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E-Learning through an Adaptive cMOOC: Is it Worthy of Further Research?

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Abstract

This paper describes the types of MOOC considered by researchers, and highlights the latter's focus on Connectivist MOOC. In addition, it analyses MOOC methodologies, and learners' interest in MOOC based on the concepts of adaptability, connectivism, and socio-constructivism. This is to address the high dropout rate issue on MOOC platforms. The main objective of this work is to review the empirical results reported in these studies. To reach this goal, a Systematic Literature Review of 798 papers was carried out from 2013 until April 2021, where 446 papers were selected as primary studies. The results obtained from the classification and the analysis of the collected data confirmed the importance of continuing research in the field. Based on the concepts of socio-constructivism and adaptability, the objective is to provide an adaptive cMOOC for the profile and the needs of each learner; blending learning styles and pedagogical models with machine learning technologies.

Keywords: cMOOC, adaptive MOOC, machine learning, intelligent system, systematic literature review, covid-19

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1. Introduction

As a revolutionary type of E-learning [1], MOOC represents the Massive Online Open Courses [2] offered today by hundreds of platforms [3] worldwide [4]. There are two main types of MOOC [5]:

- xMOOC (eXtended MOOC): Based on the transmissive learning approach, where the teacher is the sole contributor [6].
- cMOOC (Connectivist MOOC): The focus is more on the links and collaborations between learners, and between learners and the instructor [7].

After its emergence in 2008 [8], the number of MOOCs exceeded 11 400 in 2018, with 101 million learners enrolled [9]. However, recording text files or video conferences and uploading them to their MOOC platforms makes the learner face the same pedagogical problems as in classical classrooms [10]. This lack of adaptation to each learner's preferences and needs and the limited interaction during the course presentation, negatively affects learners' engagement and motivation [11] [12]. Unfortunately, this explains why the massive number of enrolments in a course decreases [13] over the course period [14].

The majority of MOOCs are provided as xMOOCs [15]. Some suppliers or MOOC adopters are currently trying to move towards the cMOOC [16] by adopting the notion of connectivism [17] and socio-constructivism [18]. They are trying to provide some tools that can facilitate the interaction between learners, and between the learners and the instructors, such as social networks, discussion forums, FAQs, direct virtual conferences. In addition, guides/handbooks with text, pictures, or videos, explaining the progress of the course [14]. However, at the same time, they continue with the transmissive method of teaching (xMOOC). They use the conventional method, where a

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trainer gives a lecture by providing the maximum amount of information in a limited time, without any adaptation to each learner's profile [19]. This situation poses challenges regarding the courses' pedagogical scenarios [10] [20] and brings us back to the same major pedagogical issue.

Moreover, deadlines for homework or quizzes often trigger new time and rate constraints. This is contradictory, especially to the term "Open," which means that people can learn and be trained at their own pace. Each learner has a different profile, and pedagogically, this process is not effective in distant learning because it is not adapted to the disparate types of learners [6].

The primary purpose of this article is to answer the research questions cited in the materials and methods section. To get objective results, we conducted a Systematic Literature Review (SLR) [21] to search for and analyse all the different primary studies found, and to shed some light on the different methodologies used or proposed to provide a MOOC, based on adaptability, connectivism [22], and socio-constructivism.

The rest of this work is structured as follows: Section 2 describes the method used in this study. Section 3 presents the results discussed, and the key findings are described in section 4. Finally, section 5 presents the conclusion of this study and further work is proposed.

2. Materials and Methods

For this study, the method used was an SLR. This method describes how to plan, execute and present the results of the reviewed literature. It is a reliable way to evaluate the primary and relevant studies and research [23] concerning a specific topic and to review the empirical results reported in these studies [24]. In this paper, the SLR followed a clearly defined protocol by respecting the criteria stated before the review was conducted.

2.1. Search Strategy

A literature search was carried out in relevant academic databases: ACM Digital Library, IEEE Computer Society Digital Library (IEEE Xplore), Scopus, ScienceDirect, Springer, Educational Resource Information Center (ERIC) database, World Scientific Net, Taylor & Francis e-library, and Wiley Online Library.
This research work includes papers from 2013 until April 2021, with the keywords: Adaptive MOOC, Adaptive cMOOC, Social MOOC, "Connectivism" AND "MOOC," "Collaborative" AND "MOOC," "MOOC" AND "Literature review."

Our SLR was started by citing the purpose and the need for this study. Subsequently, a set of research questions were posed to be answered through this work. After that, the relevant papers search began, using the different keywords cited above, selecting the white papers as the primary studies of interest, and eliminating grey ones through any of the Inclusion/Exclusion criteria defined previously. The next step was to identify each selected paper with a unique ID. We processed our research protocol by gathering some information for each one, such as title, authors, country, date, type of paper (Journal article, Conference proceeding, or Book chapter), digital library, study selection (inclusion/ exclusion criteria), research type, MOOC type, and contribution type.
Finally, based on the data extracted from the white papers, classification graphs were generated to analyse and display the study results.

2.2. Motivation and Justification

Since its appearance in 2008 [25] by G. Siemens and D. Cornier, many attempts have been made to develop MOOC platforms. However, one of the biggest challenges that these platforms face up to the present day is the high dropout rate [26] [27]. Thus, an academic literature review was crucial in order to search for and evaluate all available relevant research work related to MOOC. This review includes the researchers' proposals to minimise the dropout rate [28], and analyses the degree of their contributions, and the way they focus on adaptation, connectivism, socio-constructivism and collaboration in the domain of MOOC.

2.3. Research Questions

The definition of the research questions leads to the search process, the analysis of the papers, the classification, and the data extraction. The following is the list of research questions that we posed:

- RQ1: Which type of MOOC has focused on scientific interest recently?
- RQ2: In which ways did studies focus on adaptive cMOOC?
- RQ3: What are the methodologies followed to provide a cMOOC/sMOOC?
- RQ4: What are the types and the degree of contribution in the field?

RQ1 focuses on which type of E-learning is provided: Non-specific MOOC, cMOOC, sMOOC, MOOC Collaborative Learning, Adaptive Non-specific MOOC, Adaptive cMOOC, and Adaptive MOOC. RQ2 aims at identifying the amount, the type and the evolution of papers in cMOOC by year, and other fields.

RQ3 seeks to check if the learners follow a pedagogical or a technological path, in the case of an adaptive E-learning product. Finally, RQ4 sheds light on the degree of contribution made by each paper. That means if the papers include theoretical approaches to deal with the high dropout rate, or if they propose pedagogical approaches or techniques; if they present a modelisation of new systems or a new and actual E-learning Production (such as a Platform or Application)

2.4. Data Classification and Extraction

We extracted the necessary data to answer the research questions, respecting the criteria mentioned in the previous paragraph. To do this, we constructed a matrix of data that includes: Specific metadata for each work, the study selection criteria, the research types, the MOOC types, and the contribution types.

Study Selection Criteria

To select the papers that could be chosen as primary studies, we started initially by reading the title, the abstract, the keywords, and the conclusion. However, it was indispensable to read more details. For example, the methodology and occasionally the results, because the abstract (and sometimes even the conclusion) did not provide the pertinent information needed to classify the work according to the selected criteria.

Therefore, this SLR was conducted based on the following Inclusion/Exclusion criteria. In other words, some works were chosen while others were rejected depending on the following:

- **Unsupported language:** Work published in languages other than English, French, Arabic, or Spanish.
- **Out of scope:** Work not directly related to our topics of interest.
- **Duplicated:** Work contribution that is already cited in other included research. If several publications by the same author are found, only one is selected based on its relevance (a journal has priority) and publication date (the most current one is considered).
- **Included:** Accepted work that concern our topics of interest.

It was straightforward to apply the first criteria, which did not take long. However, the rest of the criteria required longer time and effort to: Read, analyse and evaluate each work.

Research Types

This step classifies our research as the following:

- **Literature review:** The paper summaries a descriptive report of information found in the literature related to the selected area of study.
- **Opinion Paper:** The publication indicates the personal opinions of the author(s) concerning specific techniques, whether they are good or not, and more appropriate approaches.
- **Philosophical paper:** concerns those that design a new way of looking at the existing reality by structuring the field in taxonomy or a conceptual framework [29].
- **Comparative study:** The paper proposes a comparative study between some techniques or existing MOOCs.
- **Proposition of solution:** The solution can either be a new one or an extension of an existing product. It can consider a new pedagogical approach, conception, or the implementation of a new system.
- **Experience Paper:** It indicates an experience of the author(s). For instance, a survey, a case study with existing or new platforms.
- **Validation Research:** This is a new contribution that has not been implemented in practice. Techniques used are, for example, experiments like studies done in a laboratory.
- **Evaluation Research:** Solutions are implemented in practice with evaluation [29].

Contribution Types

This indicates the type of the main work contribution. If it is:

- **Theoretic:** Papers include theoretical approaches to deal with the high dropout rate.
- **Pedagogic:** Author(s) propose(s) pedagogical approaches to improve the problem.
- **Technique:** They propose some techniques to improve it.
- **Modelisation:** Work that presents the design of new systems.
- **E-Product:** Papers present a new and real E-learning production (as a Platform or Application).

MOOC types

It specifies the type of MOOC that the paper focused on:

- **Non-specific MOOC:** Studies that concern Massive Online Open Courses in general.
- **cMOOC:** Research work focused on the Connectivist type of MOOC.
- **sMOOC:** Research on MOOC that follow the social-constructivist approach.
- **MOOC Collaborative Learning:** Studies that include MOOC based on or concerning collaborative learning.
- **Adaptive Non-specific MOOC:** It deals with Adaptive MOOC in general.
- **Adaptive cMOOC:** This type focuses on Adaptive Connectivist MOOC.
- **Adaptive sMOOC:** These Adaptive MOOCs respect the social-constructivist approach.

Data Analysis and Visualization

The last step involves processing and viewing data. This data has been grouped into tables and shown visually on graphs, as described in detail in the following section.

3. Results

Once the papers were selected and classified, we analysed the data obtained. Table 1 illustrates the initial number of primary studies found:

Table 1. Results and Primary Studies According to Each E-Library

	Results	Primary Study
ACM Digital Library	225 (28%)	118 (15%)
Eric	85 (11%)	45 (6%)
IEEE Digital Library (Xplore)	64 (8%)	36 (5%)
ScienceDirect	130 (16%)	82 (10%)
Taylor & Francis e-library	12 (2%)	10 (1%)
Wiley Online Library	16 (2%)	9 (1%)
World Scientific Net	17 (2%)	5 (1%)
Springer	142 (18%)	82 (10%)
Scopus	108 (14%)	59 (7%)
Total	798 (100%)	446 (56%)

Our research started with 798 papers distributed in the most well-known digital libraries in the field. 446 papers (about 56%) were selected as primary studies. The difference between the initial results and the percentage of primary studies passing the inclusion criteria for each database is remarkable.

3.1. Study selection

The 446 primary studies' annual distribution of those papers from 2013 until April 2021 is displayed in Figure 1. Those papers were published as Conference Proceedings, Journal Articles, or Book Chapters.

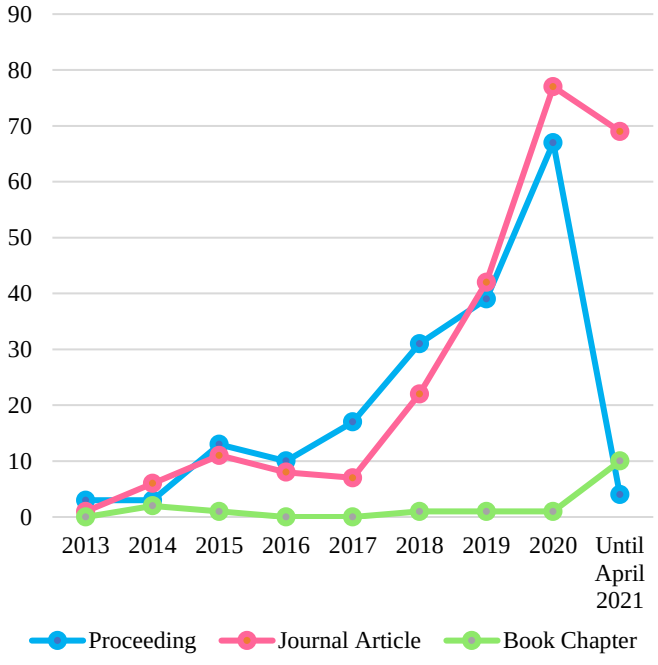

Figure 1. Type of Papers during 2013-April 2021

As the curve above displays, three types of paper production increased each year, reaching their peak in 2020. During the period 2013-2018, the number of proceedings exceeded the number of articles. However, since the beginning of 2019, the rate of articles has exceeded the number of proceedings. Meanwhile, the book chapters' rate was low until the beginning of 2021, when it started to progress.

Since journal publications are more mature and more profound, their production growth and improvement reflect the increasing interest and research focus in the domain. It can be evidence of the advance and progress of research.

Those studies were selected according to the Inclusion/ Exclusion criteria cited before in section 2.4.1.

Figure 2 indicates the percentage of papers in each category. Almost half of them were not directly focused on our topics of interest.

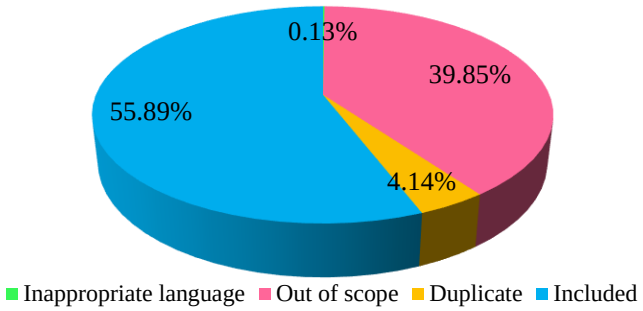

Figure 2. Study Selection Results

3.2. Research Types

Each selected paper was classified according to the eight categories described before in section 2.4.2.

Figure 3 shows the distribution of primary studies according to research type categories listed in the table above.

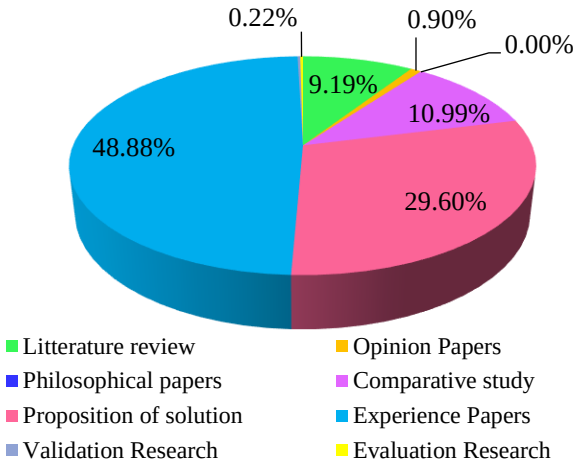

Figure 3. Results of Research Types

Based on the results illustrated in Figure 3, just under half of primary studies (48.88%) were classified as experience papers. Simultaneously, about one-third of them only proposed a solution to a problem related to the research subject. Furthermore, 9.19% of papers were classified as literature reviews. The rest were distributed as opinion papers, comparative studies and philosophical papers. There was only one paper concerning evaluation research, and one about validation research.

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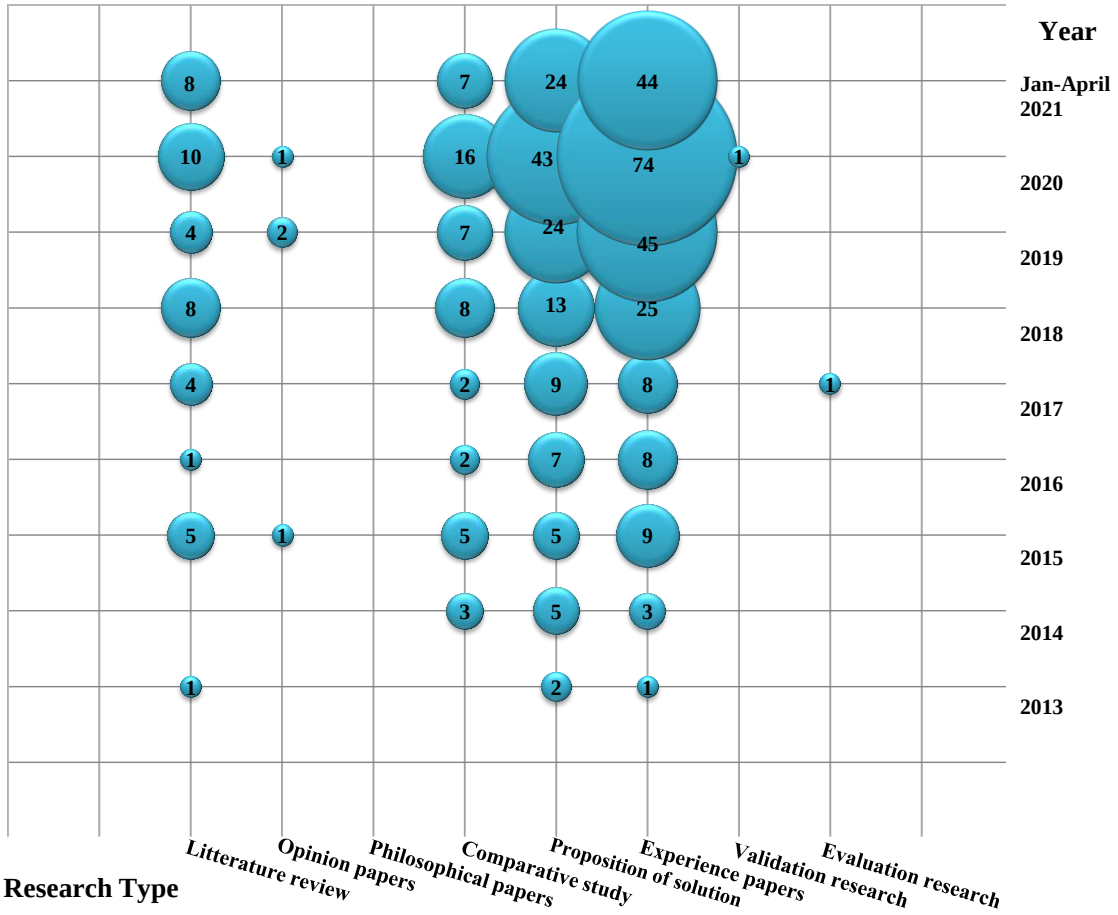

Figure 4. Distribution of Research Types during the period 2013-April 2021

3.3. Study Data Extraction

The bubble diagram in Figure 4 displays the distribution of research types from 2013 to April 2021.

Between 2013 and 2017, the number of experience papers and those that proposed solutions evolved almost identically. Since 2017, the production rate of both types of papers continued to increase. However, the first type exceeded the second by almost 100% every year until the first quarter of 2021.

From 2014 to 2021, comparative studies followed the evolution of the types mentioned above but with modest rates. Moreover, the literature review papers come with an insufficient number of papers. A common characteristic is that all the papers cited peaked in 2020 and continued to progress in 2021. For opinion works, few papers were selected from 2014 to 2020. For validation research only one paper was selected in 2020 and for evaluation research only one paper in 2017.

4. Discussion

This section discusses the results found in our SLR regarding the research questions previously posed in the "Method" section.

RQ1: Which type of MOOC has focused on scientific interest recently?

To answer the (RQ1), the diagram in Figure 5 displays the distribution of MOOC types from 2013 to April 2021. It is

based on seven MOOC types: Non-specific MOOC, cMOOC, sMOOC, MOOC Collaborative Learning, Adaptative Non-specific MOOC, Adaptive cMOOC, and Adaptive sMOOC.

Starting with Non-specific MOOC, we note that the interest in this type of E-learning grew from 2013. By the end of 2018 until April 2021, the focus on Non-specific MOOC is noted. From the middle of 2013 to 2021, studies were increasingly interested in the cMOOC and sMOOC, with less interest in cMOOC from 2016 to April 2021. In addition, the concentration on MOOC collaborative learning rather than on cMOOC and sMOOC was evident since the beginning of 2018.

Adaptability issues began to be integrated modestly with Non-specific MOOC in 2013. In 2017, the interest in the Adaptive Non-specific MOOC increased. In the same year, the research in A. cMOOC also grew. Concerning Adaptive sMOOC, the degree of interest started reducing in 2020.

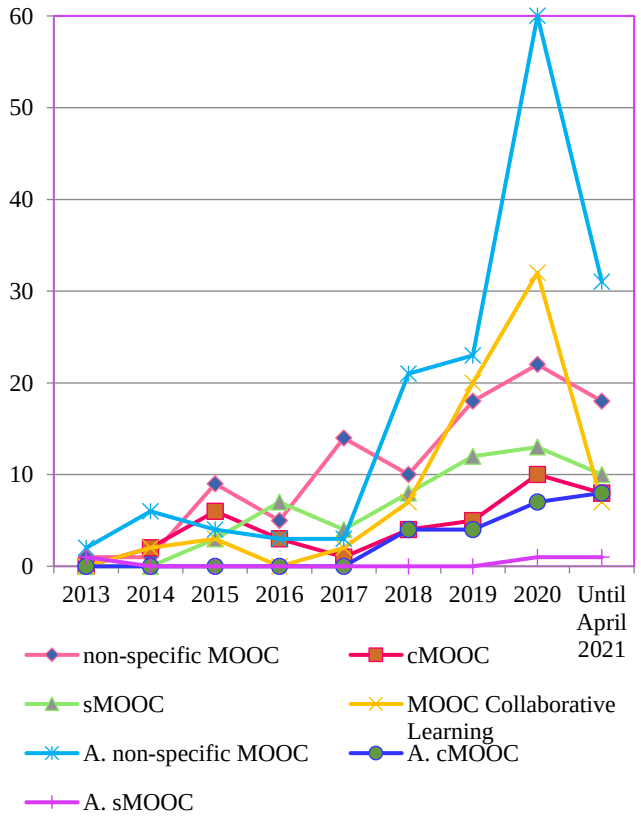

Figure 5. Distribution of MOOC Types in the Period 2013-April 2021

According to the diagram above, a common remark is that compared to previous years, all the MOOC types reached their peak in 2020.

The hypothesis that can be posted here is that after the emergence of MOOC in 2012 [18], it was expected that researchers would be interested in Non-specific MOOC in the following few years. However, because of the problems on MOOC platforms (specifically the high dropout rates), researchers started to look at how the problem could be solved by thinking about other modalities of learning. They started by integrating the pedagogical theories of connectivism and socio-constructivism through MOOC collaborative learning, cMOOC, and sMOOC (from 2013). Those steps were the key to bringing them knocking on the door of adaptive learning from 2013 by researching the Adaptive Non-specific MOOC. In 2020, scientific productions were at their peak with research and added adaptability features to MOOCs. In the same year, many work combined connectivism and socio-constructivism principles with adaptability to provide A. cMOOC. This expansion continued even into the beginning of 2021.

In December 2019, Wuhan, the capital of central China's Hubei province, declared the first cases of humans infected with coronavirus covid-19 [30] [31] [32]. Consequently, the various schools and universities were forced to close. The daily life of nearly 1 billion students in 120 countries was affected in March 2020 [33].

To face this new emergency, the decision-makers worldwide in these fields were forced to seek an alternative solution to maintain the activities linked to learning while respecting health precautions. Several countries adopted flexible solutions to guarantee the continuity of teaching and pedagogical learning in their education systems [34]. MOOC platforms were among the leading solutions adopted [35]. Some of the major MOOC providers such as Coursera and edX offered their support to some higher education institutions [36].

2020 was a challenging year for all the educational systems around the world. Despite the efforts invested in implementing those platforms to share courses and guarantee pedagogical continuity, these systems still experienced high dropout rates [37]. These rates made, MOOC providers think, once again, about improving the solutions offered, by reinforcing connectivity, collaboration, and adaptation. This situation prompted researchers to look at the field, clearly explaining the peak of production in 2020.

RQ2: In which ways did studies focus on adaptive cMOOC?

Regarding the (RQ2), since our research subject focuses on Adaptive Connectivist MOOC, we searched for studies that combine connectivism/socio-constructivism with adaptability. Therefore, here we will discuss the results of the research concerning A. cMOOC, A. sMOOC, collaborative & MOOC, and Connectivism & MOOC. Most of them were published as journal articles (Figure 2). The peak of research was in 2020 (Figure4) and distributed in the different Digital Libraries cited before. It is generally noticed that the selected studies in most libraries describe research about MOOC and occasionally Adaptive Non-specific MOOC. Some of them discuss MOOCs based on connectivism, collaborative or social concepts. Meanwhile, the number of those that concern Adaptive cMOOC or sMOOC is very modest.

In 2017, when the Non-specific MOOC began to decline, the Adaptive Non-specific MOOC rose significantly. In parallel with this rise, the number of cMOOC and A.cMOOC

research works increased to record the highest level in 2020. Research works were continued until the beginning of 2021 for cMOOC, A. cMOOC, and A. sMOOC.

By searching for and reading the papers about sMOOC and MOOC collaborative learning, we deduced that they deal with the same objectives of cMOOC, sMOOC, and MOOC collaborative learning are based on connectivism and socio-constructivism. It is noted that the research work on the three terms try to achieve the same objectives. sMOOC studies began in 2014 (they fail to talk about adaptability) and continued to rise until 2016. In 2017, they fell slightly and then set off again to score a high level until the first quarter of 2021.

Generally, these results explain that some researchers have been aware of the importance of integrating an interactive social environment for the learners enrolled in MOOC platforms. In addition, they are aware of the importance of providing them with knowledge in a more flexible way to motivate and attract them to stay there. However, the field of research about A.sMOOC requires more research and development.

RQ3: What are the methodologies to provide an adaptive MOOC/cMOOC?

For the (RQ3), on the one hand, some studies are interested in analysing learners' behaviour [38], learners' specific demands, learning styles [39], preferences and the context [40]. At the same time, these studies look at collaborative activities [41], data acquisition [37], assessment and resource management [42].

One of the selected studies proposes integrating xMOOC characteristics based on formal e-training with cMOOC based on informal and cooperative e-training. In addition, they suggest different learning strategies adapted to different learning objectives, learner profiles and learning styles. [43].

Other research work was oriented towards previous experience with or knowledge of MOOC [44], motivation to enrol in a MOOC [7] [45], and learners' profiles (gender, age, geographical location, and academic level) [46].

On the other hand, some researchers are interested in applying Big Data Analytics [47] and Data Mining algorithms for MOOCs [48]. For example, one of the studies designs a model of a MOOC adaptive learning system based on Intelligent Push, Adaptive Learning Path, Diagnostic Assessments and Intelligent Feedback [49]. Other studies show how motivation influences the variations in the learners' preferences [50]. In contrast, others propose some machine learning approaches [51] to identify and track learners' learning styles based on their behaviour and actions during a MOOC in order to provide them with personalised recommendations [52] based on their learning styles [53].

Overall, most studies about adaptability focus on motivation, learners' preferences, learning styles and learners' profiles. Others consider the technological path of big data and machine learning to analyse behaviours and preferences. However, few studies have tried to apply connectivism, constructivism, or socio-constructivism.

RQ4: What are the types and the degree of contribution in the field?

To answer the question (RQ4), the diagram of Figure 6 portrays the distribution of primary studies according to contribution type. On one side, it shows the research type, and on the other, it highlights the type of MOOC.

According to the type of research, the most frequent type being experience papers, most of them present systems modelisation (21.07%), followed by theoretical ones (10.76%). Some others are technical (8.29%) or pedagogical (4.71%), and few studies talk about E-products (3.81%).

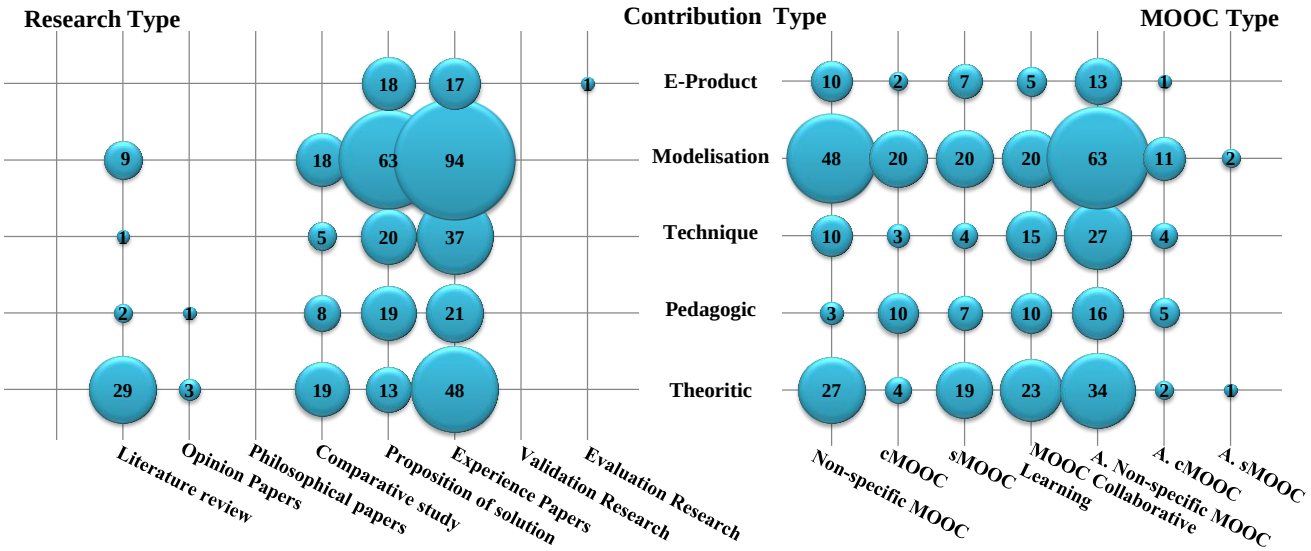

Figure 6. Distribution of Contribution Type According to Research and MOOC Types

The second research type rate concerns the studies that propose a solution for the dropout issue. Most of them present platform modelisation (14.12%), followed by technical contributions (4.48%), pedagogical contributions (4.26%), and then E-Products (3.81%).

Papers concerning comparative studies are the third research type rate, followed by literature reviews and opinion papers. The majority of them have general theoretical contributions. Besides, we can notice that there is one evaluation without any philosophical paper or validation research.

Considering research types, the rate of studies that concern E-products or pedagogical contributions is low. The experience papers with E-products represent (3.81%) of primary studies, while those focusing on pedagogical contributions represent (4.71%). Studies that propose solutions for dropout on MOOC platforms give, in most cases, systems architecture or development, with a modest rate of pedagogical contributions. This overall contribution seems inadequate and insufficient because most existing platforms offer similar functionalities. They tried to develop a system and implement a platform from a technical point of view. However, the problem remained the same from the pedagogical point of view.

The remaining papers are published as comparative studies, literature reviews, or opinion papers with theoretical contributions in most cases. Here the absence of validation or evaluation research (only one paper) is noticed. These figures allow us to affirm the lack of study hypothesis in the field and the need for more scientific efforts by combining pedagogical and technological contributions to produce E-products (platforms) that have to be tested, evaluated, and validated.

From the MOOC type view, the majority of contributions were concerning Adaptive Non-specific MOOC touch system modelisation (14.12%), followed by those that are theoretical (7.62%), and (6.05%) have technical contributions. Only (3.59%) have pedagogical contributions and (2.91%) as E-products.

The papers about cMOOC are often focused on modelisation (4.48%), followed by pedagogical contributions (2.24%). And even less (0.90%) are theoretical contributions, technical contributions, and E-products.

For sMOOC, most studies concern modelisation (4.16%). In addition, (2.24%) of the studies refer to pedagogical studies, and less than (0.90%) to theoretical contributions, technical contributions, and E-products.

Concerning MOOC collaborative learning, theoretical contributions constitute (5.15%) of the primary studies. (4.16%) talk about modelization, (3.36%) about technical contributions, (2.24%) about pedagogical contributions, and only (1.12%) about E-products.

While for A.cMOOC, only (2.47%) of papers represent modelization, (1.12%) concern pedagogical contributions, and less than (0.90%) for theoretical contributions or E-products. For A.sMOOC only (0.45%) represent modelization, and just one paper for E-products.

On the one hand, talking about socio-constructivism (considering cMOOC, sMOOC, and MOOC collaborative learning), only (6.05%) of the papers deal with pedagogical contributions, even less (4.93%) of them are technical, and just (2.69%) are E-products.

On the other hand, some of the selected studies try to combine socio-constructivism with adaptability to solve the existing platform problems, especially the dropout rate. (6.95%) are technical contributions, (4.71%) are pedagogical contributions, and only (3.13%) tackle E-products. This implies that researchers have recently started seriously working this way (See Figure 5 where the peak of studies was in 2020). This research axis involves further work. Most contributions provide modelisations with little focus on adaptability and socio-constructivism. The results can also be seen in Figure 5.

Contributions concerning adaptability or socio-constructivism are more focused on technical than pedagogical issues. This hypothesis is supported by the number of MOOC platforms growing and the high dropout rates.

5. Conclusion and Future Work

To conclude, an SLR was carried out to analyse the methodologies used and the degree of interest in MOOCs based on adaptability, connectivism, and socio-constructivism. Furthermore, the integration of big data and machine learning algorithms is required to lower the dropout rate on MOOC platforms.

After the analysis of the chosen E-Libraries, (55.89%) of the papers were selected as primary studies based on the study selection criteria. After that, we classified the different results obtained, whether concerning MOOC types, paper types and contributions. Most of the selected studies that discuss adaptability and socio-connectivism on MOOC platforms were published as journal articles. Research reached its peak in 2020, the pandemic year.

Most of the selected studies focused on Non-specific MOOC. Due to the problems on MOOC platforms, researchers turned towards other modalities by integrating connectivism and socio-constructivism approaches through cMOOC, sMOOC, and MOOC Collaborative learning. Based on the selected studies concerning those three types of MOOC, we deduced that: The three terms refer to the same thing, have the main objective, and are based on the same principles. By talking about cMOOC, we can consider all the studies concerning the two other types, which started in 2014. In parallel, and since 2013, attempts have been based on adaptability. However, those that integrated it with socio-constructivism started in 2017 and reached their peak in the first quarter of 2021. This explains that researchers became more conscious of providing flexible learning and responding to each learner's needs adaptively to motivate his learning motivation and engagement. Among those talking about adaptability, most try to think about motivation, learners' preferences, learning styles and learners' profiles. Others

consider the technological path of big data and machine learning to analyse behaviours and preferences. The studies that bring adaptability and socio-constructivism together in MOOCs are scarce (theoretical contribution or modelisation).

The several selected papers, as well as the number of contributions, can affirm that learning via an Adaptive cMOOC is a domain that invites further research (only 5% of primary studies have been specifically focused on the A. cMOOC and just 1% on the A. sMOOC).

The low rate of pedagogical consideration supports the need for more research that combines pedagogical and technological contributions to get E-products that can be tested, evaluated, and validated.

After a rigorous study, we aim to continue our research focusing on the adaptability concept and socio-constructivism, to provide an adaptive cMOOC suitable to each learner's profile, preferences, and abilities. Moreover, it encourages us to consider integrating learning styles and pedagogical theories with big data and machine learning technologies. As a result, this can optimise learning performance and engagement by minimising restrictions and improving online learners' motivation.

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