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Scientometric Analysis Of Massive Open Online Courses (Moocs): A Comprehensive Study

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ABSTRACT

This study examines authorship patterns in Massive Open Online Courses (MOOCs) publications via the lens of scientometrics. The analysis identified Alario-Hoyos C and Perez-Sanagustin M as the most prolific authors, possessing an h-index of 15. The research identified Meinel C. as the most often cited local author, possessing 66 articles and a fractionalized value of 20.99. The analysis selected Meinel C. and Wang Y as the most prolific authors from 2013 to 2023. The study indicates an increase in collaborative works, which explains the popularity of publications with many authors, with the USA at the forefront. This study primarily examines authorship trends in Scientometric research related to MOOCs to foster a more equitable, diverse, and impactful research environment that authentically reflects the intricacies and challenges of MOOC activities. This article analyzes Lotka's Law, the most locally referenced writers in MOOCs, authorship patterns, the productivity of authors with time, and the most globally cited publications in Massive Open Online Courses.

Keywords: Massive Open Online Courses, MOOCs, Online Learning, Educational Technology, Distance Education, E-Learning, Scientometric Analysis.

1. INTRODUCTION:

In recent years, the educational environment has experienced a substantial upheaval, mostly driven by the emergence of digital technology and the internet. The debut of Massive Open Online Courses (MOOCs) in the early 2010s represents a transformative advancement in education, transcending geographical and institutional limitations. MOOCs provide complimentary or inexpensive access to superior educational resources from prestigious colleges and institutions, enhancing worldwide educational accessibility. The principal attraction of MOOCs is their ability to support an infinite number of participants, allowing learners from various backgrounds to interact with course material at their own speed. The democratization of education has altered conventional classroom learning methods, offering both benefits and problems for educators, learners, and policymakers. Consequently, MOOCs have ignited dialogues regarding educational justice, the future of higher education, and the evolution of pedagogical approaches.

Despite the rapid growth and popularity of MOOCs, a thorough comprehension of their research ecosystem remains deficient. The current research predominantly emphasizes case studies, user experiences, and course design, whereas systematic examinations of the academic output related to MOOCs have garnered insufficient attention. This work seeks to address that deficiency by performing a scientometric analysis of research output concerning MOOCs, investigating publication trends, authorship patterns, citation dynamics, and the overall influence of MOOCs on the educational domain. This study will rigorously study the existing literature to provide useful insights into the evolution of MOOCs as a research domain, identify significant contributors and groups, and highlight new themes and trends. The findings will boost comprehension of the existing status of MOOCs and guide future research trajectories and educational methodologies in the dynamic digital learning landscape.

2. REVIEW OF LITERATURE:

Chen & Song (2019) paper presents a versatile methodology for performing systematic scientometric reviews, crucial for visualizing and comprehending research domains. The authors underscore the significance of computational and visual analytic methodologies to address issues in identifying representative scholarly papers. They evaluate various search strategies to improve the relevance and specificity of the subjects addressed. This methodology enables researchers to methodically examine and illustrate the evolution and framework of a research domain, offering significant insights into trends, principal contributors, and nascent areas of interest. The study emphasizes the capacity of scientometric reviews to guide research plans and policy decisions by providing a thorough overview of a certain topic.

Ghaleb et al. (2022). presents a scientometric examination of the literature about construction project complexity. The authors employ co-occurrence and co-citation analysis to uncover prolific authors, pertinent keywords, and significant publications within this academic field. The study emphasizes critical research themes and trends, providing insights into the most impactful publications and contributions in the discipline. The authors delineate the intellectual framework of construction project complexity research, proposing future research avenues and underscoring the significance of comprehending complexity to enhance project management methodologies. This thorough analysis is a significant resource for researchers and practitioners seeking to understand and engage with the changing dynamics of construction project complexity.

Jordan (2014) analyzed enrollment and completion patterns in MOOCs using a scientometric approach. Through the examination of data from multiple MOOC platforms, Jordan emphasized the ongoing issue of poor completion rates despite elevated enrollment numbers. This analysis highlighted the necessity for continued research into the elements affecting learner engagement and performance in MOOCs, stressing the significance of structuring courses that accommodate various learning styles and preferences.

3. OBJECTIVES OF THE STUDY:

The primary objectives of this study are as follows:

i. Examine the temporal trends in publication rates of Author's involved in MOOCs.
ii. Evaluate Lotka's Law to comprehend authorship distribution in MOOCs research.
iii. Identify Authors with the highest citation frequencies in MOOCs literature.
iv. Examine the evolution of author productivity in MOOCs across time.
v. Identify the leading journals that contribute to research on MOOCs.
vi. Identify the most frequently cited documents in the MOOCs domain and assess their influence.

4. METHODOLOGY:

This study employs a scientometric technique utilizing a quantitative method. Data was collected from the Scopus database, known for its extensive and reliable collection of academic literature. Data collection occurred on 10th, September 2024 and focused on publications related to MOOCs through a search using the keyword "MOOCs" and associated terms. This search yielded a total of 3,417 results covering the time span from 2013 to 2023.

Informal publications and sources not indexed by Scopus were excluded from the analysis. To analyze the data, the open-source software RStudio, using the bibliometrix-biblioshiny package, was utilized to identify authorship patterns and trends. The analysis commenced with data extraction, cleaning, and loading via Biblioshiny, where the search metadata was exported in BibTeX format for further analysis and visualization. The study focuses exclusively on authorship-related aspect.

5. ANALYSIS & INTERPRETATION:

The authors analysed and interpreted the available data based on most productive authors, Lotka's law, most local cited authors in MOOCs, author production over time, and most globally cited documents.

5.1 Most Productive Authors

Author productivity is assessed through the analysis of the h-index, g-index, m-index, and total citations (TC). Table 1 presents these metrics for the most productive authors in the field of MOOC research. In Table 1, it can be seen that Alario-Hoyos C and Perez-Sanagustin M are tied for the highest h-index of 15, indicating their significant contribution to the field, with total citations of 793 and 1,463 respectively. Zhu M follows closely with an h-index of 14 and a total citation count of 596, showcasing their impactful research output. The fourth position is held by Hauff C, Li X, Munoz-Merino PJ, Reich J, Ruiperez-Valiente JA, and Zhang J, each with an h-index of 13. Their total citations range from 380 to 898, reflecting their varying levels of influence and recognition within the MOOCs research community. Lastly, Davis D rounds out the group with an h-index of 12 and a total citation of 780. This range of indices and citations indicates the

diverse contributions of these authors, highlighting different aspects of productivity and impact in the burgeoning field of MOOCs.

Table 1. Most productive authors

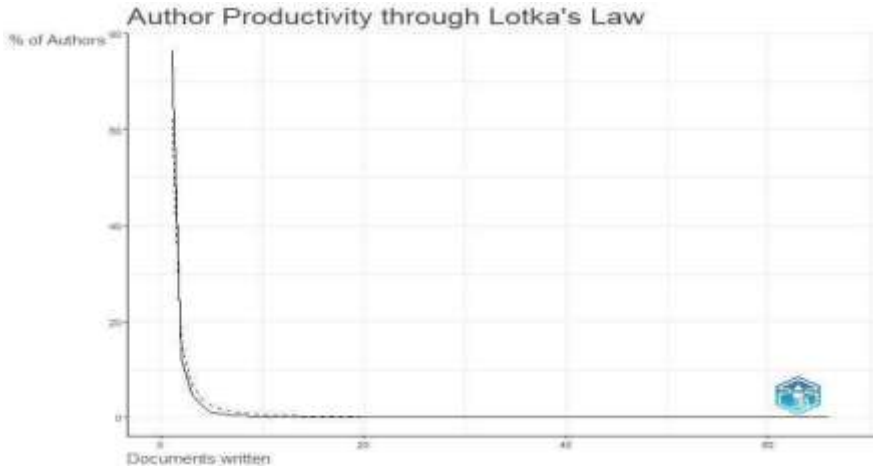
Author	h-index	g-index	m-index	TC
ALARIO-HOYOS C	15	28	1.36	793
PÉREZ-SANAGUSTÍN M	15	23	1.36	1463
ZHU M	14	19	2	596
HAUFF C	13	20	1.44	512
LI X	13	19	1.3	380
MUÑOZ-MERINO PJ	13	21	1.18	536
REICH J	13	24	1.18	898
RUIPÉREZ-VALIENTE JA	13	21	1.18	475
ZHANG J	13	25	1.3	640
DAVIS D	12	13	1.33	780

5.2 Lotka's Law

The table summarizes the distribution of authorship based on the total number of documents written, highlighting a clear trend aligned with Lotka's Law. It shows that 5,472 authors (76.25%) have authored only 1 document, indicating that the majority of contributors are infrequent writers. This is followed by 887 authors (12.36%) who contributed 2 documents, 348 authors (4.85%) who wrote 3 documents, and 184 authors (2.56%) who authored 4 documents. The numbers continue to decline significantly with 67 authors (0.93%) writing 5 documents, only 62 authors (0.86%) contributing 6 documents, and even fewer for higher counts, with only 16 authors (0.22%) producing 10 documents. Overall, the data illustrates that a small group of prolific authors dominates the publication landscape, while the vast majority of authors contribute only a single work.

Table 2. Author productivity through Lotka's

Documents written	No of Authors	Proportion of Authors
1	5472	0.762
2	887	0.126
3	348	0.048
4	184	0.026
5	67	0.009
6	62	0.008
7	37	0.005
8	26	0.003
9	21	0.002
10	16	0.002



(Figure 1. Author Productivity through Lotka's law.)

5.3 Most Local Cited Authors in MOOCs

The table lists the most locally cited authors in the field of Massive Open Online Courses (MOOCs) along with the number of articles they've published and their fractionalized article contributions. Leading the list is Meinel C. with 66 articles, contributing a significant 20.99% of the total citations. Following closely Wang Y with 35 articles 10.21%, and both Alario-Hoyos and Li X have authored 30 articles, accounting for 6.29% and 6.83%, respectively. Other notable authors include Staubitz T with 26 articles 6.74%, Zhang J with 25 articles 6.58%, Reich J with 24 articles 6.84%, Perez-Sanagustin M with 23 articles 5.22%, and Ruiperez-Valiente JA with 22 articles 4.77%. Lastly, Kloos CD has published 21 articles, contributing 4.6% of the citations. This data highlights the prominent contributors in the MOOCs domain, showcasing their influence through their publication output.

Table 3. Most local cited authors in MOOCs

Authors	Articles	Articles Fractionalized
MEINEL C	66	20.99
WANG Y	35	10.21
ALARIO-HOYOS C	30	6.29
LI X	30	6.83
STAUBITZ T	26	6.74
ZHANG J	25	6.58
REICH J	24	6.84
PÉREZ-SANAGUSTÍN M	23	5.22
RUIPÉREZ-VALIENTE JA	22	4.77
KLOOS CD	21	4.6

5.4 Author Production Over Time

Table 4. Author production over time

Author	Year	Frequency	TC	TCpY
MEINEL C	2023	7	9	4.5
WANG Y		7	29	14.5
ZHANG J		3	15	7.5
LI X		1	13	6.5
MEINEL C	2022	7	15	5
WANG Y		6	97	32.33
LI X		3	47	15.66
STAUBITZ T		3	39	13
ZHANG J		3	40	13.33
MEINEL C	2021	5	17	4.25
WANG Y		4	39	9.75
ALARIO-HOYOS C		4	52	13
LI X		3	60	15
ZHANG J		4	113	28.25
REICH J	2020	7	201	39.6
LI X		6	90	18
MEINEL C		6	22	4.4
WANG Y		5	189	37.8
RUIPÉREZ-VALIENTE JA		4	124	24.8
MEINEL C	2019	15	60	10
ZHANG J		5	172	28.66
RUIPÉREZ-VALIENTE JA		4	63	10.5
STAUBITZ T		4	17	2.84
WANG Y		3	47	7.84

ALARIO-HOYOS C		3	34	5.67
ALARIO-HOYOS C	2018	8	150	21.42
MEINEL C		6	45	6.42
PÉREZ-SANAGUSTÍN M		5	119	17
ZHANG J		3	136	19.42
KLOOS CD		3	69	9.85
LI X	2017	11	51	6.37
PÉREZ-SANAGUSTÍN M		8	873	109.12
MEINEL C		7	70	8.75
WANG Y		6	22	2.75
KLOOS CD		5	247	30.87
MEINEL C	2016	7	229	25.44
STAUBITZ T		5	218	24.22
ZHANG J		3	120	13.33
PÉREZ-SANAGUSTÍN M		2	134	14.88
REICH J		2	113	12.55
REICH J	2015	5	236	23.6
RUIPÉREZ-VALIENTE JA		3	38	3.8
KLOOS CD		3	34	3.4
LI X		1	47	4.7
ZHANG J		1	20	2
ALARIO-HOYOS C	2014	4	121	11
PÉREZ-SANAGUSTÍN M		3	93	8.45
REICH J		2	94	8.54
KLOOS CD		2	31	2.81
STAUBITZ T		2	9	0.81
MEINEL C	2013	3	122	10.16
KLOOS CD		1	13	1.08

The provided data reflects the scholarly productivity of various authors from 2013 to 2023, showcasing their the frequency of their publications, total citations (TC), and total citations per year (TCpY). Notably, authors like Meinel C and Wang Y exhibit consistent high productivity, with Wang Y's remarkable output in 2020 (5 publications, TC: 189) and Meinel C's sustained contributions across multiple years. Other authors like Zhang J and Ruiperez-Valiente JA also show significant engagement in the field, while some contributors, such as Alario-Hoyos C and Staubitz T, present more varied publication patterns. The data reveals fluctuations in publication frequency and citation counts, with Meinel C peaking in 2019 with 15 publications and Perez-Sanagustin M achieving the highest citations in 2017 with 873 citations. Emerging authors like Ruiperez-Valiente JA and Alario-Hoyos C show significant citation impacts in specific years, suggesting their growing influence.

5.5 Most Globally Cited Documents

The table provides a comprehensive scientometric analysis of influential research papers on MOOCs, detailing key metrics such as total citations (TC), citations per year (TC per Year), and normalized total citations (Normalized TC). The papers span from 2013 to 2023 and are published in reputable journals and conferences, reflecting the evolving research landscape of MOOCs. For example, Liyanagunawardena TR's 2013 paper in the "International Review of Research in Open and Distance Learning" has the highest total citations (804), with an average of 67 citations per year and a normalized TC of 14.70. Similarly, Kizilcec RF's 2013 paper in the "ACM International Conference Proceedings Series" has 758 total citations, averaging 63.17 citations per year, and a normalized TC of 13.86. Hew KF's 2014 paper in "Educational Research Review" stands out with 700 total citations, 63.64 citations per year, and a normalized TC of 19.16, indicating

its significant impact. Another notable paper by Kizilcec RF (2017) in "Computers & Education" has 629 total citations, with a high average of 78.63 citations per year and a normalized TC of 31.94, reflecting its substantial influence in the field. Other influential papers include those by Jordan K, Margaryan A, Hone KS, and Alraimi KM, each contributing valuable insights and receiving considerable citations. For instance, Jordan K's 2014 paper in the "International Review of Research in Open and Distance Learning" has 646 total citations, averaging 58.73 citations per year, and a normalized TC of 17.68. Margaryan A's 2015 paper in "Computers & Education" has 529 total citations, with an average of 52.90 citations per year and a normalized TC of 15.85.

Table 5. Most globally cited documents

Paper	DOI	Total Citations	TC per Year	Normalized TC
LIYANAGUNAWARDENA TR, 2013, INT REV	10.19173/irrodl.v14i3.1455	804	67	14.70
KIZILCEC RF, 2013, ACM INT	10.1145/2460296.2460330	758	63.17	13.86
HEW KF, 2014, EDUC RES	10.1016/j.edurev.2014.05.001	700	63.64	19.16
JORDAN K, 2014, INT REV	10.1109/ISECon.2013.6525230	646	58.73	17.68
KIZILCEC RF, 2017, CO.EDU	10.1016/j.compedu.2016.10.001	629	78.63	31.94
MARGARYAN A, 2015, CO.E	10.1016/j.compedu.2014.08.005	529	52.90	15.85
HONE KS, 2016, CO.EDU	10.1016/j.compedu.2016.03.016	504	56.00	17.14
ALRAIMI KM, 2015, CO.EDU	10.1016/j.compedu.2014.08.006	498	49.80	14.92
KAPLAN AM, 2016, BUS	10.1016/j.bushor.2016.03.008	489	54.33	16.63
LITTLEJOHN A, 2016, INTER	10.1016/j.iheduc.2015.12.003	421	46.78	14.31
ANDERSON A, 2014, WWW	10.1145/2566486.2568042	419	38.09	11.47
JUNG Y, 2018, COMPUT	10.1016/j.compedu.2018.02.013	371	53.00	22.11
WONG J, 2019, INT J HUM-	10.1080/10447318.2018.1543084	357	59.50	20.55
HEW KF, 2016, BR J EDUC	10.1111/bjet.12235	336	37.33	11.42
CLOW D, 2013, ACM INT	10.1145/2460296.2460332	319	26.58	5.83
JORDAN K, 2015, INT REV	10.19173/irrodl.v16i3.2112	303	30.30	9.08
KIM J, 2014, LS - PROC ACM	10.1145/2556325.2566239	291	26.45	7.96

Note: TC: Total Citations; Normalised TC: calculated by dividing the actual count of citing items by the expected citation rate for documents with the same year of publication.

6. DISCUSSION AND CONCLUSION:

Based on many criteria connected to publications, authorship studies are carried out on a broad spectrum of topics worldwide. Past times have seen these carried out in the humanities, social sciences, and sciences among other subjects. Using Scientometric analysis in MOOCs, authorship analysis allows to investigate worldwide patterns and the effects of research on pragmatic applications in knowledge distribution. Using scientometric techniques, one can investigate patterns of cooperation and pinpoint important authors, author productivity, scientific productivity, most locally cited papers, most relevant affiliations, and most internationally cited papers in MOOCs. By offering qualitative frameworks and useful instruments in handling information, scientometric studies are not only complimentary but also indispensable for strong and influential research. Based on papers taken from the Scopus database from 2013 to 2023, this study attempts to depict the current situation in Massive Open Online Courses. The main objective of this research is to show the trends in authoring in MOOCs. Examining these criteria reveals that authorial studies ought to be expanded to other fields to do more future quantitative research. With an h-index of 15, the analysis revealed Alario- Hoyos C and Perez-Sanagustin M as the most productive authors. The analysis revealed that the great proportion of authors having published just one article on this field. This study offers insightful research of field publication behavior, showing that most of the authors barely add to the body of information. Just 887 authors added two articles; 5472 authors provided one article.

With 66 articles with a fractionalized value of 20.99, Meinel C is discovered to be the most locally cited author. The study also carried author production over time analysis and discovered that academics have been regularly supporting MOOCS. From 2013 to 2023, Meinel C and Wang Y turned out to be the most prolific authors in MOOCS. The study found that the most cited document in MOOCS during this period was published by Liyanagunawardena TR, 2013 in International Review of Research in Open and Distance Learning with a total citation of 804. Regarding format, most of these published research products are journals; reviews and conference articles follow from there. It also shows that more documents were cooperative, which explains the predominance of publications including several authors. Leading the world in author collaboration was the USA. The study sought to determine the most prolific author and authoring patterns in Massive Open Online Courses utilizing analytical approaches such as total citation count, h-index, g-index, and others. Research indicates that global trends in Massive Open Online Courses represent an emerging and promising field requiring additional investigation.

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