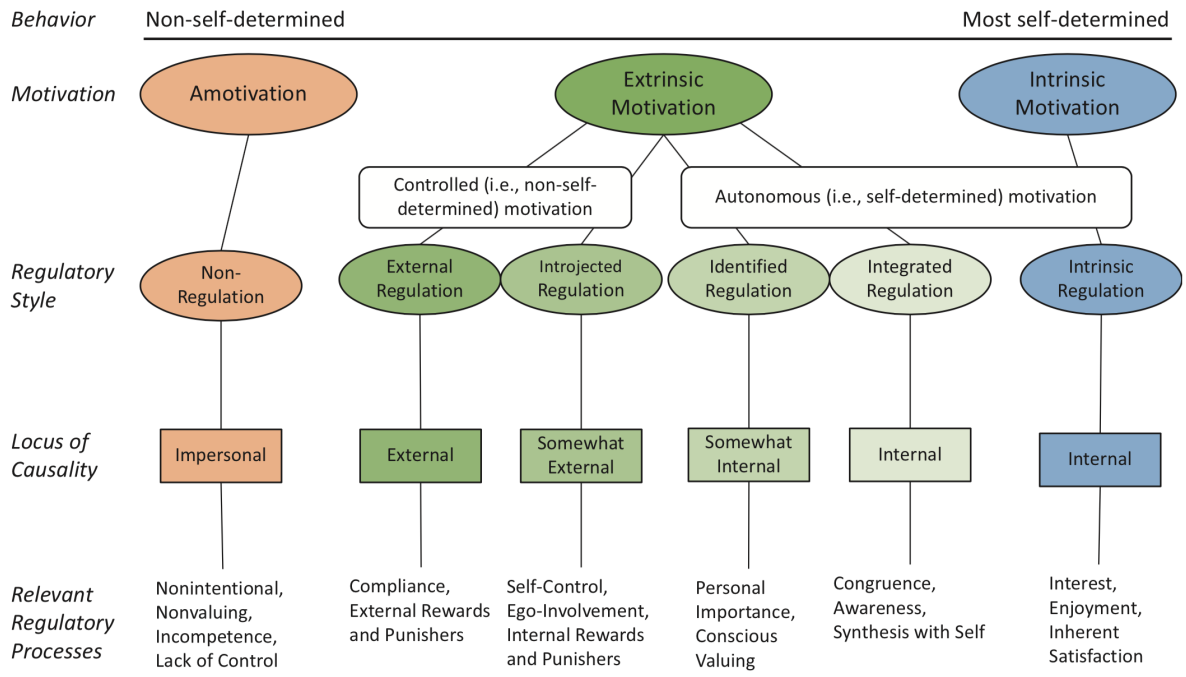


Figure 2.1: The internalization continuum: types of motivation according to self-determination theory from Legault [19]

This sub-theory of SDT is called organismic integration theory, in the figure it shows from left to right the degree to which motivation are self-determined [15]. For students, knowing how to promote more active (self-determined) forms of extrinsic motivation becomes an essential strategy for successful

teaching [16], since not all students are intrinsically motivated by a specific subject matter.

Since self-determined types of motivation are the ones we should focus on to motivate students. In *identified regulation* there is a conscious valuing of a behavioral goal or regulation [15]. Next comes *integrated regulation* comes when ones values align with ones needs, this differs from intrinsic motivation because a behavior is still done to achieve an external outcome. This state of motivation is also characterized by a greater sense of autonomy in a individual.

These two types of autonomous extrinsic motivation are associated with the three basic needs also associated with intrinsic motivation (competence, autonomy and relatedness) [15].

## 2.3 Flow Theory

Csikszentmihalyi [20] defined flow as a state of absorption in one's work characterized by intense concentration, loss of self-awareness, a feeling of being perfectly challenged and a sense that time is flying. It's a balance between challenge and skill (see figure 2.2).

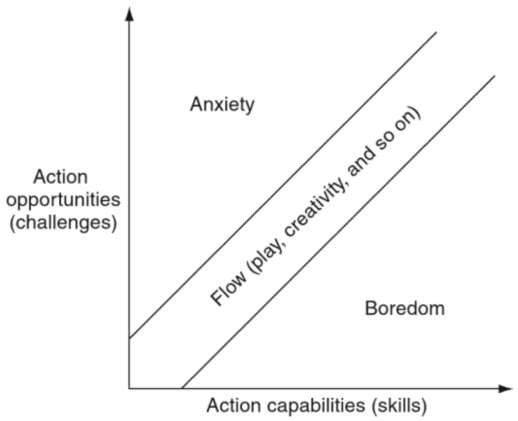


Figure 2.2: Model for flow state from Nakamura and Csikszentmihalyi [21]

Flow has also been defined as an optimal state of intrinsic motivation [22]. A person *in the flow* is so involved in an activity that nothing else seems important [23].

Csikszentmihalyi [20] defined flow as a state of absorption in one's work characterized by intense concentration, loss of self-awareness, a feeling of being perfectly challenged and a sense that time is flying, it is an optimal state of intrinsic motivation [22]. A person *in the flow* is so involved in an activity that nothing else seems important [23].

Aparicio et al. [24] say flow won't help gamification. It can however be used to plan difficulty of badges [25], meaning to plan the difficulty of small goals. When reviewed alongside with SDT, Flow Theory can help us to know when to set rewards, and what those rewards should be.


Figure 2.3: Engagement Loops from Werbach and Hunter [26]

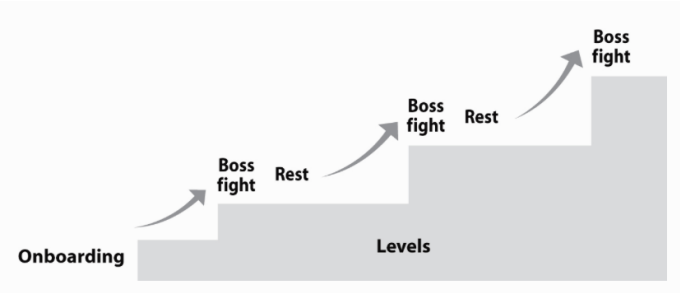


Figure 2.4: Progression Stairs from Werbach and Hunter [26]

## 2.4 Game Design

After analyzing the game design elements used in the literature we can't just choose at random, or even the most commonly use. There should be a guide of best practices to follow and help our design. To do so we will follow a iterative game design process proposed by [26]. This process is implemented in six steps:

1. **Define business objectives**: elaborate a list of precise objectives that are not a means rather an end goal. For each objective it should be explained its clear benefit.
2. **Delineate target behaviors**: elaborate a list of all the desired behaviors and develop metrics for success. That is, find ways to express behaviors into quantifiable results.
3. **Describe your players**: describe the most likely user types that will be interacting with the system, and what can motivate, or demotivate, for each user type.
4. **Devise activity cycles**: a game isn't simply a sequence of events. It needs to have, for example, both *engagement loops* (see figure 2.3) and *progressions stairs* (see figure 2.4) to create some action.
5. **Don't forget the fun**: it's essential not to forget that games are supposed to be fun, and the best way to see if a system is fun is to test it. We should see if all extrinsic elements were removed, would a user still play? It helps to look at different kinds of fun.
6. **Deploy the appropriate tools**: at last we will choose the game design elements most appropriate for our system

This should be an interactive process, if the first iteration doesn't work we should go back to the drawing board and see what did and did not work. To properly analyze the system it helps to keep proper metrics and interview users about what they liked and what they disliked.

# Chapter 3

# Research Methodology

In the next section we'll talk about the research methodology followed in this study, and the reasoning for following it.

## 3.1 Systematic Literature Review

Before initiating our Systematic Literature Review (SLR) we analyzed the need for one by looking into the gaps in the literature.

The short literature found motivated us to conduct this SLR as a way to concise the existing literature and examine how it's being studied. The choice to follow this specific methodology stands from the need for a fair evaluation on the subject matter while following a trustworthy, rigorous, and auditable methodology [27].

The SLR follows the guidelines of Keele et al. [27], and there are three steps in this process:

1. **Planning the review**: identifying the need for a review (section 4), formulating the research questions (section 4.1), developing and later evaluating a review protocol (section 4.2).
2. **Conducting the review**: identifying the research available, doing a study selection and quality assessment, and conducting a data extraction and synthesis. This step will be done in section 5.
3. **Reporting the review**: writing and disseminating the results of the review. This step will be done in section 6.

# Chapter 4

# Planning the Review

In this chapter we will present the first step of our Systematic Literature Review, planning the review, as described in section 3.1.

## 4.1 Questions

The main goals of this SLR is to identify the impact that gamification has in MOOCs, as well as the different success metrics being used. And so our research questions are:

RQ1 What's the impact of gamification on MOOCs?

- What type of MOOCs are used?
- What identifiers of performance are used to evaluate gamified MOOCs?
- Why does it have impact?
- What gamification elements are used?
- What effect does gamification have in MOOCs?

## 4.2 Research Protocol

In the beginning of chapter 2.2 we've discussed the need for this SLR stemming from the lack of a concise yet thorough review of the literature. After we've formulated the research questions which will be used as the guide for the rest of the review.

To do this we've set the search term to **((MOOC OR MOOCs) AND gamification)** and selected the search engines with which we would conduct the search: ACM Digital Library; IEEE Digital Library; dblp; Scopus; Google Scholar.

Lastly we set our selection criteria with which we'll be including or excluding papers in the next phase (section 5).

This criteria will be used during three phases of elimination. This first phase we will read the title and abstract, and exclude papers based on the set criteria. All papers that we are unsure of will be temporally accepted and pass to the next round.

### 4.2.1 Inclusion Criteria

- Empirical papers;
- Related to the main question;
- Written in: English, Portuguese, Spanish or French.

### 4.2.2 Exclusion Criteria

- Conceptual papers;
- Papers on *Serious Games*;
- Papers on *Playful Design*;
- No access to full paper;
- Low quality journal;
- Unknown journal quality.
- Not written in: English, Portuguese, Spanish or French.

# Chapter 5

# Conducting the Review

In this chapter we will present the second step of our Systematic Literature Review, conducting the review, as described in section 3.1.

The initial search using the search term defined in the section above returned 378 papers, after excluding 209 duplicates we were left with 169 papers (see table 5.1). After that an initial selection took place based on the title and abstract of each paper and its relatedness to our research questions and based on the quality of the journal. This first selection rejected 45 papers.

Table 5.1: Paper selection

| References | Accepted | 2nd Rejection | 1st Rejection | Duplicated | Total |
|---|---|---|---|---|---|
| ACM Digital Library | 0 | 3 | 1 | 17 | 21 |
| dblp | 3 | 2 | 0 | 14 | 19 |
| IEEE Digital Library | 3 | 5 | 3 | 14 | 25 |
| Scopus | 12 | 71 | 31 | 125 | 239 |
| Google Scholar | 4 | 21 | 10 | 39 | 74 |
| Total | 22 | 102 | 45 | 209 | 378 |

A final selection then took place based on the introduction and conclusion of the papers resulting in 102 rejected papers. And so we were left with 22 papers to analyze. An exception was made to not exclude a limited number (n=3) of conceptual papers.

The data extracted can be seen in table 5.2.

Table 5.2: Data Collected

| Beginning of Table 5.2 | | | | | |
|---|---|---|---|---|---|
| **References** | **Goals** | **Theories** | **Elements** | **Effects** | **Extra** |
| Aparicio et al. [24] | - Success | - Flow theory<br>- Information Systems (IS) success theory<br>Gamification theory | - Points<br>- Peer-review<br>- Time constraints<br>- Clear goals<br>- Increasing difficulty | - Participation<br>- Success<br>- Enjoyment<br>- Satisfaction<br>- Challenge | - xMOOC<br>- IS success model |
| Staubitz et al. [28] | - Retention Rate (RR)<br>- Motivation | -Self-determination theory<br>- Intrinsic and extrinsic motivation<br>- Drive theory<br>- RAMP (Relatedness, Autonomy, Mastery, Purpose) framework | - Badges<br>- Points<br>- Forums<br>- Progress Bar | - Participation<br>- Motivation<br>- Performance | - User type<br>- Analyse several MOOCs<br>- 26 weeks |
| Vaibhav and Gupta [6] | - Engagement<br>- Retention Rate<br>- Compare non-gamified with gamified MOOC | - None | - Flash cards<br>- Others (speller, space race scatter) | - Increased RR<br>- Participation<br>- Enjoyment<br>- Feeling challenged<br>-Reduced failure rate<br>- Improved learning | 100 participants<br>- Evaluating: one final test |

| Continuation of Table 5.2 | | | | | |
|---|---|---|---|---|---|
| **Title** | **Goals** | **Theories** | **Elements** | **Effects** | **Extra** |
| Saraguro-Bravo et al. [29] | - Satisfaction<br>- Increase Participation | - Intrinsic/extrinsic motivation<br>- Game Thinking | - Badges | - Increased motivation<br>- Increased engagement<br>- Satisfaction | - 100 active students<br>- 4 weeks |
| Ortega-Arranz et al. [30] | - Engagement<br>- Motivation | - Flow theory | - Badges<br>- Leaderboard<br>- Forums<br>- Peer-review | - Participation<br>- Increased motivation | - User types<br>- 8 weeks<br>- $n^{enrolled} = 1031$<br>- $n^{no_show} = 342$<br>- $n^{comp} = 117$ |
| Chang and Wei [31] | - Engagement<br>- Identifying game elements | - None | - 40 gamification elements | - Identified game elements | - $n^{participants} = 5020$<br>- 40 gamification elements analysed |
| Krause et al. [32] | - Learning Outcomes<br>- User Goals<br>- Retention | - None | -Social competition<br>- Points<br>- Progress bars<br>- Time constrains<br>- Virtual goods<br>- Avatars<br>- Leaderboard | - Increased retention | - Social gamification<br>- 3 test groups |

| Continuation of Table 5.2 | | | | | |
|---|---|---|---|---|---|
| **Title** | **Goals** | **Theories** | **Elements** | **Effects** | **Extra** |
| Romero-Rodríguez et al. [33] | - Engagement<br>- Retention Rate | - Intrinsic motivation<br>- Integrated Theoretical Gamification Model in E-Learning Environments (E-MIGA) | - Badges<br>- Leaderboard<br>- Feedback | - Increased RR<br>- Engagement<br>- Motivation | - xMOOC<br>- $n^{enrolled} = 123.124 + 10.629$<br>- $n^{comp} = 16.232 + 655$ |
| Araújo et al. [34] | - Promote the use of badges | - None | - Badges | - Promoted the use of badges | - $p^{active} = 60,7\%$<br>- $RR = 14,8\%$<br>- No evaluation |
| Antonaci et al. [35] | - Engagement<br>- Identifying game elements<br>- User goals<br>- Performance | - Game design pattern | - Levels<br>- Forums<br>- Clear goals<br>- Skill trees<br>- Storytelling<br>- Teams/guilds | - Identified game elements | - game designers, learning scientists and TEL experts |
| Khalil et al. [36] | - Engagement<br>- Retention rate Activities<br>- Comparing non-gamified with gamified MOOC | - Intrinsic/extrinsic motivation<br>- Inverse blended theory<br>- Self-Regulated Learning | - Forums<br>- Progress bar<br>- Feedback | - Participation<br>- Increased RR<br>- Level of attention<br>- Engagement | - Social gamification<br>- 8 weeks<br>- German<br>- $n^{enrolled} = 11.003 + 476 + 284$<br>- $n^{comp} = 176 + 94 + 74$ |

| Continuation of Table 5.2 | | | | | |
|---|---|---|---|---|---|
| **Title** | **Goals** | **Theories** | **Elements** | **Effects** | **Extra** |
| Reischer et al. [37] | - Comparing non-gamified with gamified MOOC<br>- Increase Participation<br>- Increase Communication | - None | - Badges<br>- Leaderboards<br>- Points<br>- Rewards<br>- Others | - Enjoyment<br>- Decreased retention rate | - Social gamification<br>- German<br>- $n^{enrolled} = 1519 + 605$<br>- $n^{enrolled} = 19.07\&12.56\%$ |
| Martínez-Núñez et al. [38] | - Retention rate<br>- Motivation<br>- Learning outcome | -Self-determination theory<br>- Intrinsic/extrinsic motivation | - Badges<br>- Forums<br>- Peer-review | - Increased motivation<br>- Satisfaction | - gcMOOC<br>- 5 weeks<br>- $n^{enrolled} = 12.849$<br>- $n^{initial_active} = 16.948$<br>- $RR = 21,6\%$<br>- $NRR = 39,9\%$ |
| Lehtonen et al. [39] | - Engagement<br>- Retention rate<br>- Comparing non-gamified with gamified MOOC | - None | - Badges<br>- Leaderboards<br>- Levels<br>- Points | - Participation<br>- Increased retention rate<br>- Level of attention | - No certificate<br>- 2% did all exercises (instead of previous 0%) |

| Continuation of Table 5.2 | | | | | |
|---|---|---|---|---|---|
| **Title** | **Goals** | **Theories** | **Elements** | **Effects** | **Extra** |
| Butgereit [40] | - Engagement | - None | - Badges<br>- Leaderboards<br>- Levels<br>- Points<br>- Clear goals<br>- Storytelling<br>- Onboarding<br>- Engagement loops | - Participation<br>- Engagement | - Social gamification<br>- App<br>- Notifications<br>- No evaluation |
| Piccioni et al. [41] | - Complement an existing course | - Inverted Curriculum Approach<br>- Design by Contact Technique | - Badges<br>- Levels<br>- Feedback | - Participation | - SPOC<br>- 14 weeks<br>- Difficulty levels<br>- No evaluation |
| Bustamante and Jiménez [25] | | - Flow theory<br>- Active learning strategies | - Levels<br>- Forums | | - Social gami.<br>- gcMOOC<br>- $n^{enrolled} = 1.910$<br>- $n^{comp} = 216$ |
| Ortega-Arranz et al. [42] | - Analyse the effects of rewards | -Self-determination theory<br>- Intrinsic/extrinsic motivation<br>- Flow theory | - Badges<br>- Redeemable rewards | - Participation on gamified tasks | - No increase in retention or behavioural engagement |
| Antonaci et al. [43] | - Retention rate<br>- Success | - Implementation Intention theory | - N/A | - N/A | - Net Retention Rate<br>- Users' goal achievement |

| Continuation of Table 5.2 | | | | | |
|---|---|---|---|---|---|
| **Title** | **Goals** | **Theories** | **Elements** | **Effects** | **Extra** |
| Khalil et al. [7] | - Overview of studies on gamification in MOOCs | - N/A | - N/A | - N/A | - N/A |
| Ortega-Arranz et al. [8] | - Systematic literature review of the usage of gamification in MOOCs | - N/A | - N/A | - N/A | - N/A |
| Hansch et al. [22] | - Review of current practices on online learning platforms | -Self-determination theory<br>- Intrinsic/extrinsic motivation<br>- Flow theory | - N/A | - N/A | - N/A |

# Chapter 6

# Reporting the Review

In this chapter we will present the data collected and summarized which will answer our research questions. Due to the size of this step instead of keeping it in chapter 4 we decided to give it it's own separate chapter.

## 6.1 What Type of MOOCs are Used?

MOOC types vary greatly based on the objective and theory used to develop them. These are the type of MOOCs that appeared in our literary review:

- **SPOC** (Small Private Open Course): supplement classroom teaching as opposed to replacing it [41];

- **cMOOC** (Connectivist MOOC): the concept comprehends a connected and sharing digital context, which follows a philosophy of collectivism [24];

- **xMOOC** (eXtended MOOC): based on a behaviorist pedagogical approach and focused on existing courses in universities [24];

There are also two other MOOC types that appear a mix of the above mentioned. The first is cooperative MOOC: this combines features both of the xMOOC and cMOOC, defined by three layers: technological, training, behavioral fidalgo2013mooc. The other MOOC types found is gcMOOC (gamification cooperative MOOC): adds a new gamification layer to the cooperative MOOC.

Here we added only papers that self identified as a certain type, hence only 5 papers were included. For a more extensive list of existing MOOC types, that did not appear in our literary review, consult Bustamante and Jiménez [25].

Our search analyzed papers from 2014 to July 2019, see figure 6.1.

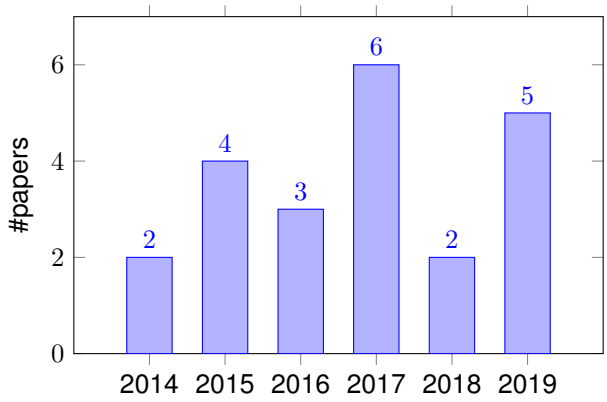


Figure 6.1: Number of papers by year of publication

## 6.2 What Identifiers of Performance Are Used to Evaluate Gamified MOOCs?

In the following section we'll look into the different ways in which papers define success in MOOCs, meaning what identifiers of performance are used to evaluate gamified MOOCs and their overall performance.

### Engagement

The most common goal of research into MOOCs is to increase engagement in users, however this is not reported as often as an effect of gamification in MOOCs (see figures 6.2 and 6.5).

*Engagement* is often used as a mean to increase other effects like *retention rates*, *participation* or *motivation*. It should be decided at the planing stage exactly how the level of engagement will be determined at the end of a study.

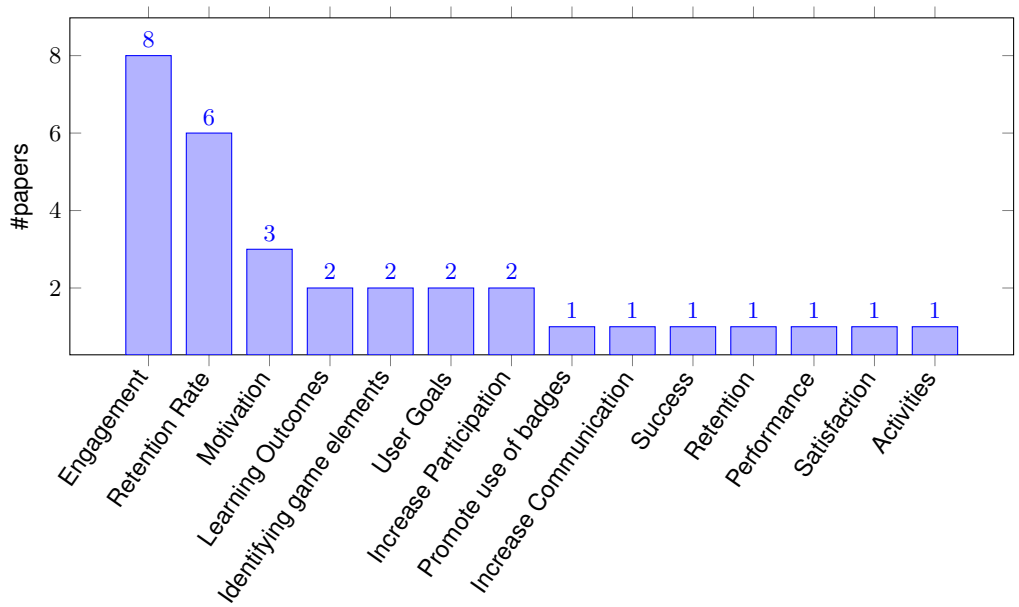


Figure 6.2: Number of papers by goal

#### Retention Rate

The increment of retention rates, sometimes referred to as completion rate, is the second most reported goal. However it's definition is not always the same with some authors calculating it with equation 6.1 and others with equation 6.2, giving vastly different results.

Retention rate is usually defined as the number of students who completed the course ($n^{comp}$) divided by the number of students who enrolled ($n^{enrolled}$).

$$Retention\ Rate\ (RR) = \ n^{comp}/n^{enrolled} \tag{6.1}$$

#### Net Retention Rate

However some papers define it not by the number of enrolled students, but by the number of students who never participated in any MOOC activity ($n^{no\_show}$). This is because there can be a big discrepancy between the number of enrolled ($n^{enrolled}$) and the number of initially active people ($n^{enrolled} - n^{no\_show}$). To solve this problem some authors, like Bustamante and Jiménez [25] calculate their retention rate like so:

$$Net\ Retention\ Rate\ (NRR) = \ n^{comp}/(n^{enrolled} - n^{no\_show}) \tag{6.2}$$

In table 6.1 we compared three of the papers which had enough information to calculate Retention Rate ($RR$), Net Retention Rate ($NRR$) and the rate of enrolled users who never participated in any MOOC activity, *no-show* rate. The latter is defined as:

$$No\_Show\ Rate\ = \ n^{no\_show}/n^{enrolled} \tag{6.3}$$

We can see in table 6.1, the $NRR$ is always higher than $RR$, and as we can deduce $NRR$ will always be higher or equal to $RR$ since the best possible outcome is to have a case with $n^{no\_show} = 0$, which would lead to $NRR = RR$.

Staubitz et al. [28] also argue that *no-show* rates effect results, but thez went a step further proposing to look only at users who enrolled before the middle of the course when considering the completion rate. This reasoning stands because, depending on the evaluation method, a user who entered after half-way through a course doesn't have enough time to get a certificate and some activities may have already ended. Instead of regarding the lack of a certificate gained by these users as a failure, they can be considered simply as those who could never have finished the MOOC since they enrolled too late.

Some confusion may arise because some papers don't specify exactly which equation they use referring simply to retention or completion rates. $NRR$ (equation 6.2) enhances results when compared to $RR$ (equation 6.1).

Table 6.1: Retention Rates of 3 papers

| References | $n^{enrolled}$ | $n^{no\_show}$ | $n^{comp}$ | $no\_show(\%)$ | $RR(\%)$ | $NRR(\%)$ |
|---|---|---|---|---|---|---|
| Ortega-Arranz et al. [30] | 1,031 | 342 | 117 | 33.17% | 13.68% | 20.46% |
| Martínez-Núñez et al. [38] | 12,849 | 5,901 | 2,779 | 45.93% | 21.6% | 39.3% |
| Bustamante and Jiménez [25] | 1,910 | 1,020 | 216 | 53,40% | 11.31% | 24.3% |

**Overall Goal Achievement Rate**

The retention rate focuses on completing a MOOC and earning a certificate, but that's not every user's goal. Furthermore there are different types of certificate, typically an honor track which is free, and then a verified certificate track. There may be other types of users, and so it is important to remember the level of motivation for MOOC participants may vary greatly, specially if a user has chosen a paid track.

We cannot assume everyone intends to finish a MOOC, users have their own personal goals, from earning a certificate, to auditing the course or simply browsing. Ortega-Arranz et al. [42] sent an initial questionnaire to the students of their study and found only 58.64% planned to actively participate in the course.

Antonaci et al. [43] consider that MOOCs do not need to be completed to be considered successful, and so they propose a new way of calculating the completion rate keeping in mind the users' personal goals:

- User Intention Ratio (UIR): percentage of the course intended to be completed by the user
- Personal Completion Ratio (PCR): percentage of the course completed by the user

The new measure for personal success becomes:

$$Personal\ Goal\ Achievement\ Rate\ (PGAR)\ =\ PCR/UIR \tag{6.4}$$

And so the new measure for overall success becomes:

$$Overall\ Goal\ Achievement\ Rate\ (OGAR)\ =\ 1/(n * \sum PGAR) \tag{6.5}$$

Even with these ways of calculating overall success we should keep in mind that Krause et al. [32] stress that even students with a personal goal to complete the course may struggle to achieve it.

Wilkowski et al. [44] were also interested by personal individual goals and asked students of their MOOC to complete a questionnaire about their intent when enrolling in the MOOC. These goals could vary from completing the whole course, to just one specific part. They concluded that 42.4% either met or exceeded the goals they set out to achieve when enrolling.

Furthermore, after the MOOC was over Wilkowski et al. [44] sent a follow up survey and found that:

- 90.8% of the students who completed the course and answered the survey, agreed that they met their personal goal

- 51.8% of the students who did not complete the course but answered the survey, agreed that they met their goal

These new ways of rethinking retention rates can show that MOOCs are more successful than previously thought. Thinking about the objective of the users and not the point of view of instructors helps teachers to design better MOOCs.

MOOC designers should think of always having an initial evaluation of users' motivations and goals as to understand if users do intend to finish the course. Or to see if users' intents are not what is expected and maybe we can consider a user not finishing the course as them still achieving their own personal goal.

#### Motivation

Three papers identified *motivation* as one of their goals in the MOOC and all three were successful in their goal, indicating *motivation* as an outcome of their MOOC (see table 6.5). Staubitz et al. [28] reported based on STD that users were intrinsically motivated to perform self-tests and early submissions, and proposed they should decrease gamification on these activities and focus on forum activity (see section 6.3 Self-Determination Theory for more on intrinsic/extrinsic motivation).

Motivation can be important to lead a user to complete a task and participate [45], which in turn can lead to an increase in retention rates [33]. But as with engagement motivation is not directly measurable and it should be decided before hand with a base theory how exactly it should be measured.

For more detail on these three papers, see: Aparicio et al. [24], Ortega-Arranz et al. [30].

#### Others

Several identifiers of performance are used, but we should call to attention that these goals set are not always analyzed extensively at the end of studies. Just as mentioned in section 6.2 engagement identifiers of performance should be planned before the study and later properly reported as to have a clearer idea of what makes a MOOC *successful*.

## 6.3 Why Does it Have Impact?

In this section we will look into the theories used when developing a gamified MOOC.

#### Intrinsic and Extrinsic Motivation

All papers mentioning *extrinsic motivation* also mentioned *intrinsic motivation* (see figure 6.3 and table 6.2). These concepts were further explained in section 2.2.

To prevent gamification from lowering intrinsic motivation some authors gamified only optional parts of the course [8, 42]. Some used curiosity and novelty to try and increase intrinsic motivation [36].

Staubitz et al. [28] used intrinsic and extrinsic motivation to review user types, based on the user types defined by Marczewski [46], and which game design element could have the effect they wanted

on each type. They tried to define three user types (*socializers, achievers, explorers*) with each type being intrinsically motivated by a slightly different thing. For example the *socializers* being motivated by *relatedness*.

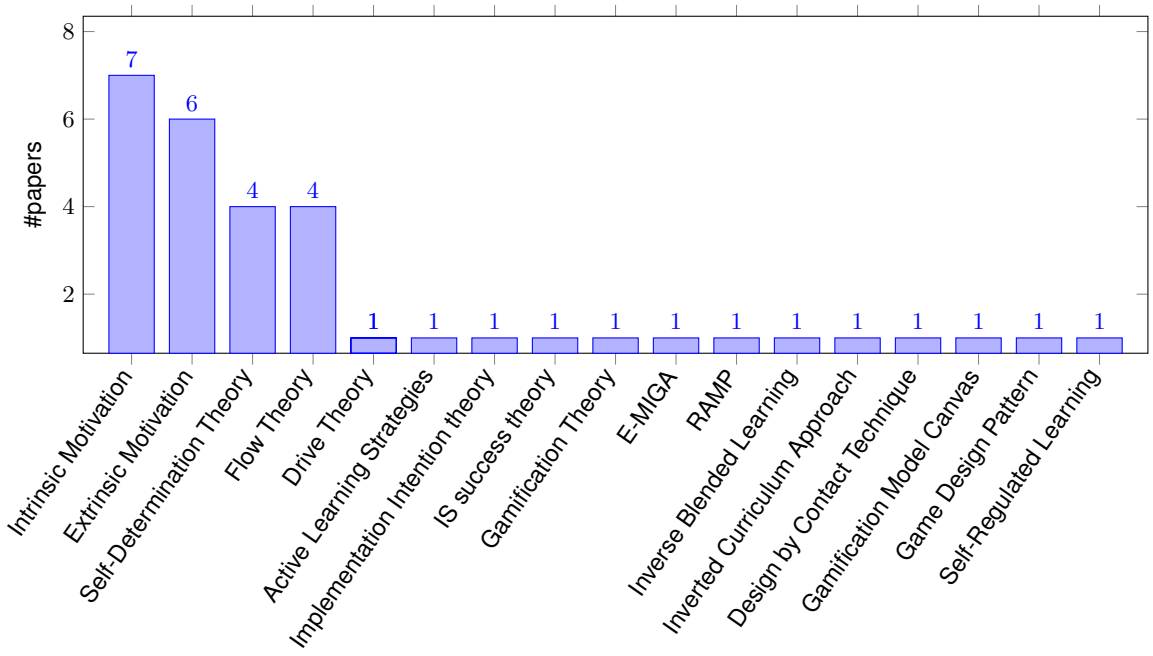


Figure 6.3: Number of papers by theory

### Self-Determination Theory

Self-Determination theory (SDT), as explained in section 2.2, has been at least partly mentioned by four papers out of the 22 analyzed (see figure 6.3). SDT is also indirectly mentioned twice by papers talking about *intrinsic motivation* (see table 6.2).

Understanding what motivates a person is an important part of knowing how to best design a MOOC that meets the goal of engaging users. Out of the 6 papers mentioning STD, 5 showed increasing retention as one of their goals.

Table 6.2: Mentions of Self-determination theory

| Papers | SDT | Intrinsic motivation | Extrinsic motivation |
|---|---|---|---|
| Staubitz et al. 28 | x | x | x |
| Saraguro-Bravo et al. 29 | | x | x |
| Romero-Rodríguez et al. 33 | | x | |
| Khalil et al. 36 | | x | x |
| Martínez-Núñez et al. 38 | x | x | x |
| Hansch et al. 22 | x | x | x |
| Ortega-Arranz et al. 42 | x | x | x |

**Flow Theory**

Flow theory calls for a balance between challenge and skill and it is mostly used in gamification in MOOCs in order to plan badge-related conditions that are neither too easy or too complicated (as mentioned in section 2.3 Flow Theory).

For further reading see: Aparicio et al. [24], Bustamante and Jiménez [25], Ortega-Arranz et al. [30, 42].

## 6.4 What Gamification Elements Are Used?

In figure 6.4 we present the 23 game design elements from the 22 papers analyzed. In the rest of this section we will present a brief summary of the information collected.

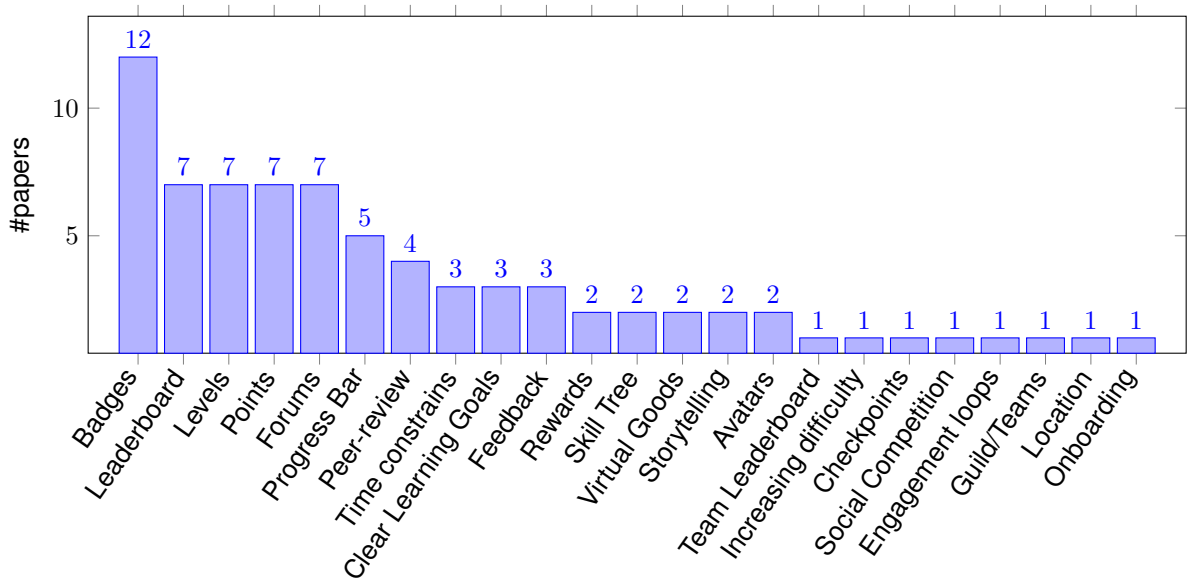


Figure 6.4: Number of papers by gamification element

Chang and Wei [31] studied 40 gamification mechanics chosen by a focus group with 25 MOOC frequent users and later reviewed by 5,020 MOOC learners. They reported that the top 10 which accounted for 50% of the over all engagement. Their to most engaging gamification mechanics in MOOCs are:

1. *Virtual goods*
2. *Redeemable points*
3. *Team leaderboards*
4. *Where's Wally game*
5. *Trophies and badges*
6. *Peer grading*
7. *Peer emoticon feedback*
8. *Memory-game interactions*
9. *Check points*
10. *Skill points*

On the other hand Antonaci et al. [35] looked into the top game design patterns (GDPs) for 3 different

goals: *Enhancing learning performance; Enhancing goal achievement; Enhancing engagement*. 21 GDPs were reviewed by 42 experts in three fields: game design; learning science and technology-enhanced learning. The result of the top ranked 9 GDPs were by goal:

- Enhancing learning performance: *Empowerment, Smooth Learning Curves and Communication Channels;*
- Enhancing goal achievement: *Levels, Clues, Communication Channels, Smooth Learning Curves, Goal Indicators and Skills tree;*
- Enhancing engagement: *Guild, Skills tree, Storytelling.*

However the gamification mechanics lists studied in each paper are not exhaustive, and not all items in them match. The fact that neither list is exhaustive could explain some of the mismatch between the combined results.

### 6.4.1 Badges

Badges are the most used gamification elements with 12 mentions (see figure 6.4) out of the 22 papers analyzed. Although they are so widely used their way of being implemented are vastly different.

To help explain badges' success we can look into Goal Setting Theory that says goals focus people and can show task strategies [17]. To increase badges effectiveness they should do two things:

1) be accompanied by a source of feedback, like a progress bar [17];

2) be specific and challenging so they call on intrinsic motivation but not so hard they demotivate people [17]. In other words, they should motivate without boredom or frustration [30].

Ortega-Arranz et al. [30] found students who earn more badges perceive them as positive. Also they found no one reported a loss of engagement caused by badges, although those who earned badges participated more.

### 6.4.2 Leaderboard

Leaderboards are amongst the most used gamification elements with 7 mentions out of the 22 papers analyzed. Werbach and Hunter [47] showed in studies incorporating game elements that can be compared by participants, such comparison doesn't enhance users' performance.

These findings are in line with Chang and Wei [31] who compared two types of leaderboards: Individual Leaderboards that rank learners based on their learning achievement, and Team Leaderboards that rank teams. *Individual Leaderboards* scored low as an engaging gamification mechanic. Yet *Team Leaderboards* ranked as the top 3 on most engaging.

In the absence of any study looking purely into *leaderboards*, no conclusions can be drawn.Most studies used at least two gamification mechanics making it hard to know exactly which caused the effect; any one individual mechanic or a combination of two or more.

#### Levels

Levels were also mentioned by 7 paper, but unlike *leaderboard* there is one empirical study that used simply *levels* and *forums* as a game design elements in their MOOC. This was Bustamante and Jiménez's cgMOOC on *Thinking Outside The Box: Creative Entrepreneurship*. They had an $RR = 11.31\%$ and a $NRR = 24.30\%$.

Bustamante and Jiménez [25] attributed this result to a combination of three factors: gamification, interaction and content quality. It is impossible to separate them and understand the true impact of *levels*.

#### Points

Both *Redeemable points* and *Skill points* were considered by Chang and Wei [31] as two of the top 10 most engaging gamification mechanics in MOOCs. However this element wasn't studied by itself.

#### Forums

Staubitz et al. [28] found a strong relationship between total forum activity and retention rates, and a little relationship between participants' forum activity and their performance. This showed the user type *socializers* exists, and their need for *relatedness* can be intrinsically motivating.

Antonaci et al. [35] mentioned *community channels* as one of their top 9, they aim to develop a sense of community and information sharing.

For a further reading Reischer et al. [37] studied forums more profoundly, adding badges on forum participation.

#### Progress bar

Although not in the top 10, *Progress Bar* was well classified by Chang and Wei [31]. Khalil et al. [36] used a kind of *Progress Bar*, this would fill up each week based on 3 specific tasks a user did, instead of filling up depending on how far along the user was in a MOOC, or part of a MOOC. On top of that the 3 tasks were explicitly explained to the users in order to foster intrinsic motivation from discovering the mechanics by themselves.

Progress Bars can also be used like Krause et al. [32], showing the bar and percentage of the user's progress in the course and in each lesson.

#### Peer-review

Chang and Wei [31] show *peer grading* is in the top 10. A relevant aspect of *peer-review* is a user receiving feedback, and not just an automatic grade. This goes along with Goal Setting Theory, offering a goal and feedback Landers et al. [17]. It also solves the *relatedness* need, a universal desire to interact and be connected with others Aparicio et al. [24], mentioned by Self-Determination Theory (see section 2.2).

#### Time constrains

Both Krause et al. [32] and Aparicio et al. [24] used time constrains during quizzes or tests with the intention of building tension with the time limit. Yet to watch videos there was no time pressure added. For Chang and Wei [31] the *animated countdown timer* and *time bar* weren't rated highly as an engaging gamification mechanic.

#### Clear learning goals

As mentioned in section 6.4.1 on Badges, goals should be specific and challenging in order to call on intrinsic motivation, but should not be so hard they demotivate people [17]. In other words, they should motivate without boredom or frustration [30].

#### Feedback

Chang and Wei [31] didn't evaluate *feedback* as a gamification mechanic specifically, but *peer emoticon feedback* ranked in their top 10.

As mentioned in section 6.4.1 on Badges, a goal should be accompanied by feedback as in the case of Piccioni et al. [41].

#### Rewards

For Chang and Wei [31] *rewards* were a general criteria, with the most specific gamification mechanics being: *recognition, praise, virtual gifts* and *currency*. All with a good classification, but just shy of the top 10.

For Ortega-Arranz et al. [8] *rewards* did not improve retention rate nor behavioral engagement. However they did help already motivated students complete optional tasks, as rewards were only on optional tasks.

#### Skill Tree

*Skill trees* were only analyzed theoretically by Antonaci et al. [35], who identified them among the top 9, and by Chang and Wei [31], who named them *talent trees* and they got a good classification, but not in the top 10.

#### Virtual Goods

Krause et al. [32] used *virtual goods* for *avatar's* clothing and props. These avatars were visible to the other MOOC users accompanied by a list of achievements.

#### Storytelling

Butgereit [40] used over-arching story as a way to set a long term goal, and so give meaning to the course. This was used along side short term goals to increase immersion, this was done with weekly missions. Antonaci et al. [35] ranked *storytelling* as one of their top GDPs for gamification.

#### Avatars

The ranking of Chang and Wei [31] showed *avatars* were not highly rated. However as seen in section 6.4.2 on Virtual Goods, Krause et al. combined both, with the intent to have the avatar act as a trophy case. For further reading, Chang and Wei [31], Krause et al. [32].

#### Others

Many other gamification elements were referenced only once, from these we want to mention:

- Team Leaderboard [see 31]
- Checkpoints [see 31]
- Guilds [see 35]
- Social Competition [see 32]

Furthermore the gamification mechanics were rarely studied alone. It becomes hard to connect the individual gamification mechanic to its effects.

## 6.5 What Effect Does Gamification Have in MOOCs?

In the following section we will look into the effects reported by the gamified MOOCs analyzed (see table 6.5).

#### Participation

The most common effect amongst all papers was an increase in user participation. This was reported in many ways such as:

- Increase of the number of tasks done [30, 39–41];
- More time spent on the platform [30, 39];
- MOOC use [24];
- Forum activity [28];
- More students attending the evaluation [6, 36];
- Number of lessons done [32].

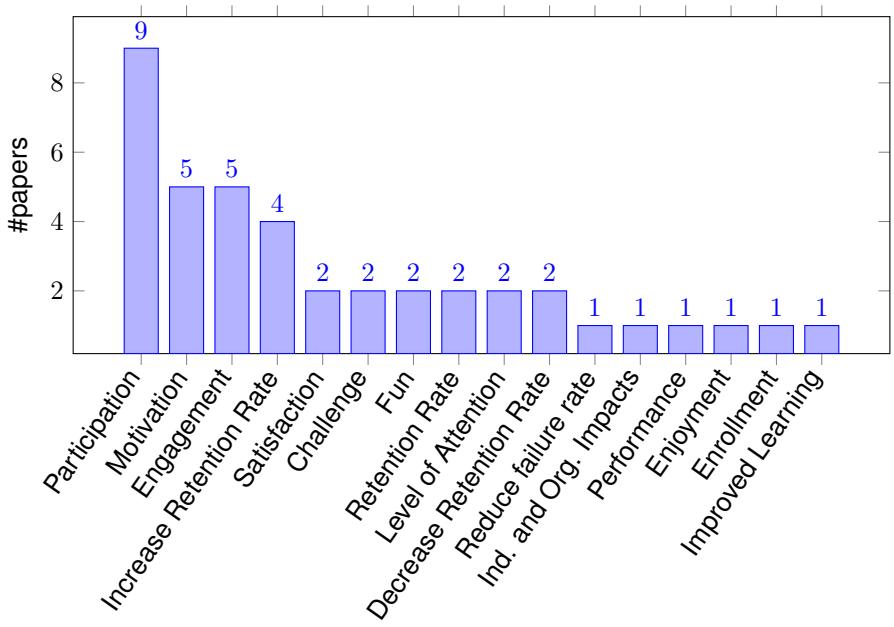


Figure 6.5: Number of papers by gamification effect

For Ortega-Arranz et al. [42], even though their gamified MOOC did not help the retention rate nor engagement compared to their non-gamified MOOC, it did help already motivated learners to perform optional tasks (i.e. participation). This shows the importance of measuring *engagement* with metrics like participation.

#### Increased Retention Rate

Six MOOCs compared a plain version without game design elements, to a gamified version of the same MOOC. Of the six, four found an increase in retention rate, and two did not find this, see section 6.5 Decrease Retention Rate.

For further reading, Vaibhav and Gupta [6], Krause et al. [32], Romero-Rodríguez et al. [33], Khalil et al. [36]

#### Motivation

*Motivation* was a performance identifier on three papers Staubitz et al. [28], Ortega-Arranz et al. [30], Martínez-Núñez et al. [38], being positively reported on all three.

Meanwhile Saraguro-Bravo et al. [29] did not set motivation as a main goal, instead they studied the level *satisfaction* and *participation*. They gave an online survey in order to determine the *level of satisfaction* where they measured four main criteria (content, activities, experience, motivation). All were favorable, with *quality of content* and *motivation* in the participants being tied for highest.

#### Engagement

Although engagement was the most common goal (see figure 6.2), with eight papers reporting it, it only appeared in five papers as an effect of gamification in MOOCs. This could be because engagement

itself is unmeasurable, showing up as *participation* or *motivation*.

Khalil et al. [36] focused on increasing engagement and concluded that the gamified MOOC increased the level of students' attention and engagement. This was because there was a stable weekly retention in quizzes, not present in the non-gamified versions.

If engagement is so highly used as a goal, for the sake of consistency, it should be better reported as an effect of gamification.

#### Decrease Retention Rate

There were two papers ([42] and [37]) that showed a decrease in the retention rate when comparing two versions of the same MOOC: a control group without gamification elements; and a gamified version of the same MOOC.
Ortega-Arranz et al. [42] evaluated three environments with the following Retention Rates:

- RR = 34.12% on a control MOOC with no rewards or game elements;
- RR = 37.06% on a badge version of the MOOC, with 8 badges throughout the course;
- RR = 28.82% and a rewards version with 8 redeemable rewards whose requirements were the same as the badges.

Even though the gamified version did not help the retention rate nor engagement, it did help already motivated learners to perform optional tasks.

For further reading see: Reischer et al. [37].

#### Others

Many other effects were reported, most shine a positive light on gamification in MOOCs. However some papers like that of Ortega-Arranz et al. [42] showed those unlikely to finish a MOOC will most likely be neither engaged nor motivated by rewards.

In spite of this gamification had an effect on how much time already motivated users spent on the MOOC, and it had an effect on the number of exercises done [30, 33, 36, 39].

# Chapter 7

# MOOC Case Study

Given the review performed on the previous chapter we became interested in understanding the concrete applications of the methods talked about in section 6.2 which discusses *what identifiers of performance are used to evaluate gamified MOOCs*.

Due to the correct limitations in the MOOC Técnico platform (`https://mooc.tecnico.ulisboa.pt/`) we evaluated a non-gamified course, instead of a gamified one, with only peer-grading as a gamification element. It was the first run of the course named *ISO27001*. The course covers transversal skills and it's participants are expected to be external of the university with prominence of working professionals.

## 7.1 Course Characteristics

The course ISO27001, covers Information Security topics such as confidentiality, integrity and availability (CIA) of information. The course was taught in English. The topics were presented using many practical examples, real-world case studies, interviews with experts and practitioners, video tutorials, hands-on exercises, and interactive games.

The course evaluation was based on responses given to exercises across four topics ($E1$, $E2$, $E3$, $E_{final}$), with one topic per week. The topics included pre-recorded short videos that introduce the main concepts. Additionally, the usage of practical examples, recorded interviews, extra videos, case studies, exercises, and games. To obtain the certificate of participation, without classification assigned, it was necessary to complete at least $60\%$ of the assessed activities with success. The final grade was calculated in the following way:

$$Final\ Grade\ =\ E1 * 0.2\ +\ E2 * 0.2\ +\ E3 * 0.2\ +\ E_{final} * 0.4 \tag{7.1}$$

The assessment activities were based on a peer review from four exercises (one exercise per main topic), in which each participant, just after submitting their answers, had to assess the answers from 3 to 5 other participants. The grades assigned were reviewed and confirmed by the tutor of the course.

## 7.2 Course Participants

In total, 589 people enrolled in the course. When joining the MOOC Técnico platform, participants were asked some questions regarding their level of education (see figure 7.1), their year of birth (see figure 7.2) and finally their main goal.

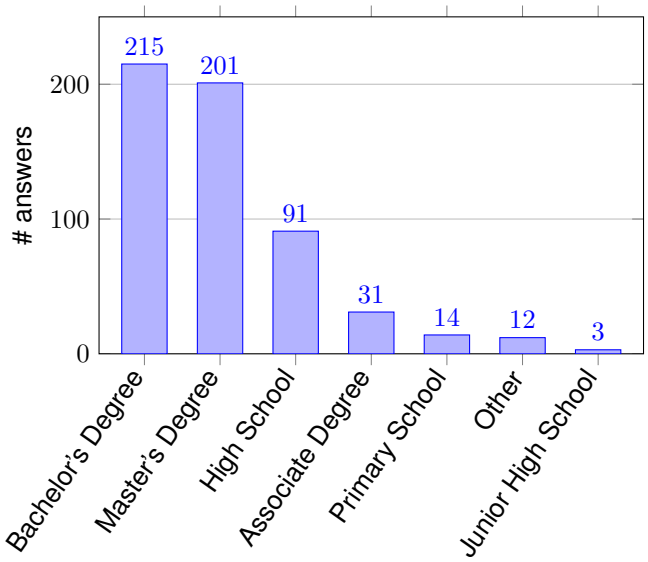


Figure 7.1: Studies of participants

Asking to state their main goal however yielded only simple answers since participants didn't include specific goals such as to get a certificate or to simply audit a certain course. Most goals were along the lines of *learning*, either for professional or personal reasons.

As such, we cannot know participants' reasons and conclude if they achieved their personal goal or not. This problem could have been solved by the initial questionnaire done about the motivation of participants, however this questionnaire was only completed by $51.81\%$ of participants. This means we were unable to use Antonaci et al. [35]'s Overall Goal Achievement Rate calculations to determine success, as discussed in section 6.2.

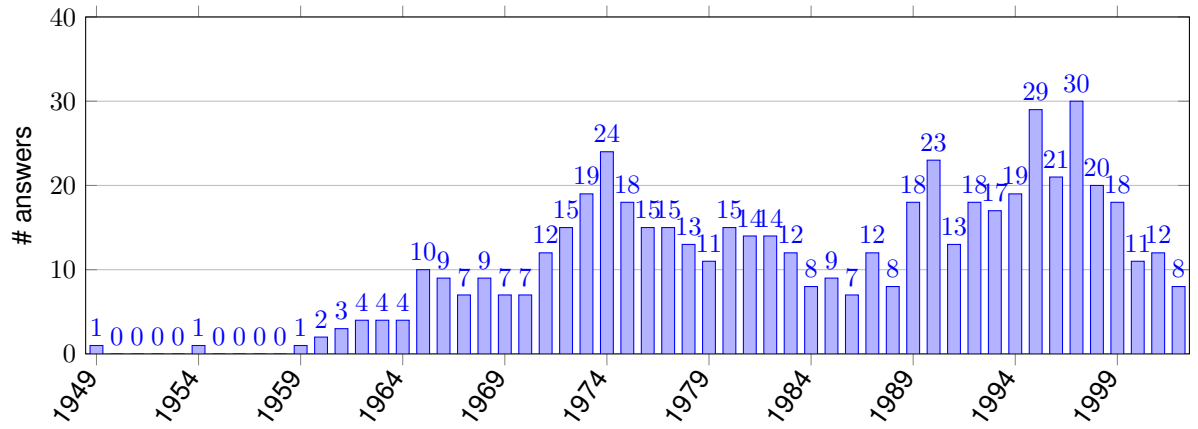


Figure 7.2: Year of birth

## 7.3 Analysis of Retention Rates

Table 7.1 shows the retention rates of the course according to the metrics explained in section 6.2. Out of the 581 enrolled, there were in total 163 participants that did the final evaluation of the course, with 157 participants having a positive overall passing grade.

Table 7.1: Retention Rates of the course

| $n^{enrolled}$ | $n^{no\_show}$ | $n^{comp}$ | $No\_Show\ Rate(\%)$ | $RR\ (\%)$ | $NRR\ (\%)$ |
|---|---|---|---|---|---|
| 581 | 352 | 157 | 60.59 % | 27.02 % | 68.56 % |

To analyze these results we go back to the SLR (section 6.2) where we discussed that the most common identifier of performance is RR (equation 6.1), which gives us a success rate like so: $RR = 157/581 = 27.02\%$.

An alternative way of looking at retention rates considers irrelevant all the enrolled people that never participated in an evaluation, in our case that number is 352. This makes the number of active participants 229.

To further break down these number we looked into the number of active user per evaluation (see figure 7.4). From the 592 enrolled participants, 363 never participated in any of the 4 evaluations. This makes a $No\_Show\ Rate = n^{no\_show}/n^{enrolled} = 60.59\ \%$ (equation 6.3), thus more than half the individuals who enrolled never actually actively participated in the course.

Because of the big $No\_Show\ Rate$ we needed a way to see the retention of the users that did stay in the course from week to week. To calculate this weekly retention we do $week\_1 = E1/Enrolled = 38.18\%$, $week\_2 = E2/E1 = 79.20\%$ and so forth. In figure 7.4 we can see the result of these calculations for every week.

Weekly retention stabilized close to 95%, only after a big portion of the enrolled students not showing up for the $E1$ evaluation (week 1), and another drop after this first evaluation (week 2).

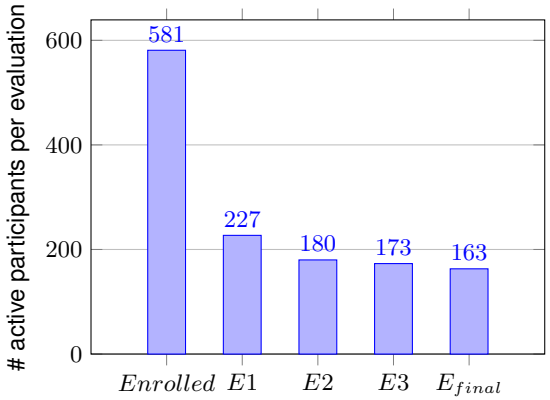


Figure 7.3: Number of participants per evaluation

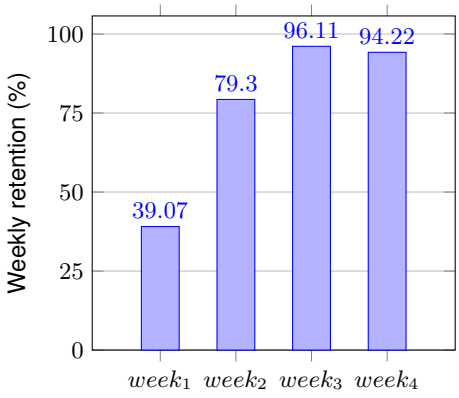


Figure 7.4: Weekly retention

If, like for the NRR, we ignore the no show participants and only look into the ones that actually participated then we would end up with a average weekly retention of $89.88\%$, instead of $77.18\%$.

This further highlights the difference no show participants have on our course results. If we look at RR then the course may look like it was a failure with only $27.02\%$ finishing it. However if we ignore the no show participants the NRR is $68.56\%$, meaning a significant portion of the active participants finished the course.

We should not think of MOOCs as traditional courses, where such a low success rate would not be acceptable. MOOCs, comparatively to elite education, have a low barrier of enrolling [5]. We should instead recognize the MOOC for its more core characteristics, Massive and Open, meaning there is no limit to how many people can enroll and that is open to anyone no matter their previous knowledge or personal goal.

To try to understand participants goals when enrolling an initial questionnaire was done to try and support the fact that maybe not everyone that enrolls want to finish the course. This possibly could explain the number of no show participants. However the questionnaire did not give us the needed information due to some limitations.

## 7.4 Initial Questionnaire

Before the start of the first module participants were asked to answer a short questionnaire. This had the intent to understand the reasons that led participants to enroll in the course, what their main goals were and what was their overall motivation.

This questionnaire was done anonymously and so we cannot cross reference its answers with the participants performance in the course. This might not have been a problem, however this became a limitation because only 301 people answered the questionnaire, out of the 581 enrolled (see table 7.4), meaning only $51.81\%$ of participants actually answered.

Given that only just over half of people answered the questionnaire we cannot draw conclusions about the motivations and goals of all the enrolled participants. Most likely the people who did not answer this initial questionnaire may be the same who never even participated in a single evaluation ($n^{no\_show} = 352$). Furthermore out of those who did not answer the questionnaire we do not know if they may have taken advantage of the resources offered and simply did not engage with any evaluation part of the course.

Although we are limited in what conclusions we were able to reach, it is still valuable to look into the results of this questionnaire.

First participants were asked what were their main goals for the course (see figure 7.5). 231 participants said it was to complete all modules and get the participation certificate. This is in line with the fact that the number of active participants in the course was 229.

If all the 231 out of the 301 participants had finished the course that would make a retention rate of $76.74\%$. This is just higher than the NRR, $68.56\%$. When asked what different reasons led to participants enrollment in the course (see figure 7.7) the majority answered Professional reasons, $83.72\%$.

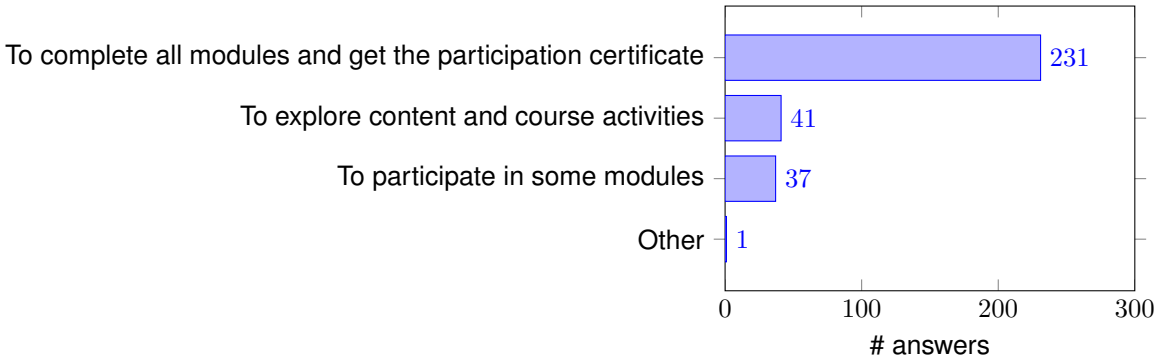


Figure 7.5: What are your main goals for this course

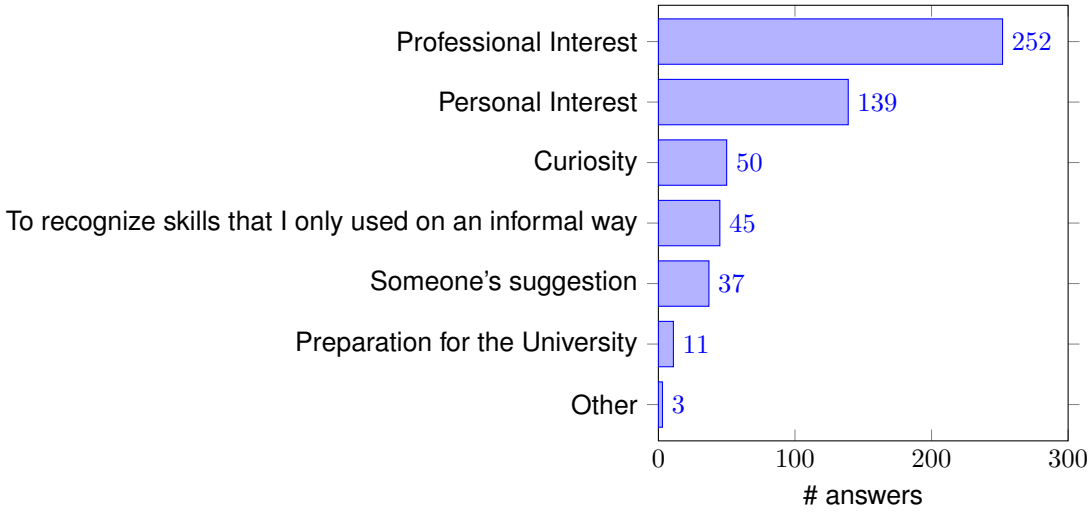


Figure 7.6: What are the reasons that led you to enroll in this course

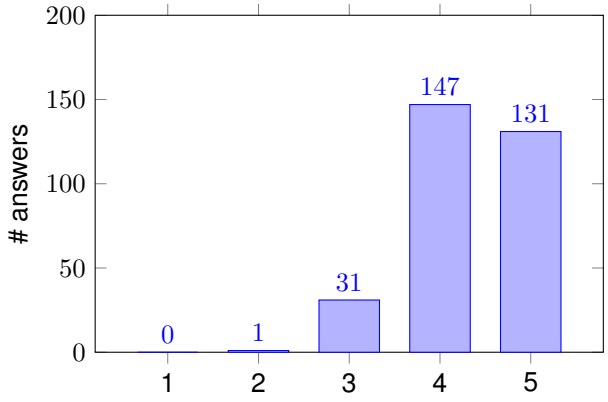


Figure 7.7: On a scale of 1 to 5, what is your motivation for this course

# Chapter 8

# Conclusion

## 8.1 Contribution

In the systematic literature review we analyzed the impact of gamification in MOOC, reviewing 22 papers and their contributions to the study matter.

As far as goals identified the two most frequent were to either increase *engagement* or *retention rate*. The first presents difficult to measure. And the latter has different definitions, none more correct than the other. This shows the difficulty of defining a clear goal and determining a MOOCs' success.

*Participation* was the most reported effect, with slightly different meanings, such as participation in tasks or simply time spent on the platform (see section 6.5). However all these different definitions point to a higher interaction with the system and to a potential increase in intrinsic motivation.

Regarding the case study we were unable to reach a conclusion in regards to participants achieving their goals or not. As for the identifiers of performance analyzed there was a $RR = 27.02\%$ and a $NRR = 68.56\%$. The high NRR means the participants that who did do at least one evaluation were very likely to finish the course successfully.

## 8.2 Limitations

In terms of limitations we have 4 things to note relating to our SLR. The first limitation is the lack of studies on specific game design elements. The number of empirical studies analyzing only one element or comparing elements are limited, with 3 studying *badges* [29, 34, 42] and one study specifically on *claimable rewards* [42]. It then becomes hard to distinguish and separate the effects that different elements have on users.

Secondly the way effects are measured are not systematic. The choice of analyzed effects, the way they are measured and the timing of the assessment can influence study results [7, 48]. Cook and Artino Jr go on to say effects depend deeply on the theory and the research question, however a great deal of the papers analyzed in our review did not have a good theoretical foundation. This lack of foundation may be to the very nature of chosen papers, non-conceptual papers.

Thirdly, the limited number of empirical studies found made the sample of selected studies smaller than desired. Given the vast number of game design element, outcomes reported and all the different types of evaluation, it became hard to reach some conclusions. As seen in section 6.1 figure 6.1, gamification in MOOCs is still a relatively young field of study.

The forth limitation was the search term used as it may have not caught some terms, for example a paper may have used the term *gMOOC* and so not have shown up in our search. The same goes for terms like *gamified*. As such a better search term would have been *((*MOOC*) AND (gamif*))* instead of *((MOOC OR MOOCs) AND gamification)*.

Regarding the last chapter 7, our biggest limitation was the number of participants that answered the initial questionnaire. As only about $50\%$ of participants answered the questionnaire we were unable to know if this was a representative part of the enrolled students, and so unable to know if the goals that they answered a representative.

## 8.3 Communications

To the communication to other researchers and relevant audiences, the results obtained we published a paper in the journal Open Learning: The Journal of Open, Distance and e-Learning (Q2). This paper, *Systematic Literature Review about Gamification in MOOCs*, covers the SLR presented in sections 4, 5 and 6.

## 8.4 Future Work

In the future the initial questionnaire of MOOCs should have a way to connect the answers given about participants goals to their actual performance on the course. This would allow to see if those that intended to finish the course actually did, and if those that only wanted to check a few modules did so.

This could show us if maybe objectives should be changed to not favor course completeness, and instead focus on the participants goals.

Secondly, as the MOOC Técnico platform will have a gamification plug-in soon it would be interesting to compare the gamified version of a MOOC with it's earlier run.

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