Chapter

Perspective Chapter: MOOC: A Decade Later! What Is the Current Situation in Teacher Education?

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Abstract

The growth of distance education, even if in emergency modalities such as those compelled by the pandemic context in which we live in the last 3 years, seems to have potentiated a second massification of the use of MOOC. In this sense, it looks important to us to make research on the current status of these courses, namely, regarding their adoption in the continuing education of teachers. The study was based on a survey of the MOOCs carried out in the context of in-service teacher training in Portugal. The exploratory research focused only on the last 3 years—which involved the pandemic. The information was collected in the NAU platform, but also by searching for keywords in the search engines of MOOCs carried out in the field of teacher training. This way it will be possible to understand, in a more concrete and deeper way, the impact of this technology on teacher training in Portugal and the contribution it can make to improve the quality of the teacher training.

Keywords: continuing education, digital technologies, higher education teachers, MOOC, online learning

1. Introduction

Massive Open Online Courses (MOOC) seem to be, on the one hand, a very useful distance learning modality in the training of citizens in their different professional areas and, on the other hand, in the training and education of students in the different study cycles. In this sense, MOOCs present themselves as a useful and appropriate tool for the training of individuals or groups of learners, namely, through the development of their knowledge and skills supported by technology. One of the groups that seem to use this distance learning modality seems to be teachers, as part of their continuing education, but also as a contribution to the teaching and learning of their students. The use of MOOCs both in teacher training and in teaching must do, among others, with the ease of access to information, flexibility, use of technology and dynamization of the teaching-learning processes. On this basis, MOOCs "are a continuation of the trend in innovation, experimentation, and the use of technology initiated by distance and online education to provide massive learning opportunities" [1]. Littlejohn [2] states that a MOOC can be defined as a course

that targets large-scale, networked interactive participation. Thus, a MOOC can be considered to provide open access, based on a distance education model, promoting large-scale interactive participation [3] and can be one of the most versatile ways to provide quality education, especially for those residing in distant or disadvantaged regions [4].

MOOCs are free online courses available for anyone to enroll in that provide an affordable and flexible way to learn new content and acquire or improve new skills, advance your career, and deliver quality educational experiences at scale. In the next section, we seek to address in more depth the concepts surrounding MOOCs as a way for the reader to get a good understanding of the dynamics surrounding this online learning modality. However, before moving on to the next section, we would like to remind you that through this research we intend to conduct a survey on the current status of MOOCs in the continuing education of teachers. To do so and after explaining it in the methodological section, we will collect information from the NAU platform (an online project and platform, pioneering at the Portuguese national level, to support education and training, aimed at large audiences), but also by searching for keywords in the search engines of MOOCs carried out in the field of teacher training. In this way, we seek to understand not only the impact of this technology in education in Portugal, but also the contribution it can provide to improve the quality of the training teacher.

2. Massive open online courses: Concept review

The following section is fundamental to understanding the technological and pedagogical characteristics surrounding MOOCs. We present those that seem to be the most important for a general understanding of the dynamics of MOOCs.

2.1 Evolution of MOOC

In 2008, George Siemens and Stephen Downes published the first MOOC called Connectivism and Connectivist Knowledge as an open online course. Although the number of participants was just over 2300, Siemens was not exactly interested in scale, but in connections. The term MOOC was created in 2008 by Dave Cormier at the University of Prince Edward Island and Bryan Alexander of the National Institute for Technology in Liberal Education. Although the MOOCs appeared in 2008, it is worth mentioning that only in 2012 were multiple investments made in MOOC projects, allowing the courses to acquire scale and notoriety. Since 2012, all over the world, thousands of courses have emerged, supported by different platforms, and, currently, it is impossible to identify all existing MOOCs. In fact, there are thousands of MOOCs, distributed all over the world and promoted by different companies and educational institutions, public and private, or even by any individual citizen. They understand all areas of knowledge and languages and are open to all types of interested parties, so it would be unfeasible to attempt to carry out the respective task. However, we identified Cognitive Class, Coursera, Edx, FutureLearn, Iversity, Khan Academy, Myriad X, Udacity, Udemy, and Saylor as the best-known MOOC platforms. Each of these tools is unique, with its own characteristics and very specific functionalities. The technology varies from platform to platform. It is naturally up to each course creator and potential students to choose the platform that best serves their knowledge needs.

In Portugal, the first MOOC appeared in 2012, namely: The First MOOC in Portuguese, developed by João Mattar (Brazil) and Paulo Simões (Portugal) and launched simultaneously in Portugal and Brazil; Bullying in a school context: characterization and intervention, which was aimed at educators and teachers of non-tertiary education and was created by the ICT Competence Center of the School of Education of Santarém (Portugal).

In 2013, we highlight the initiative promoted by the European Commission, which resulted in the launch of the first pan-European university MOOC, which allowed Universidade Aberta (Portugal) to join it. However, the institution "went a step further than its partners and developed a specific pedagogical model for massive open online courses, thus becoming the first university in the world to do so—the iMOOC model" [5], which will be discussed further in this chapter. The iMOOC model: "the model is patented and is composed of a set of standardized pedagogical practices extended to the whole institution, each one dedicated to a type of study cycle or training level" ([6], p. 7). It is worth mentioning that "this initiative marks the pioneering design of the first institutional pedagogical model for MOOCs" ([6], p. 7). The MOOC promoted by Open University is designed based on the four pillars of the institution's Virtual Pedagogical Model (VPM), namely student-centred learning, flexibility, interaction, and digital inclusion: "The model also articulates flexibility with the pace needed to help students accomplish tasks in the face of the pressure of their daily commitments" ([6], p. 7).

Currently, in Portugal, there are already several institutions offering MOOC courses, from public and private higher education institutions, namely, universities and polytechnics. In addition to these that offer MOOC courses essentially at the level of educational offerings, there are also MOOCs offered in the context of teacher training, among which are the Ministry of Education, Directorate-General of Education, ICT Competence Centers, Scientific-Pedagogical Council of Continuing Education and the Directorate-General of School Establishments. It is also important to note that organizations, namely companies, are turning to the training of their staff through online courses, including MOOCs. This position of companies seems to facilitate the continuous training of these professionals, making it more flexible, dynamic, and innovative.

Before we address the main features of this genre of courses, it is important to talk about what MOOCs are and what their main goals are in the online education market.

2.2 Concept of MOOC

Analyzing the concepts underlying the acronym MOOC: Massive—represents the scope and geographical breadth that this genre of courses has, as they allow a large number of participants to enroll. It refers to the possibility of expanding the course in terms of the number of students [7]; Open—these are courses open to any type of participant and represent the democratization of knowledge, without any kind of restriction either in economic terms or even in terms of prerequisites; Online—available in real time, 24 hours a day, as long as you have a web connection; Course—refers to the course format, which encompasses technology, pedagogy and content. In other words, they serve as knowledge platforms for any individual who anytime, anywhere wishes to learn, which makes them a powerful and emerging learning strategy with repercussions in both educational and technological areas. According to Siemens [1], MOOCs "are a continuation of the trend in innovation, experimentation, and the use of technology initiated by distance and online education to provide learning opportunities on a massive scale" ([1], p. 5). MOOCs must innovate and create new

trends such as the use of non-traditional textbooks such as graphic novels to increase students' attention levels [8]. Jansen and Schuwer [9] states that "MOOCs are courses designed for large numbers of participants, that can be accessed by anyone anywhere as long as they have an internet connection, are open to everyone without entry qualifications, and offer a full/complete course experience online for free" (p. 11). Littlejohn [2] states that a MOOC can be defined as a course that targets large-scale, networked interactive participation. Thus, a MOOC can be considered to provide open access, based on a distance education model, promoting large-scale interactive participation [3] and can be one of the most versatile ways to provide quality education, especially for those residing in distant or disadvantaged regions [4]. There are many renowned authors and experts in the field who talk about MOOC [10–30], however, although there are different positions, the literature is consensual that MOOCs are a rapidly expanding technology based on the connectivist learning theory and consist of courses, in principle open and free of charge, which allows a large number of participants to enroll. Although MOOCs have an informal nature, they seem to contribute to the free acquisition of information and to equality in knowledge, since they promote access to quality content at a reduced cost, or even free of charge, depending, of course, on the type of courses one intends to attend.

2.3 Technical-pedagogical characteristics

The literature seems to agree that there are two major typologies of MOOC proposed by Downes [31], who designates the former as cMOOC and the latter as xMOOC [32]. Although the two typologies have common features, including content divided into weeks and the high number of participants, the main differences seem to result from the role of teachers and participants in the MOOC and the way learning is carried out. cMOOCs are based on a collaborative methodology and "are structured from self-organized learning, centered on gaining meaning through community experience, using participation tools such as blogs, RSS feeds, and other decentralized methods" ([33], p. 66). They are context-centred and correspond to a connectivist perspective in which George Siemens, Stephen Downes, Jim Groom, Dave Cormier, Alan Levine, Wendy Drexler, Inge de Waard, Ray Schroeder, David Wiley, Alec Couros, among others, have been involved since 2008: The "c" represents the connectivist MOOCs. The cMOOCs were the first MOOCs that emerged. These courses place emphasis on student knowledge creation, creativity, autonomy, and social and collaborative learning ([34], p. 4). The Connectivism and Connective Knowledge course (CCK08), Personal Learning Environments Networks and Knowledge (PLENK2010), MobiMOOC, EduMOOC, Change11, Digital Storytelling (DS106) and Learning Analytics and Knowledge (LAK12) are some examples of this type of courses.

Given that this typology follows the connectivist practices of student participation and self-direction, the pedagogical practices are considered to follow more specifically Downes's [35] four principles, namely:

- Autonomy: students could choose where, when, how, with whom and what to learn. In other words, it is related to the freedom to choose goals and content;

- Diversity: it allows for a sufficiently diverse population to avoid misinformation and closed-group thinking (heterogeneous groups). There is an incentive to engage in diverse readings, discussions, and environments, which allows for a wide spectrum of opinions, tools, and content;

- Degree of openness: encompasses all levels of participation, with no barriers between what/who is in or out. Such a characteristic ensures the free flow of information through the network and encourages a culture of sharing and a focus on knowledge creation;

- Interactivity: is what makes everything possible, with knowledge emerging as a result of interactions between the various participants.

The four principles proposed by Downes [35] influence each other in the sense that the diminution of any one of them weakens the quality of the teaching-learning process and, with it, the learning network itself—connectivism. In this sense, it is crucial that all principles are at the same level for the learning process to run smoothly.

According to Figueiredo [36], the main benefits and limitations of cMOOCs are also highlighted. In the benefits, the author suggests that the technology is exploratory, disruptive, deconstructive, incubating and contextual:

- Exploratory: they follow an exploratory path, of trial-error-reflection cycles, closer to design practices than to traditional sciences. In complex and unpredictable social environments, this type of approach offers opportunities for emergence and collective creativity;

- Disruptive: an innovation is disruptive when it is born at the margins of traditional markets or social systems and asserts itself by gradually winning over customers who tolerate its initial imperfections and contribute to overcoming them;

- Deconstructive: to deconstruct is to question already installed ideas and thus conclude on whether they are still valid or whether they should be reformulated. In an environment like education, where the habit of questioning the big ideas is almost non-existent, cMOOCs have the merit of doing so;

- Incubators: they allow new practices to be developed, evolve and consolidate until they can be transposed to traditional contexts;

- Contextual: cMOOCs themselves are learning contexts, co-constructed and adapted by those who are learning. The same is not true of xMOOCs, which are predominantly content-centred.

The absence of a business model, the problematic accreditation, the reduced scalability, the difficulty in authenticating students and the high dropout rate are the main constraints of the cMOOCs [36]:

- Absence of a business model: there is no market, income and cost logic compatible with cMOOCs. Thus, for now, the sustainability of this type is based on economies of reputation;

- Problematic accreditation: the logic of complexity and large numbers that characterize the model conflicts with the reliable calculation of market value for each of the participants that complete a cMOOC. The compatibility between cMOOCs and reliable valuation is one of the model's most interesting problems;

- Reduced scalability: concerns pedagogical and assessment processes that take advantage of complex adaptive social systems, the laws of scale and, obviously, social networks to become applicable to large populations without requiring additional teaching resources;

- Difficulty in authenticating students: the eventual transposition of the cMOOC model to the market, as well as the adoption of accreditation bodies, justifies looking into reliable methods of authenticating participants;

- Dropout rate: a large number of participants who attend a cMOOC end up dropping out. However, it is important to note that even those who do not finish can derive great benefits from their participation.

The xMOOCs come from MIT/Stanford and are content-centred and more rigidly organized, limiting creativity. Thus, their activities are guided by the teacher who has the role of providing the supporting materials and directing the discussions. Participants can contribute by sharing content and ideas. xMOOCs are the most common MOOC model: "The "x" stands for commercial MOOCs, that is, those offered through commercial or semi-commercial platforms, such as Coursera, edX, and Udacity. These MOOCs are centred on viewing videos and completing short exam-type exercises ([34], p. 4).

xMOOCs follow an instructivist course design in which learning objectives are predefined by the instructor [2] and materials are designed and prepared in advance. Students watch video series (lectures), read recommended articles, and solve quizzes [37]. While Rodriguez [38, 39] considers that xMOOCs are based on cognitive-behavioral pedagogical practices, Conole [40] states that this typology mainly adopts a behaviorist learning approach. It is of interest to note that this model has received much criticism from connectivist authors Parr [41]. EdX, Coursera, Udacity and FutureLearn are some of the examples of xMOOC platforms [42, 43] that the following points are characterized.

In short, cMOOCs emphasize creation, creativity, autonomy, and social networked learning, emphasizing participation among their members. xMOOCs emphasize a more conventional learning approach through video presentations and short exercises and tests, with the teacher continuing to take a leading role. In cMOOCs, there is no rigid assessment process as is known in conventional institutions [44], as participants are encouraged to assess their progress and understanding through interaction among all. In xMOOCs, assessment follows instructional practices, relying on completing various questionnaires and completing projects.

Besides cMOOC and xMOOC there are other proposals for categorizing MOOCs in the literature, which are presented below.

- Network-based MOOCs are considered the original ones, that is, those taught by Alec Couros, George Siemens, Stephen Downes, and Dave Cormier. In this type of MOOC, "the goal is not so much content and skill acquisition, but dialogue, socially constructed knowledge, and exposure to the open web learning environment using distributed media" ([45], p. 35). The pedagogy of network-based MOOCs is grounded in connectivist methods.

- Task-based ones "emphasize skills by requiring the student to complete certain types of work" ([45], p. 35). Community is crucial, especially in terms of examples

and assistance, yet it is a secondary goal. The pedagogy of this type of MOOC, unlike network-based ones, is "task-supported and tends to be a mix of instructivism and constructivism, and traditional assessment is also difficult" ([45], p. 36).

- Content-based ones, supported by instructionalist pedagogy, have a high number "of enrollments, commercial prospects, renowned university professors, automated testing, and exposure in the popular press" ([45], p. 36). In this type of course, the acquisition of the content is fundamental, and the network or the completion of the activities are considered secondary aspects.

In addition to the previous MOOC categories, Clark [46] proposes a taxonomy based on the pedagogy adopted, namely ([46], pp. 6379–6380):

- TransferMOOC: are derived from other courses provided on virtual platforms, such as Coursera;

- MadeMOOC: consists of courses oriented towards innovation, problem-solving, work and peer review. An example of a platform that offers this type of course is Udacity;

- SynchMOOC: these have fixed start and end dates and have delimited certain periods of time either for the completion and presentation of work or for the evaluation of the same, such as, for example, Cousera and Udacity;

- AsynchMOOC: they can be attended anytime, anywhere and work best in different time zones. Coursera is an example of a platform that provides this type of courses;

- AdaptiveMOOC: based on dynamic assessment, these are courses geared towards personalized learning, such as Gogbooks;

- GroupMOOC: this type of course starts with a very small group of trainees, who are selected based on a set of criteria such as their previous skills. One example is the NovoEd platform;

- ConnectivistMOOC: these are courses inspired by the work of George Siemens and Stephen Downes and are supported by the connections established in the network. The autonomy of the participants is fostered through the sharing of knowledge. An example of this type of course is the Connectivism and Connective Knowledge Online Course (CCK08);

- MiniMOOC: short, very intensive courses with very clear and concrete objectives, such as Open Badges.

There are also other categories such as BOOC (Big Open Online Course), COOC (Community Open Online Course), DOCC (Distributed Online Collaborative Course), MOOR (Massive Open Online Research), POOC (Personalized Open Online Course), SMOC (Synchronous Massive Online Course), SPOC (Self-Paced Online Course), SPOC (Small Private Online Course), and MOOOC (Massive Online Open Ongoing Courses), among many others.

Naturally, each type of MOOC has its own characteristics, such as the type of content to be made available, the number of participants expected, the communication strategy adopted among peers and, especially, the pedagogical and technological model of each MOOC. In this sense, it is the responsibility of each educational institution, or each promoter, to choose the most appropriate model for each specific teaching-learning process.

2.4 MOOC planning and development

Based on the researchers' experience in creating courses in the MOOC modality, it is easily understood that the planning of an online course is always a fundamental factor that must involve a multidisciplinary team (with different specialities), especially in three central areas: technology, pedagogy, and content production. In the technological area, it is necessary to define the platform where the MOOC will be developed, as well as the tools that will be made available considering the digital skills of the target audience. In the area of pedagogy, it is important to define pedagogical strategies and methodologies suitable for implementing the teaching-learning process, which also involves planning and developing activities that are useful for boosting and innovating learning. In the area of content, it is necessary to consider the design and production of diversified and quality content (text, video, images, sound, among others) that contribute to the progress of students in the most diverse subjects.

According to Read and Covadonga [47], the planning of a MOOC should take into account:

- The acquisition of basic skills to use the necessary platforms or tools, by teachers and students;
- Reflection on how the contents and activities of the MOOC differ from the materials used in face-to-face courses;
- The large-scale interactions that MOOCs may require, as teachers will play a key role in course development;
- The analytical mechanisms are available for the analysis of learning and, preferably, the support combined with questionnaires for obtaining data and assessments.

Blanco et al. [48], Read and Covadonga [47] and Riedo et al. [49] summarize the aspects to be considered in the development of a MOOC, namely:

- Being aware of the responsibility of distributing training on a topic as specific as possible to a broad and differentiated audience;
- Highlight that the centre of learning is the learner and the teacher has the role of making content available, adapted to the MOOC format, and monitoring, guiding and interacting through discussion forums or other social tools
- Establish a duration generally between 25 and 125 hours;
- Take into account the different prerequisites and motivations;

- Structure the MOOC into four to eight modules, each with four to eight videos and other materials that motivate and challenge students;
- Avoid videos longer than 12 minutes, with the same topic having more than one;
- Offer content and other support materials in different formats;
- Prepare varied activities at different levels;
- Clarify which activities and tasks are mandatory and appropriately value those that allow validation of achievement;
- Be prepared to integrate different technologies suited to the specificities of the contents or the profile of the users.

According to Costa et al. [50], the team responsible for developing a MOOC course is responsible for the following tasks:

- Defines the target audience/audience for which the course is intended (general characteristics of the profile or profiles of the participants);
- Defines general learning goals;
- Lists and organizes the topics that will be worked on in the course;
- Clarifies the existence of prerequisites in terms of previous knowledge and/or skills;
- Explains the selected strategies and ways of organizing work;
- Explains the modalities of interaction, communication and collaboration;
- Explains the objectives and methods of evaluation chosen.

There is no single model for planning and developing a MOOC. However, from the authors' experience in designing this kind of course and supported by the literature, MOOC promoters should take into consideration the three major dimensions mentioned at the beginning of this section: technology, pedagogy, and content. Each of these dimensions is absolutely central in the planning and development processes of a MOOC, since the teaching-learning process nowadays can only be achieved through these three dimensions.

2.5 MOOC platforms

In this section, we present the six main existing MOOC platforms, taking into account the principles of the impact they have on education, but also the quality of the service provided to their users.

Coursera: Is one of the most popular MOOC platforms that offers hundreds of online courses taught by recognized educational institutions, in several languages. It offers many free courses, but also has paid classes or MOOCs that, although free,

require payment for official certification. Coursera partners with over 275 leading universities and companies to bring flexible online learning to individuals and organizations around the world. It also has more than 113 million students.

Udemy: This is a platform created by Eren Bali. This platform has more than 44 million students, 65,000 instructors, 183,000 courses, 594 million course enrollments, 75 languages, and 8600 corporate clients. Course content is quite varied and ranges from music theory and pet care to programming (from basic to advanced), data analysis, design, sales, and more. Some courses are free and others are paid, with or without certificates of completion. It is one of the solutions more available for any type of user who wants to offer a MOOC.

FutureLearn: With a wide range of paid and free online courses, FutureLearn stands out as one of the platforms with the largest offer of accredited diplomas. FutureLearn is based in the UK and owned by The Open University, a UK-based distance learning university. It has over 40 years of experience in distance and online university education.

Saylor: Uses accredited teachers to create free courses and use open educational resources in over 15 categories. Upon passing the final exam, participants can download a certificate of completion.

edX: with over 2500 online courses, edX covers over 30 academic fields, from medicine to design. Founded in 2012 by Harvard University and the Massachusetts Institute of Technology, this non-profit organization partner with top establishments around the world.

Khan Academy: is a non-profit organization founded by Salman Khan and has a mission to provide free, high-quality education for everyone, everywhere. It offers a free collection of videos on math, medicine and health, economics and finance, physics, chemistry, biology, computer science, and other subjects.

Each of the identified platforms has its own characteristics, namely principles and values, functionalities, and tools, among others. It is therefore up to each entity promoting a course or each trainee or student to choose the platform that is best suited, on the one hand, to the production and implementation of a course and, on the other hand, to the acquisition of knowledge and skills in the area of interest of those who sign up. Whatever the promoters' or students' decision, they must always consider three principles that seem central to us: (i) Knowledge of the greatest possible number of platforms through the exploration of their functionalities; (ii) The topics addressed in the course; (iii) The architecture of the course in the digital and pedagogical aspects. Knowing how to select the MOOC platform is half the battle for the success of the course and learning.

2.6 Process of evaluation, certification and accreditation of MOOCs

The process of student assessment in MOOC courses is not consensual in the literature and indeed should not be since each learning context is obviously unique. The platform created or adopted for the implementation of the MOOC, the digital tools used for communication, interaction and collaboration among peers and among teachers, the pedagogy adopted, the type of activities proposed, the type of content produced, the MOOC recipients, the social and economic context, the topics addressed, the type of training, the promoter, the objectives to be achieved with the implementation of the MOOC, among others, are absolutely central aspects that determine the evaluation model of MOOC. It is also important to mention that MOOCs are difficult to evaluate because there are no established evaluation criteria,

completion rates are low, there are many instructors and there are accessibility problems. Regarding specifically the dropout rate in MOOCs, "most students who enroll in a MOOC have no intention of completing the course, their intention is to explore, find out something about the content and immediately do something else" [51]. In this follow-up, Cairo [52] considers that the rate of participants who complete a MOOC is between 10% and 15%. Also [51] points out that the percentage of students who complete a MOOC is around 10%. Cisel and Bruillard [53], on the other hand, state that less than 10% of enrollees typically complete a course. In general, dropouts in MOOCs are associated with difficulties regarding the "level of autonomy required, the ability to deal with the technological environment adopted, as well as the persistent feeling, in some cases, about the absence of the physical presence of teachers and classmates" ([54], p. 3). Obviously, the dropout and the difficulty to control the inputs and outputs in a MOOC also conditions the evaluation process.

According to Explorance [55], there are four ways to evaluate a MOOC:

- By the process perspective: proposed by Stephen Downes this method to evaluate a MOOC is referred to as the 'process perspective' whereby the MOOC is evaluated by the criteria of successful networks (autonomy, diversity, openness, interactivity);

- Via the outcomes perspective: the second method that Downes proposes is the 'outcomes perspective'. In this approach, MOOCs are evaluated as knowing systems; as entities which learn as a whole. MOOC effectiveness is then based on the system's success and not on individual participant outcomes. Both of Downes' approaches are very interesting and deserve more thought and exploration.

- By self-assessment:

- Some MOOCs are experimenting in using self-assessment to evaluate student progress. However, this type of evaluation only examines participant learning and not the quality of the course or the teaching approach. With MOOCs not establishing learning goals and with students creating their own, the evaluation process becomes even more complex. Another factor to consider is that relying solely on self-assessment can lead to inaccurate and unreliable results.

Clark [46] identifies a set of MOOC certification models (pp. 6380–6381):

- Absence of certification: no document is issued to certify attendance; participants attended only to acquire learning experience;

- Attendance and completion certificate: is awarded to all participants who complete the MOOC, in order to recognize their attendance in the respective course, however, no official accreditation is granted to them. In addition to Coursera, which awards this type of certificate, the ECOiMOOC model of the Open University (Portugal) stands out, in which the certification process involves the existence of a summative assessment, aimed at participants who wish to obtain a course completion certificate. However, participants must submit for evaluation at least two of the artifacts produced. In addition to this type of certificates, some MOOCs offer verified certificates [56, 57];

- Certificate of mastery: this type of certificate presents a grade, however, it is not considered as an official credit. One example is the courses promoted by EdX.

- Distinction certificates: institutions that want to assess the knowledge acquired by their students while attending their courses are provided, at a reduced cost, with sets of tests, as is the case with Udacity.

- University credits: an example of the accreditation process is also the ECOiMOOC, which offers the possibility for participants to request, after completing their learning, a formal accreditation by paying a certain amount. In this MOOC model, credits (ECTS) will be awarded after an evaluation.

Bergeron and Klinsky [58] warn of the complexity of MOOC accreditation, as does Auyeung [42], who states that MOOC providers fail in the accreditation process. Thus, there is still a low applicability rate on the part of Portuguese educational institutions, except for the Open University (Portugal) which, as previously mentioned, grants the accreditation of its MOOCs upon payment of a certain amount. Currently, there are already several platforms such as, for example, Coursera and NAU that offer courses with a certificate of completion. However, some courses have as prerequisites either the payment of a certain amount or a minimum grade to obtain them. Regarding accreditation, most courses are not accredited by the Scientific-Pedagogical Council for Continuous Training in Portugal. There is, therefore, a long way to go in these two matters—certification and accreditation, but especially in the latter. If MOOCs are accredited, they will certainly have more teacher participation and, consequently, greater digital training for teachers to improve their practices and innovate in the teaching-learning process. But many MOOCs have been used with considerable weight and importance in various continuing education courses or short courses.

3. Methodology

This section identifies and explains the main methodological options focusing on the research objectives, the characterization of the NAU platform, the data collection instruments, and the processes of processing and analysis of the data collected.

3.1 Research objectives and methodology adopted

This study is supported by exploratory and descriptive research. Exploratory insofar as researchers, supported by a set of pre-defined criteria, look for the MOOCs that have been carried out in the last 3 years within the scope of teacher training. Descriptive research because it allowed describing a phenomenon in its context, that is, understanding the recipients of each course, the objectives, the curricular structure, the evaluation, and the certification process, among other relevant aspects.

The research has three objectives:

1. Identify the MOOCs carried out in the last 3 years in the context of teacher training.

2. Determine the impact of MOOCs on teacher education in Portugal.

3. Understand the contribution of MOOCs to improving the quality of teacher education.

The first objective was achieved through a search for MOOCs on the NAU platform (www.nau.edu.pt/pt/) but also through a web search for the following set of keywords: MOOCs in the context of teacher training; MOOC courses for teachers; MOOC in the professional development of teachers. The search for keywords was carried out according to the following criteria:

- Type of websites: platforms offering MOOCs;
- Recipients: all teachers of all educational levels in Portugal, with the exception of higher education;
- Language: Portuguese.
- Time range: May 2019 to December 2022.

The research was carried out through the usual search engines, but also on the six main platforms promoting MOOC courses that were identified in the literature. Platforms like www.my-mooc.com and www.mooc-list.com that offer a list of MOOCs and free online courses were not ignored, and we tried to follow their news about these types of courses. The European Multiple MOOC Aggregator, called EMMA for short, was also used. It aims to setting excellence in innovative teaching methodologies and learning approaches through the large-scale piloting of MOOCs on different subjects.

3.2 Characterization of the NAU platform

The NAU platform (Online Teaching and Training for Large Audiences) is an online project and platform to support teaching and training, aimed at large audiences. It is a service developed and managed by the FCCN Unit of the Foundation for Science and Technology (FCT) that allows the creation of courses in MOOC format produced by recognized and relevant entities in society. One of these entities is the General Directorate of Education (GDE) which is a central service of the direct administration of the State responsible for implementing policies related to the pedagogical and didactic components of preschool education, basic and secondary education, and extra-curricular education.

It should be noted that NAU is part of the cross-cutting actions of the Portugal INCoDe.2030 initiative by promoting digital development, inclusion and digital literacy, education, and qualification of the active population.

NAU offers courses in several areas, such as exact sciences and technologies, training and education, health and life sciences, communication and marketing, economics and management, natural sciences and environment, social sciences, law, arts and culture and human and political. On the platform, MOOCs are categorized into three levels, namely: initial, intermediate, and advanced and are taught in Portuguese and English only. Most courses created are aimed at teachers—from preschool to secondary education—without excluding all other professionals working in schools, and all human resources in Education.

The courses are promoted by the following institutions: Directorate-General for Education, INA—National Institute of Administration, I.P, INCoDe.2030, MetaRed, CENJOR—Protocol Center for Professional Training for Journalists, Directorate-General for Health, National Center for Cybersecurity, Polytechnic Institute of Lisbon, General Secretariat for Education and Science and University of Évora. Any institution can apply for collaboration with the NAU and to do so must contact the respective entity. The process of producing a course on this platform is quick and simple and will always have the support of the NAU team.

3.3 Collection, processing and analysis of data

Data collection was based on participant observation, which allowed the identification of a set of MOOC courses within the scope of continuing teacher education. Data collection was carried out on the NAU platform but also on other MOOC platforms supported by a set of criteria previously established and presented earlier. Data were recorded in the investigator's diary according to previously defined parameters.

Data were recorded, processed and analyzed in Microsoft Excel through a set of previously established categories, namely: digital platform, promoting entity, course designation, target audience, number of hours and date of completion. While the quantitative analysis only sought to identify the existing MOOCs between 2019 and 2022 in the context of teacher training, the qualitative analysis (content analysis) sought to identify the themes of the MOOCs, learn about the certification process for these courses and determine the format of the course.

4. Discussion of results and conclusions

This section presents the results of research on the current status of these courses in continuing teacher education in Portugal. Based on the results, a reflection is made on the themes and the importance of greater use of this type of course in teacher training is also pointed out.

At the time of selecting this topic for carrying out this investigation, we immediately thought that, due to the pandemic, there would be many courses in MOOC modality aimed at the continuous training of teachers. And if there were not many, at least there would be a significant growth of MOOCs in teacher education. However, we are completely wrong, unfortunately! In fact, during the pandemic, there was a huge growth in the offer of online courses, some in e-learning format and others in MOOC format. However, the courses that were offered in the e-learning modality were more oriented towards teacher training and those that were offered in the MOOC typology were oriented towards all those interested in learning online. That is, during this investigation, it became clear that MOOCs were not the modality adopted for teacher training. Even after the pandemic, the market for online courses continues to grow, whether in e-learning, b-learning or MOOC, but there are still very few MOOCs for teacher training. It is difficult to understand the reasons why teacher training only takes place mainly in face-to-face, b-learning or e-learning. Incidentally, understanding these motives would certainly make a good research question for another study. The fact is that MOOCs are not the main modality of support for teacher training.

In Portugal, in addition to some higher education institutions and a few other entities that have already offered and still offer some MOOC courses within the scope of

teacher training, only NAU assumes the responsibility of offering this type of course. In the area of education and training, NAU partners with the Directorate-General for Education, the University Institute of Lisbon, the Foundation for Science and Technology, the Institute for Employment and Vocational Training, the University of Algarve, the University of Trás-os-Montes and Alto Douro, University of Évora, Porto Nursing School, Polytechnic Institute of Tomar, Open University, Polytechnic Institute of Leiria, Polytechnic Institute of Lisbon, Gaia Nascente—Training Center of Association of Schools, New University of Lisbon and the School Superior of Nursing in Lisbon. It should be noted that each of these partners offers, through the NAU platform, MOOC courses on various topics that were identified in the methodology section.

During the research, 16 MOOCs were found on the NAU platform. Some of these courses have 1 edition, others have 2 and still, others have 3 editions. In this sense, the total editions of the courses are 26, that is, 26 courses were promoted, between 30 May 2019 and 30 December 2022. levels of education (public and private), school directors, teacher training centre directors, librarian teachers, professional teaching teachers, among other professionals in the area of education and training, and also all those who are interested in the topics covered in each one of the MOOCs. It should be noted that the 16 courses available on the NAU platform were promoted by a single entity, in this case, the General Directorate of Education. Then, the MOOCs identified in the survey are highlighted: "E@D in Schools"—15 h (1 edition); "Collaborative Work with eTwinning: First Steps"—3 h (3 editions); "Prevention of online addictions in children and young people"—15 h (1st edition); "Bullying and Cyberbullying: Prevent & Act"—25 h (3 editions); "Technologies for Inclusion and Accessibility"—5 h (2 editions); "Will Artificial Intelligence Transform School?"—25 h (2 editions); "Collaborative work with eTwinning: Next Level"—15 h (1 edition); "Learning and School Communities"—25 h (1 edition); "Education for Sustainability"—39 hours (3 editions); "Inclusive Education"—25 h (2 editions); "Active Learning Scenarios"—25 h (2 editions); "Autonomy and Curriculum Flexibility"—30 h (1 edition); "CyberSecurity in Schools"—15 h (1 edition); "eTwinning MOOC".—3 h (1 edition); "Cooperative Learning Communities, Inclusion and Digital Environments"—25 h (1 edition); "Safeguard and protect children and young people in sport"—4 h (1 edition). As can be seen in the designation of each course, each one of them addresses a different theme. Each of these courses presents information about what will be learned, description of the course, format in which it will be taught, the necessary prerequisites to attend the MOOC, the evaluation and certification process and also the general plan of the course that, normally, appears divided by modules.

5. Impact of MOOC on teacher training

Throughout the development of this research, we were faced with a few surprises. One of them was clearly thinking that the pandemic and all the facts associated with it (confinements, social isolation, emergence of online education, technological evolution, among others) would clearly and unequivocally bring out the growth of MOOCs in education, especially in the context of continuing education of teachers. It seems that we were wrong! Online teaching has indeed grown a lot, obviously in quantity with the transposition of face-to-face teaching to online teaching, but also in quality. Quality because it was necessary to improve the technological infrastructure of

educational institutions, it was necessary to rethink pedagogical models for effective practice with technologies in online environments and to produce quality activities and digital content for students to assimilate the various knowledge. However, this increase in quality and quantity in online education does not seem, at least in the Portuguese case, to have occurred in MOOCs. In general, the teaching-learning processes took place through videoconferencing tools such as Zoom, Microsoft Teams, Google Hangouts, and Google Meet, among others. Thus, it is verified that the use of MOOCs before the pandemic period in education was not an option for the educational institutions, as it was during the pandemic period. Currently, according to the research and observations we had the opportunity to perform, they are still not an option for schools in the teaching-learning process. Although some may have used it, mainly to improve their knowledge and skills, there is no statistical significance in such a large universe of Portuguese educational institutions.

However, in the context of continuing teacher education, there seems to have been an evolution in the adoption of MOOCs. The investigation confirmed that the Directorate-General for Education, through the NAU platform, promoted 26 MOOC courses aimed at teacher training in the last 3 years. It is true that since 2017 the General Directorate of Education has been producing MOOCs, but it was only since mid-2019 that the NAU platform emerged having a proactive role in Portugal, which came to give a new look to the offer of MOOCs for teacher training. This shows that there is beginning to be an interest and perhaps an attraction for this type of distance learning modality on the part of institutions and teachers. However, there is still a long way to go, since most training continues to be offered in e-learning and/or b-learning modality, without support for any MOOC platform.

6. Contribution of MOOC in improving the quality of the training teacher

MOOCs also seem to make a rather important contribution to the realization of continuing teacher education. The results seem to indicate that this contribution is categorized on several levels that articulate and are indispensable to the implementation of useful training to improve teachers' practices: innovate in training, modernize and digitally empower teachers, enhance teachers' autonomy in carrying out tasks, promote flexibility in learning, democratize access to information, enhance the creation of learning communities, promote online socialization, involvement, sharing and collaboration among peers, encourage the design and production of digital content and innovate in the evaluation model of training. Teachers will be enriched if MOOCs are adopted as a support modality for the implementation of teacher training. In addition to the themes that teachers reflect, discuss and learn in online training, they also have the opportunity to acquire digital skills of various levels that will be useful not only for the implementation of MOOC training but also for digital innovation in the teaching-learning process and thus boost the process and motivate students to learn.

The technologies in teacher training and in the teaching-learning process are currently indispensable contribution and their role will always be to help in the planning, development and dissemination of knowledge and never the opposite.

Some institutions in Portugal, like the Polytechnic Institute of Bragança, are joining Learning Programs on Coursera to offer as soon as possible MOOCs to enhance curricula with world-class content and hands-on experiences; improve career readiness and prepare graduates with job-based learning; enable faculty with

supplementary content and promote blended learning; increase student capacity without increasing infrastructure costs; and attract new students with a stronger global reputation. Later these experiments may be replicated for teachers in non-higher education as well. If will result as a strategy, we must wait a couple of semesters to see if we feel changes and evaluate this new possible scenario.

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