

## DISRUPTIVE INNOVATION IN EDUCATION: A BIBLIOMETRIC STUDY ON MOOCS

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**Abstract:** The aim of this study is to present the research scenario involving MOOCS, a new learning format that has the potential to become a disruptive innovation when compared to traditional teaching-learning models. Descriptive and quantitative work, bibliometric in nature, seeks to raise the characteristics of academic production. For that, a bibliometric search was carried out in the Web of Science database, in which 2,079 articles published in the period from 2011 to 2020 were investigated, in the respective database, including the characterization of production, methodological aspects and related themes. Initially, the total number of publications was identified, characterized by their thematic areas, types of documents, year of publication, authors, funding agencies and institutions, countries and languages. The research was carried out using Excel tools and VOSViewer software. It is also observed that the degree of cooperation between the authors is significant. Among those that stand out more are Kloos C.D. and Hoyos A.C. It can be seen that the main authors in the area are Spanish, despite the fact that this education model emerged in the United States in 2008.

**Keywords:** Bibliometry. Moocs. Disruptive Innovation

## INOVAÇÃO DISRUPTIVA NA EDUCAÇÃO: UM ESTUDO BIBLIOMÉTRICO ACERCA DOS MOOCS

**Resumo:** O objetivo deste estudo é apresentar o cenário das pesquisas que envolvem os MOOCS, um novo formato de aprendizagem e que apresenta potencial para tornar-se uma inovação disruptiva quando comparado aos modelos tradicionais de ensino-aprendizagem. O trabalho descritivo e quantitativo, de natureza bibliométrica, busca levantar as características da produção acadêmica. Para tanto, foi realizada uma pesquisa bibliométrica na base de dados *Web of Science*, na qual foram investigados 2.079 artigos publicados no período de 2011 a 2020, na respectiva base de dados, incluindo a caracterização da produção, dos aspectos metodológicos e dos temas correlatos. Inicialmente, foi identificado o total de publicações, sendo caracterizado por suas áreas temáticas, tipos de documentos, ano das publicações, autores, agências financiadoras e instituições, países e idiomas. A pesquisa foi feita com uso de ferramentas de Excel e do software VOSViewer. Observa-se, ainda, que o grau de cooperação entre os autores é significativo. Entre aqueles que possuem maior destaque encontram-se Kloos C.D. e Hoyos A.C. Verifica-se que os principais autores da área são espanhóis, apesar do fato deste modelo de educação ter surgido nos Estados Unidos, em 2008.

**Palavras-chave:** Bibliometria. Moocs. Inovação Disruptiva

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## 1. INTRODUCTION

Beyond the walls of the school, most people learn by interrelating subjects, settings, and experiences. However, for most of our student life, we are taught a method that organizes blocks of time for learning specific content, which is very reminiscent of the factory production system. According to Carter (2016), we are living through one of the most disruptive and exciting moments in history: the Information Age. The pace of change has increased exponentially due to the rapid production of new content, as life and technology become inseparable.

The speed at which information propagates continues to have a direct impact on the education system, as a large part of today's students – Generation Z – have only known the world with touchscreen technology. A vast amount of content is readily available to them through a click on the screen. Students are also creating more of their own content than any other generation in history, and because of that, they learn in fundamentally different ways than they used to. In view of this, MOOCs (Massive Open Online Courses) emerge as a new education methodology, which moves towards a chain, a process of massification and expansion of global education. These educational platforms have been used by important institutions in order to improve the ways of transmitting knowledge and information.

According to Sivamuni and Bhattacharya (2013), the Oxford dictionary defines a MOOC as a course made available through the web, at no cost and offered to a very large number of people. For Subbian (2013), MOOC is a free, web-based course with open registration and publicly shared curriculum. Mota and Inamorato (2012) state that MOOCs, a recent educational phenomenon, constitute a possible disruption in education in terms of online teaching and learning.

Such enthusiasm, although understandable, demands the necessary caution because the concept is contemporary and still being consolidated, being subjected to changes with the advent of internal trends and challenges. Despite these uncertainties, renowned universities such as Harvard, MIT, Oxford and Cambridge are examples of the creation of virtual educational environments, with lectures and recorded classes that can be revisited whenever the student is interested and possible, as part of a concept in which students study alone, outside of a traditional teaching environment. Veduca is one such platform. It gathers videos from the best universities in the country and from other international institutions. It was created in March 2012 and promotes online courses in Portuguese or with Portuguese subtitles for better understanding by students. Its characteristics are the same as other MOOCs and the courses available are based on their importance to the Brazilian economy, such as engineering,

technology, oil and gas, and environmental sustainability (TAVARES, 2014).

Therefore, there is an imminent need to review the management and innovation ideas of the players involved with the educational sector in the face of a new reality in which students, increasingly connected and interactive, no longer accept only traditional teaching-learning approaches. Making definitive statements about the impacts that MOOCs will have on face-to-face courses is still an exercise in futurology. As it is something new – the first MOOC emerged from an experience at the University of Manitoba, Canada, in 2008 – it would be unwise, for example, to say that the massive use of these platforms represents the end of face-to-face courses in the near future. . However, it is undeniable that the proliferation of channels, courses, celebrity teachers, and, above all, the exponential growth of users, makes all those who currently work in a traditional model of education, need to carefully reflect on these digital platforms.

Santos, Schwanke and Machado (2017, p. 131) reinforce this perception by stating that:

In this context of global citizenship, it is important to realize that digital technologies are part of people's daily lives. Because we usually use them in different contexts and moments of our daily lives for numerous reasons, as well as to communicate, stay informed, carry out work and research, among others. In this way, it is understood that digital technologies have been considered a necessity in the world we live in and, for this reason, the use of these instruments has been increasingly common.

Therefore, from the context visualized in the introductory stage, this research is organized into five sections, starting with an introductory approach. Then, section 2 presents a review of the literature, in which the themes definition and laws of Bibliometrics, MOOCs and Disruptive Innovations are addressed. Section 3, methodology, addresses the research methods employed during the current study. The results obtained are presented and discussed in the section. 4. Subsequently, in section 5, there are the final considerations of the study, as well as suggestions for possible future works and, finally, in the References section, the bibliographies used in the research are presented.

## **2. LITERATURE REVISION**

Education is one of the most important sectors for the development of a country. It is through the production and dissemination of knowledge that a nation grows, increases its income and people's quality of life. Therefore, Massive Open Online Courses (MOOCs) receive increasing attention from professionals involved in teaching-learning processes. In this sense,

Pernias and Mora (2013) consider MOOCs to be a ‘revolution in education’, an emerging technological and pedagogical trend, a relatively new term that is being treated as a widespread phenomenon.

Horn (2014, p.2, our translation) is even more forceful in saying that:

When Massive Open Online Courses, or MOOCs, took the world by storm in 2012, too often their description was accompanied by an adjective: disruptive. The implication? They were clearly disruptive innovations designed to transform learning.

Other authors, in turn, think that it is too early to make this kind of claim and that MOOCs have yet to prove their worth in the context of massive learning and within institutional strategies. For Sivamuni and Bhattacharya (2013), the number of graduates in MOOC-type courses is still very small and there is a great need for research that evaluates and validates the effectiveness of learning and the pedagogical strategies used by these platforms. Corroborating this concern, Poy and Gonzales-Aguilar (2014) point out that, in general, student dropout rates fluctuate between 75% and 90%, on average. And that early studies point out that these high rates may indicate a mistake in user-centered design.

Powell and Yuan (2013, p. 5) highlight the massive attention that the media, education entrepreneurs and technology professionals have given to MOOCs. The promise of innovation and access to education make this tool a more affordable option for students who would not previously have access to certain courses or training tools. The author also puts on the agenda the fact of possible ruptures and resounding changes in traditional education. Siemens (2013) argues that MOOCs are a continuation of the trend in innovation, experimentation and the use of technology initiated by distance and online learning to offer massive learning opportunities.

Furthermore, according to Forno and Knoll (2013), MOOCs emerge as a modality of courses offered, generally, for free, to anyone with internet access anywhere in the world. Relatively recent, most of these open courses are offered by renowned educational institutions and made available through virtual platforms that bring together numerous options in diverse areas of knowledge. In the view of Allen and Seaman (2014), the concept of MOOC encompasses the idea of a study program made available through the internet, free of charge and for a large number of people. Corroborating this concept, Gaebel (2013, p.3, our translation) sustains the fact that, so far, MOOCs have the following characteristics, “they are online courses, with no need for a prerequisite to enter, with no limit of subscribers, are free, and do not count as a formal curriculum”.

Fassbinder, Delamaro and Barbosa (2014) state that in relation to the classification of

MOOC projects, focusing on an instructional plan, there is a clear convergence in the sense of dividing them into cMOOCs and xMOOCs. Both share many characteristics, such as use of multimedia resources, massive number of learners and content divided into weeks. The main differences stem from the role of teachers and students in the course, in addition to the way learning is achieved. Forno and Knoll (2013) reinforce this idea by declaring that cMOOCs are based on connectivism and develop more informally in the network, being relatively free from the 'shackles' of a traditional educational institution. Thus, in cMOOCs, students are encouraged to seek more knowledge on the web, thus evolving the debates in the courses, in addition to increasing interactivity between participants in the various existing technological platforms, such as blogs, wikis, websites, social networks, etc. The cMOOC, therefore, is not all planned from the beginning, the experience evolves as the course develops (MOTA; INAMORATO, 2012).

For Siemens (2004), connectivism is “the integration of principles explored by chaos, networks, and theories of complexity and self-organization. Learning is a process that takes place in nebulous environments where the main elements are in transformation”. Still according to the author, the learning process “can reside outside of ourselves and be focused on connecting sets of specialized information, considering the fact that the connections that enable us to learn more are more important than our current state of knowledge”. Downes (2014) identified four key design principles for cMOOCs:

- a) student autonomy: allowing students to choose the content or skills they want to learn; learning is personal, and therefore there is no formal curriculum (although MOOC organizers will usually choose a main theme and invite participants);
- b) diversity: in terms of the instruments used, the range of participants and their levels of knowledge and content are varied;
- c) interactivity: in terms of cooperative learning, communication between participants, resulting in new knowledge;
- d) openness: in terms of access, content, activities and evaluation.

Thus, for advocates of MOOCs, learning does not result from the transmission of information from an expert to beginners, as in xMOOCs, but from the sharing and exchange of knowledge among participants (BATES, 2017). The xMOOCs models are more recent and correspond to an extension of the pedagogical models used by traditional educational institutions, privileging instructional teaching practices, that is, making use of instructional

design (FORNO; KNOLL, 2013).

According to Mota and Inamorato (2012), xMOOCs, unlike cMOOCs, are based on a structured and traditional format, which follows a flow, based on knowledge pre-defined by the teacher, shared from one to many. In this model, the figure of the professor is central and, in general, PhD professors from renowned universities are responsible. The contents are defined by the institution and interactivity between participants is not prioritized. The term was coined by Stephen Downes for courses developed by Coursera, Udacity, and edX. Therefore, in summary, Gaebel (2013) defines that cMOOCs focus on the creation and generation of new knowledge, while xMOOCs aim at the duplicity of knowledge for other students, whose teaching is based on the traditional and is more likely to motivate debates in the classroom higher education innovation.

## **2.1 Disruptive innovations**

Initial studies on market disruptions focus on the analysis of discontinuous technologies and innovations (CHRISTENSEN; BOWER, 1996). These initial analyzes were extended to the concept of disruptive business models, thus associating business models with technological and innovation disruptions (CHRISTENSEN; RAYNOR, 2003). In this sense, the disruption of business models occurs at a stage in which emerging technologies and innovations become critical through a new business model (MOORE, 2004). The concept of disruptive innovation started to be better understood and defined from the studies of Clayton Christensen, still in the 90's. In his book 'The Innovation Dilemma', the author presents the differences between two types of innovation: disruptive and supporters. Sustaining innovations result in products and services that meet the needs of customers in already established markets, allowing companies to increase their profit margin and sell higher quality products, without having to take great risks (CÂNDIDO, 2011).

According to Christensen (2011), disruptive innovations give rise to new markets and business models, presenting more efficient solutions than the ones that exist so far. In other words, it disrupts a business model and alters the existing bases of competition. However, for this to occur, Adner (2002) reiterates that disruptive technologies introduce a performance package that is different from the technologies in vogue in the market, having lower performance than established technologies, entering a field where performance matters a lot to traditional customers. . In the beginning, any disruptive technology needs some adaptation time to reach the standards that mainstream consumers are used to. Christensen (2012) reinforces

this idea by stating that disruptive technologies bring a value proposition to a market that is very different from that available until then. In general, these technologies underperform established products in mainstream markets. But it contains other features with some additional (and often new) advantages of customer value. Products based on these technologies are generally cheaper, simpler, smaller, and often more convenient to use.

When we analyze some of the MOOCs, some of these characteristics pointed out by the Harvard researcher are evident, such as the convenience of attending classes anywhere and at any time, the course is free or extremely competitive price and, especially, the quality of the professors who make the contents available to the students. interested students. Along the same lines, Thomond, Herzberg and Lettice (2003, p. 4, our translation) state that:

Disruptive innovation has also been defined as a technology, product or process that starts from an existing business and threatens to displace it. Typically, the disruptor offers lower performance and less functionality. The product or process is good enough for a significant number of customers - in fact, some don't buy the older version with greater functionality and accept the simplicity of disruption. And gradually, the new product or process improves to the point where it displaces the competitor.

Despite this, Cândido (2011) reminds us that disruptive innovations have been essential for reducing costs, expanding access to certain technologies and improving quality in various sectors of the economy. It should be noted that innovations in business models do not stop at discovering new products or services, but simply redefining what an existing product or service is and how it is provided to customers (MARKIDES, 2006). Thus, in the innovation of business models, attention is focused on the customer (MAGRETTA, 2002), seeking new ways of creating value for consumers, instead of the pure delivery of a new product, service or process (BASHIR; YOUSAF; VERMA, 2016). Can MOOCs be seen as a major revolution in education or just an example of the hype that often occurs when there is some technology involved? Bates (2017) argues that MOOCs are a significant evolution but have severe limitations for developing the knowledge and skills needed in the digital age. When analyzing the characteristics of MOOCs and the transformative impact they can have on students, teachers and companies involved in the education sector, it is difficult not to imagine them as a disruptive innovation.

### **3. METODOLOGY**

#### **3.1 Search type**

The present study is characterized as descriptive, empirical in nature, with a quantitative approach and application of bibliometric research, which, according to Oliveira et al. (2013), is a resource capable of measuring the influence of researchers and their journals. Through bibliometrics it is possible to identify and analyze the motivations that lead a given researcher to investigate a given subject, the relationship network between researchers, what has been published about a given topic, what are the main subjects with which studies have related the theme, among other factors (BELFORT; FREITAS; MARTENS, 2017). According to Triviños (2008), quantitative research describes the characteristics of certain populations or phenomena, looking for relationships between variables.

### **3.2. Data collect**

Data collection was performed using the Web of Science search engine, using the term “MOOCs” as a keyword. This database was chosen due to its credibility and the number of publications available. From the searched word, it was possible to extract the following information from the database: total number of publications, thematic areas, type of documents, year of publication, authors, institutions, funding agencies, countries and languages. Then, an analysis was performed using a textual map, cluster of co-citations and keyword links used in publications through the VOSViewer software.

## **4. GENERAL CHARACTERISTICS OF MOOC PUBLICATIONS ON THE WEB OF SCIENCE**

In the first phase of the study, the search for the term “MOOCs” was carried out and the presence of more than two thousand productions was verified. Therefore, the time period for the present study was selected - 2011 to 2020 - and 2,079 publications were found. Below, the general characteristics of these works are presented, according to the following categories: thematic areas, type of documents, year of publication, main authors, main institutions and funding agencies, countries and languages. Table 1 presents the five main thematic areas related to the theme according to the number of publications. The selected areas present evidence of the heterogeneity of the theme.



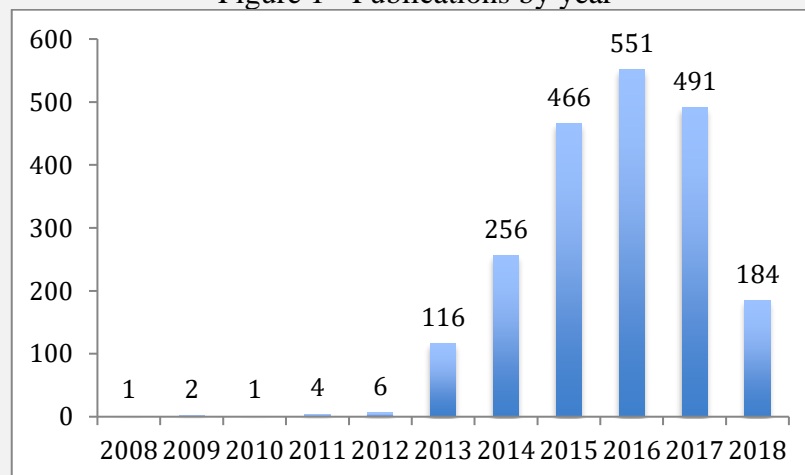
Table 1 - Thematic areas in the study on MOOCs

Thematic area	Number of Publications
1° Education educational research ( <i>Pesquisa Educacional</i> )	1.106
2° Computer Science Interdisciplinary Applications ( <i>Aplicações Interdisciplinares de Informática</i> )	355
3° Computer Science Theory Methods ( <i>Métodos de Teoria da Ciência da Computação</i> )	271
4° Education Scientific Disciplines ( <i>Disciplinas Científicas da Educação</i> )	226
5° Computer Science Information Systems ( <i>Sistemas de Informação da Ciência da Informática</i> )	225

Source: *Web of Science* (2022).

In the period between 2011 and 2020, it was found that the number of publications increased gradually over the ten years analyzed, especially from the year 2013, with its peak in 2016. Figure 1 shows the number of publications per annum.

Figure 1 - Publications by year



Source: *Web of Science* (2022).

It is possible to observe that, from 2013, the theme MOOCs starts to arouse the interest of the academy in a much more forceful way. In a span of just five years – 2012 to 2017 – there was an increase of more than 8,000% in the number of articles published on the topic. This behavior also corroborates the idea of disruptive innovation, from the moment an idea begins to be timidly accepted and, in a relatively short period of time, is adopted by a significant number of people. Table 2 shows the five authors who published the most in the analyzed period.

Table 2 - Number of articles published by author

Authors	Published articles	Country
<i>Meinel C.</i>	27	<i>Germany</i>
<i>Kloos C.D.</i>	26	<i>Spain</i>
<i>Munoz-Merino P.J.</i>	20	<i>Spain</i>
<i>Perez-Sanagustín M.</i>	19	<i>Chile</i>
<i>Alario-Hoyos C.</i>	18	<i>Spain</i>

Source: *Web of Science* (2022).

The main authors are from numerous educational institutions and stand out in the areas of technology, computing and innovation. The three main authors are: Meinel C., German scientist and university professor of Computer Science. He is President and CEO of the Hasso Plattner Institute (HPI) for IT Systems Engineering at the University of Potsdam (Germany) and Professor of Internet Technologies and Systems. His research interests are focused on internet technology and systems and on innovation research.

Carlos Delgado Kloos works in co-authorship with Pedro J. Munoz Merino, professor – full professor – at the Carlos III University, in Madrid. The fourth author who published the most in the analyzed period was Professor Mar Pérez Sanagustín. She is an associate of the computer science department at the Pontifical Catholic University of Chile and director of the education engineering unit at the same university. Mar Perez-Sanagustín has a PhD in Information and Communication Technology. He has worked with several research groups around the world: at the Universidad Carlos III de Madrid (UC3M), as a post-doc; at the LTRI group at London Metropolitan University (as a PhD student) and at the Stanford Research Institute (SRI) as a student at the Fulbright agency). His research focuses on studying the self-regulation of MOOCs, hybrid methodologies based on MOOCs, collaborative learning with mobile devices, and engineering education. In addition, she has extensive teaching experience in programming, databases, and information systems courses.

Perez-Sanagustín's main co-authors are Kloos and Hoyos. The main work carried out by the three is Analyzing the impact of built-in and external social tools in a MOOC on educational technologies, which was cited 103 times. Finally, we have Professor Carlos Alario-Hoyos, who is Deputy Vice President of Strategy and Digital Education and Deputy Director of the UNESCO Chair “Scalable Digital Education for All.” His area of interest is technology and systems and MOOCs.

As for the institutions and funding agencies, heterogeneity was identified between them, which demonstrates that there is not a single dominant institution and/or funding agency. Of the 2,079 publications, more than 100 funding agencies were identified, as well as more than 100 institutions. Table 3 shows the most outstanding institutions and agencies.

Table 3 - Main funding agencies

<b>Funding agencies</b>	<b>Records</b>
<i>1º National Natural Science Foundation of China</i>	21
<i>2º Spanish Ministry of Economy Competitiveness</i>	16
<i>3º National Science Foundation</i>	12
<i>4º European Commission</i>	7
<i>5º Regional Government Of Madrid</i>	7

Source: *Web of Science* (2022).

The funding agencies that most supported the research were: National Natural Science Foundation of China; Spanish Ministry of Economy Competitiveness; National Science Foundation; European Commission and Regional Government Of Madrid. The countries that publish the most on MOOCs are shown in the next table.

Table 4 - Main countries

<b>Country</b>	<b>Number of Articles</b>
<i>1° USA</i>	<i>415</i>
<i>2° Spain</i>	<i>294</i>
<i>3° China</i>	<i>284</i>
<i>4° England</i>	<i>165</i>
<i>5° Australia</i>	<i>101</i>

Source: *Web of Science* (2022).

As for the number of publications by country (Table 4), the United States of America leads the ranking of publications, followed by Spain, China, England and Australia. Table 6 shows the main languages in which the works are published.

Table 5 - Main languages

<b>Language</b>	<b>Number of Articles</b>
<i>1° English</i>	<i>1.971</i>
<i>2° Spanish</i>	<i>79</i>
<i>3° France</i>	<i>9</i>
<i>4° Portuguese</i>	<i>9</i>
<i>5° Chinese</i>	<i>8</i>

Source: *Web of Science* (2022).

The main language is English, which has the greatest representation, with 95% of the publications. Other languages, with less representation, are Spanish, French, Portuguese and Chinese. The result of this analysis makes it clear that the English language is undoubtedly the official language for those who wish to be inserted in the academic scenario. And the main international journals reinforce this finding.

#### 4.1 Citation report

The citation report provides statistical information based on the results retrieved and informs the h-index (an index that uses as a basis the number of articles published by a scientist and the frequency with which these articles are cited by other authors. of these, 2,856 are citations without self-citations. More than 6,000 articles were cited. The average number of citations per item is 3.22 and the h-index is 35. An index of h means that there are H publications

that were cited by less h times. It can be seen that just as publications increased year after year, citations also increased significantly from 2013. Through citation analysis, the most cited works on MOOCs were identified. These works are detailed in Frame 1.

Frame 1 – Most cited publications

DESCRIPTION	Year of publication	Citation
<b>MOOCs: A Systematic Study of the Published Literature 2008-2012</b> Por: Liyanagunawardena, Tharindu Rekha; Adams, Andrew Alexandar; Williams, Shirley Ann INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING Volume: 14 Edição: 3 Páginas: 202-227	2013	245
<b>Initial Trends in Enrolment and Completion of Massive Open Online Courses</b> Por: Jordan, Katy INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING Volume: 15 Edição: 1	2014	165
<b>A Pedagogy of Abundance or a Pedagogy to Support Human Beings? Participant Support on Massive Open Online Courses</b> Por: Kop, Rita; Fournier, Helene; Mak, John Sui Fai INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING Volume: 12 Edição: 7 Edição especial: SI Páginas: 74-93	2011	140
<b>Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges</b> Por: Hew, Khe Foon; Cheung, Wing Sum EDUCATIONAL RESEARCH REVIEW Volume: 12 Páginas: 45-58	2014	130
<b>Instructional quality of Massive Open Online Courses (MOOCs)</b> Por: Margaryan, Anoush; Bianco, Manuela; Littlejohn, Allison COMPUTERS & EDUCATION Volume: 80 Páginas: 77-83	2015	129
<b>MOOCs: So Many Learners, So Much Potential ...</b> Por: Kay, Judy; Reimann, Peter; Diebold, Elliot; et al. IEEE INTELLIGENT SYSTEMS Volume: 28 Edição: 3 Páginas: 70-77 Publicado: MAY-JUN 2013	2013	75
<b>Using mlearning and MOOCs to Understand Chaos, Emergence, and Complexity in Education</b> Por: deWaard, Inge; Abajian, Sean; Gallagher, Michael Sean; et al. INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING Volume: 12 Edição: 7 Edição especial: SI Páginas: 94-115 Publicado: 2011	2011	75
<b>Connectivism: Its Place in Theory-Informed Research and Innovation in Technology-Enabled Learning</b> Por: Bell, Frances INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING Volume: 12 Edição: 3 Edição especial: SI Páginas: 98-118 Publicado: 2011	2011	72
<b>Reflections on Stanford's MOOCs</b> Por: Cooper, Steve; Sahami, Mehran COMMUNICATIONS OF THE ACM Volume: 56 Edição: 2 Páginas: 28-30 Publicado: FEB 2013	2013	66

Source: *Web of Science* (2022).

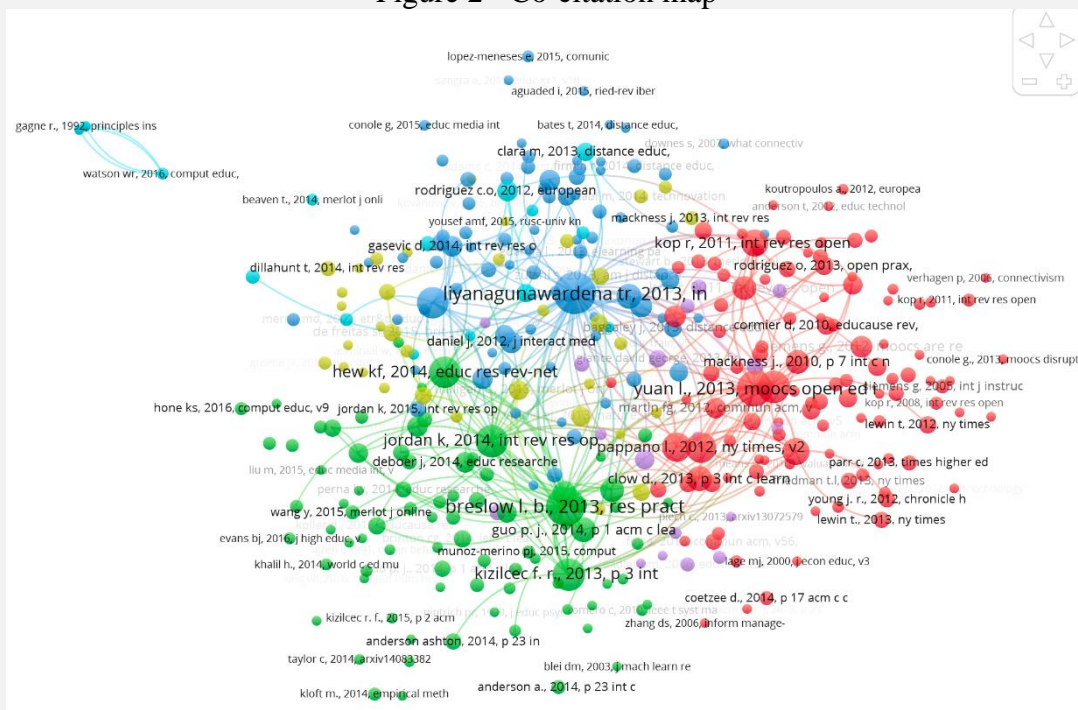
As we can see in the table above, the article with the highest number of citations is called MOOCs: A Systematic Study of the Published Literature 2008-2012, published in 2013. It is a

systematic review of the published literature on the topic among years 2008 and 2012. To this end, 45 articles extracted from journals, database searches and web searches were analyzed. According to the authors, many academics are increasingly interested in studying MOOCs recognizing the potential these courses have to deliver quality education around the world on an unprecedented scale.

#### 4.2 Quotations map

Figure 5 shows the authors' co-citation map. From the co-citation analysis, it is possible to analyze the intellectual structure among the authors. In this analysis, the more two authors are cited together, the closer the relationship between them. In this way, the co-citation analysis allows analyzing the existing clusters and the authors that belong to them. Authors cited at least 20 times were selected.

Figure 2 - Co-citation map



Source: prepared by the authors (2022).

In the co-citation map, networks of documents and their authors are generated in order to measure the relationship between two articles based on the number of citations in common. Co-citation clusters indicate the proximity or influence between authors, each author is represented by a node and from it comes the number of links originated between them, two authors are connected to each other if they have co-authored at least one article. In the present study, the VOSViewer software was used in order to identify clusters of authors as well as their





obtained through the number of citations of a topic. The calculation of the  $m$  index is obtained by dividing the  $h_b$  index by the period of years for which information is desired, and the  $h_b$  index is based on publications ranked in descending order by the number of citations they received, a number of citations equal to or the higher its position in the ranking (BANKS 2010).

Frame 2 - Definitions for hot topic classification

Índice $m$	Topic
$0 < m \leq 0,5$	It may be of interest to researchers in a specific field of research, which encompasses a small community.
$0,5 < m \leq 2$	It can probably become a hot topic as a research area, where the community is very large or the topic/combination has very interesting characteristics.
$m > 2$	It is considered a hot topic, unique topic with reach not only in its own area of research and is likely to have unique application effects or characteristics.

Source: Banks (2010).

Based on Banks' (2010) definitions, in this study, topics with an index  $m > 2$  will be considered as hot topics. hot topic or with the potential to be. (KELLY; JENNIONS, 2006). Ten topics related to the theme of publications found on the Web of Science were selected. Subsequently, each topic listed in Table 7 was combined with the term MOOCs, and the total number of publications for each combination was calculated (related topic x MOOCs); the  $h$ -index (index obtained through the number of citations in publications that have obtained a number of citations equal to or greater than their position in the ranking, representing the productivity and impact of the work) and the coefficient  $m$  (obtained by dividing of the  $h_b$  index for the period of years for which information is sought ( $n$ )) In view of this, the table below shows the results obtained from the combinations of the twenty themes with the topic entrepreneurial education, as well as the results related to the indices.

Table 6 - Hot topics in the study on entrepreneurial education

Área temática	Number of Articles	Índice $h-b$	Índice $m$
1° <i>Learning</i> (Aprendendo)	1.587	33	3,3
2° <i>Education</i> (Educação)	1.225	32	3,2
3° <i>Student</i> (Aluno)	1.027	24	2,4
4° <i>High Education</i> (Educação Superior)	618	23	2,3
5° <i>Technology</i> (Tecnologia)	634	22	2,2
6° <i>University</i> (Universidade)	626	22	2,2
7° <i>Teaching</i> (Ensino)	595	22	2,2
8° <i>Strategy</i> (Estratégia)	227	19	1,9
9° <i>Performance</i> (Desempenho)	235	14	1,4
10° <i>Innovation</i> (Inovação)	204	12	1,2

Source: *Web of Science* (2022).



According to Banks (2010), combinations with terms that obtained an m index greater than 2 can be classified as hot topics. In the study in question, we had seven terms that presented this index. The other terms scored between 0.5 and 2, which means they have great potential to become a hot topic. Therefore, from the analysis of Banks (2010), it is possible to affirm that the MOOCs theme is a hot topic and, therefore, considered a relevant topic for the academy.

## 5. FINAL CONSIDERATIONS

After reading articles that deal with MOOCs and analyzing the database, the idea that there is an ongoing transformation becomes increasingly evident. For some, recognizing that an industry that has changed so little over the past few decades could be radically transformed is almost heresy. However, not recognizing the potential impact that these platforms have, specifically in the education sector, is a classic example of business myopia. Thus, the objective of the study was to present the scenario of research on the topic Massive Open Online Courses (MOOCs), from the Web of Science database. The choice was due to the relevance that these platforms have achieved in the various academic environments in recent years.

The analysis of the database revealed that, between 2011 and 2020, 2079 works were published, most of them - 53.5% - related to the area of education. This result is not surprising, given the innovative and even disruptive character that digital platforms have in relation to traditional teaching-learning processes. Regarding the main authors in the area, it can be observed that most of them are in Europe. Of the five researchers with the most published articles, three are Spanish and one is German. The only representative from Latin America is Professor Mar Perez-Sanagustín. As far as funding agencies are concerned, two countries stand out: China, which through the National Natural Science Foundation of China registered 21 works; and Spain, which through two agencies - Spanish Ministry of Economy Competitiveness and Regional Government Of Madrid - registered 23 works.

It is observed that from 2013 onwards, the topic becomes much more important for the academic community and the number of publications has grown exponentially, from six articles in 2012 to 116 in 2013, which represents an increase of 1,833% . The peak of this production occurs in 2016, when 551 works on MOOCs are registered. In 2017, there was a drop and the number of publications dropped to 491 works. However, as mentioned in the theoretical framework, it is imagined that, due to the amount of instructional models derived from MOOCs, this topic should still arouse the curiosity of researchers, teachers and professionals working in the area of education, technology and systems and the number of work in the area must remain

elevated.

## REFERENCES

ADNER, R. When are Technologies disruptive? A demand-based view of the emergence of competition. **Strategic Management Journal**, p. 667-688, 2002.

ALLEN, E. I.; SEAMAN, J. **Grade Change: Tracking Online Education in the United States**. Babson Survey Research Group. Jan, 2014.

ARAÚJO, C. A. Á. Bibliometria: evolução histórica e questões atuais. **Em questão**, Porto Alegre, v. 12, n. 1, 2006.

BASHIR, M.; YOUSAF, A.; VERMA, R. Disruptive business model Innovation: how a tech firm is changing the traditional taxi service industry. **Indian Journal of Marketing**, v. 46, n. 4, p. 49-59, 2016.

BATES, T. **Educar na era digital: design, ensino e aprendizagem**. 1. Ed., São Paulo: Artesanato Educacional, 2017.

BELFORT, A. C.; FREITAS, H. M. R.; MARTENS, C. D. P. Affordances em tecnologia móvel: um estudo bibliométrico. **Revista Alcance**, v. 24, n. 3, 2017.

CÂNDIDO, A. C. Inovação Disruptiva: reflexões sobre as suas características e implicações no mercado. **IET Working Papers Series**, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Monte de Caparica, Portugal, Jul., 2011.

CARTER, D. **Goodbye, linear factory model of schooling: why learning is irregular**. Edsurge Fifty States Project, 2016.

CHAUHAN, A. Massive open online courses (moocs): emerging trends in assessment and accreditation. **Digital Education Review**, n. 25, 2014.

CHRISTENSEN, C. M. **O dilema da inovação: quando as novas tecnologias levam as empresas ao fracasso**. 1. Ed., São Paulo: M. Books, 2011.

CHRISTENSEN, C. M.; BOWER, J. L. Customer power, strategic investment, and the failure of leading firms. **Strategic Management Journal**, v. 17, n. 3, p. 197–218, 1996.

CHRISTENSEN, C. M.; RAYNOR, M. **The innovator's solution: creating and sustaining successful growth**. Cambridge: Harvard Business School Press, 2003.

CHUEKE, V.; AMATUCCI, M. O que é bibliometria? uma introdução ao Fórum. **Revista Eletrônica de Negócios Internacionais**. São Paulo, n.10, v. 2, p. 1-5, 2015.

COLLINS, E. SJSU. Plus augmented online learning environment pilot project report San Jose CA: San Jose State University, 2013.

DOWNES, S. The MOOC of one. **Stephen's Web**, 2014.

ENGLE, W. UBC MOOC Pilot: Design and Delivery Vancouver BC: University of British Columbia, 2014.

FASSBINDER, A.; DELAMARO, M. E.; BARBOSA, E. F. Construção e uso de moocs: uma revisão sistemática. In: **III CONGRESSO BRASILEIRO DE INFORMÁTICA NA EDUCAÇÃO (CBIE)**, 2014.

FORNO, J. P.; KNOLL, G. F. Os MOOCS no mundo: um levantamento de cursos *online* abertos massivos. **Nuances: estudos sobre Educação**, UNESP, Presidente Prudente-SP, v. 24, n.3, p. 178-194, set/dez 2013.

FREITAS, A.; PAREDES, J. Understanding the faculty perspectives influencing their innovative practices in MOOCs/SPOCs: a case study. **International Journal of Educational Technology in Higher Education**, p. 1-13, (2018)

GAEBEL, M. MOOCs: Massive Open Online Courses. **EUA Occasional Papers**. Jan., 2013.

GALLEGO, J. C.; ARROYO, Y. A. MOOC: valoración de un futuro. RIED. **Revista Iberoamericana de Educación a Distancia**, 21(2), pp. 219-241, 2018.

HERNANDEZ, R. et al. Promoting engagement in MOOCs through social collaboration Oxford UK: **Proceedings of the 8<sup>th</sup> EDEN Research Workshop**, 2014.

HORN, M. B. **Move over MOOCs, it's online, competency time**. Clayton Christensen Institute for Disruptive Innovation, Jul, 2014.

MACHADO J., C.; SOUZA, M. T. S.; PARISOTTO, I. R. S.; PALMISANO, A. As leis da bibliometria em diferentes bases de dados científicos. **Revista de Ciências da Administração**, n.18, v.44, p. 111-123, 2016.

MACKNESS, J. cMOOCs and xMOOCs – Key differences, **Jenny Mackness**, 2013.

MAGRETTA, J. Why business models matter. **Harvard Business Review**, 2002.

MARKIDES, C. Disruptive innovation: in need of better theory. **Journal of Product Innovation Management**, v. 23, n.1, p. 19-25, 2006.

MOORE, G. Darwin and the demon: innovating within established enterprises. **Harvard Business Review**, v. 82, n. 7-8, p. 86-93, 2004.

MOTA, R.; INAMORATO, A. MOOC, uma revolução em curso. **Jornal da Ciência**, Nov. 2012.

OLIVEIRA, J. M. de; RIBEIRO, F. de S. A empresa júnior e a formação de empreendedores. **Anais do XXIII Seminário Nacional de Parques Tecnológicos e Incubadoras de Empresas**, Recife; ANPROTEC, 2013.

PERNIAS, P. P.; LUJAN-MORA, S.. Architecture of a MOOC based on course builder. In:

**12th international conference on information technology based higher education and training (ITHET, 2013)**, Antalya (Turkey), 2013, p. 1 – 8.

POWELL, S.; YUAN, L. **MOOCs and Open Education: Implications for Higher Education**. 2018.

POY, R.; GONZALES-AGUILAR, A.. Factores de éxito de los MOOC: algunas consideraciones críticas. **Revista Ibérica de Sistemas y Tecnologías de Información (RISTI)**, n. E1, p. 105-118, 2014.

SANTOS, P. K.; SCHWANKE, C.; MACHADO, K. Tecnologias digitais na educação: possibilidades para o desenvolvimento da educação para a cidadania global. **Educação por escrito**, v. 8, n. 1, p. 129-145, 2017.

SIEMENS, G. Connectivism: A Learning Theory for the Digital Age. **Elearnspace: everything elearning**. December 12, 2004.

\_\_\_\_\_. Massive Open Online Courses: Innovation in Education? **Commonwealth of Learning**, Athabasca University, 2013, p. 5-16.

SIVAMUNI, K.; BHATTACHARYA, S. **Assembling pieces of the MOOCs jigsaw puzzle**. In: Innovation and Technology in Education (MITE), IEEE International Conference in MOOC, 2013, p. 393-398.

SUBBIAN, V. Role of MOOCs in integrated STEM education: A learning perspective. In: **integrated stem education conference (ISEC)**, IEEE, 2013, p. 1-4.

TAVARES, V. B. A. Massive Open Online Courses (MOOCs): Nova tendência educacional. Programa de Pós-graduação em Relações Internacionais, **XV curso de especialização em relações internacionais**, Universidade de Brasília, 2014.

THOMOND, P.; HERZBERG, T.; LETTICE, F. Disruptive Innovation: removing the Innovators Dilemma. **Knowledge into practice – british academy of management annual conference**, Harrogate, UK, September, 2003.

TRIVIÑOS, A. N. S. **Introdução à pesquisa em ciências sociais: a pesquisa qualitativa em educação**. São Paulo: Atlas, 2008.

WATTED, A.; BARAK, M. Motivating factors of MOOC completers: Comparing between universityaffiliated students and general participants. **The Internet and Higher Education**, v. 37, p. 11–20, 2018.

YOUSEF, A. et al. MOOCs: A review of the State-of-the-Art Proceedings of 6<sup>th</sup> International Conference on Computer Supported Education – CSEDU, Barcelona, Spain, 2014.