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## Learning Management System in Developing Countries: A Bibliometric Analysis Between 2005 and 2020

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**Abstract:** The learning management system (LMS) is a crucial component of the e-learning transformation which is becoming more urgent amid the Coronavirus disease (COVID-19) outbreak. The issue of adopting LMS is even more decisive in developing countries, where lots of efforts have been put out to broaden educational opportunities. However, there has not yet been any comprehensive analysis of how LMS-related issues are examined in these countries. To address this gap, this study uses the bibliometric method to construct an overview of research on this topic. The results unveil the distribution of the literature, prominent actors, and dominant themes in the literature of LMS in developing countries. In summary, the topic is a robustly potential research matter. Future researchers can use this study as a starter when investigating relevant subjects.

**Keywords:** *Bibliometrics, developing countries, learning management system, Scopus.*

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### Introduction

In early 2020, the Coronavirus disease (COVID-19) outbreak has turned the world upside down, including the education sector. According to a United Nations Educational, Scientific and Cultural Organization (UNESCO) report released on May 25th, 2020, the pandemic has affected almost one billion students (Toquero, 2020). As a result, schools across the globe were hastily forced to move online regardless of their preparedness (Crawford et al., 2020). The learning management system (LMS), defined broadly as a web-based platform administering all learning and teaching activities (Macfadyen & Dawson, 2010), is a critical component of this rapid online shift.

Before the pandemic took place, LMS had been widely adopted in higher institutions in the Global North (Cavus et al., 2021). For example, Lang and Pirani (2014) showed that 99% of universities in the United States used at least one type of LMS. Developing an LMS system not only helps manage the remote learning option but also supports on-campus learning. Plenty of evidence has pointed out the benefits of adopting LMS in higher education cost-wise and timewise (Adzharuddin & Ling, 2013; Walker et al., 2016). While the pandemic certainly brings out unavoidable difficulties, universities in developed countries are reported implementing distance learning strategies fairly well with enormous support from the robust LMSs (Johnson et al., 2020; Murphy, et al., 2020). The LMS proved its efficiency by helping universities operate consistently and keeping students feeling belonged in times of isolation (Van Wingerden, 2021).

Adaptation of LMS in developing countries is even a more critical issue. Education is their gateway to catch up with the global north in a world dominated by a knowledge economy. Investing in online education, of which LMS is a major part, is a means to solve the accessibility problem. However, the picture of LMS adaptation in developing countries does not seem as optimistic (Aljarrah et al., 2020). They lag behind in the availability of digital devices and Internet access

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(Olanrewaju et al., 2021), and the gap in e-learning between developed countries and developing countries goes beyond infrastructure differences. Even when their LMS system was adequately equipped, their faculties and students still had insufficient level of engagement (Gasaymeh, 2017; Jomezai et al., 2018) and could not fully utilize its functions (Gamede et al., 2022). Nevertheless, most research on LMS is primarily conducted within the context of developed countries (Ssekakubo et al., 2011).

Previous researchers did make an effort to study the circumstance of LMS adaptation in underdeveloped nations from different perspectives (e.g., Cavus, 2013; Gasaymeh, 2017; Hadullo et al., 2018; Jomezai et al., 2018; Ssekakubo et al., 2012). Nevertheless, there has not yet been an overview examination of the existing knowledge on this topic. The current research aims to provide such a comprehensive outlook using the bibliometrics method. Pritchard first introduced the term "bibliometric" in 1969, and Hawkins (2001) explained it as "the quantitative analysis of the bibliographic features of a body of literature."

This research aims to answer these questions:

Q1: What are the overall publications across countries, times, and journals of the literature about LMS in developing countries (LMSiDC)?

Q2: Who are the most influential authors, and what are the most influential papers studying LMS in developing countries?

Q3: What is the intellectual structure of the LMSiDC literature?

Q4: What are the topics of interest in the LMSiDC literature in recent years?

The rest of the paper is structured as follows. First, we will describe the used method in the next section. Then, the results section will answer the four research questions in order. Next, the discussion section presents the critical interpretations derived from the results. Finally, the limitation of the study is demonstrated in the last section.

## Methodology

This study used bibliometric methods to investigate research on learning management systems in developing countries. Bibliometric analysis has been widely adopted in education research in the past (e.g., T. H. Cao et al., 2020; Q. T. Cao et al., 2021; Do et al., 2021; D. B. Pham et al., 2020, 2021; H. H. Pham et al., 2021; Nguyen et al., 2020). Our research methods do not extend to the findings of documents but rather give a picture of such documents' allocations, structures, and scholarly connections. This section presents our process of constructing the database, refining the database, and inspecting information from the database.

### *Identification of Sources*

A thorough literature search was carried in the Scopus dataset. In terms of data coverage, Scopus accommodates authors' data in cited references, which makes it better for co-citation analysis and author-based citation analysis (Zupic & Čater, 2015). Another advantage of Scopus is that its data on the educational field of study is notably more comprehensive than Web of Science (Hallinger & Kovačević, 2019). In terms of convenience, many bibliometrics software packages support extracting data from Scopus (Zupic & Čater, 2015). For the above reasons, Scopus was our optimal choice.

### *Data Collection*

The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines were used in this study (Moher et al., 2009b). The publication time of documents is not restricted. Our first set of documents in Scopus was generated through the following keyword string:

```
TITLE-ABS-KEY ( "learning management system" OR lms ) AND ( LIMIT-TO ( DOCTYPE , "cp" ) OR LIMIT-TO ( DOCTYPE , "ar" ) OR LIMIT-TO ( DOCTYPE , "ch" ) OR LIMIT-TO ( DOCTYPE , "bk" ) ) AND ( LIMIT-TO ( SUBJAREA , "SOCI" ) OR LIMIT-TO ( SUBJAREA , "DECI" ) OR LIMIT-TO ( SUBJAREA , "BUSI" ) OR LIMIT-TO ( SUBJAREA , "ECON" ) OR LIMIT-TO ( SUBJAREA , "MULT" ) OR LIMIT-TO ( SUBJAREA , "PSYC" ) ) AND ( EXCLUDE ( PUBYEAR , 2021 ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) )
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The PRISMA diagram is shown below in Figure 1.

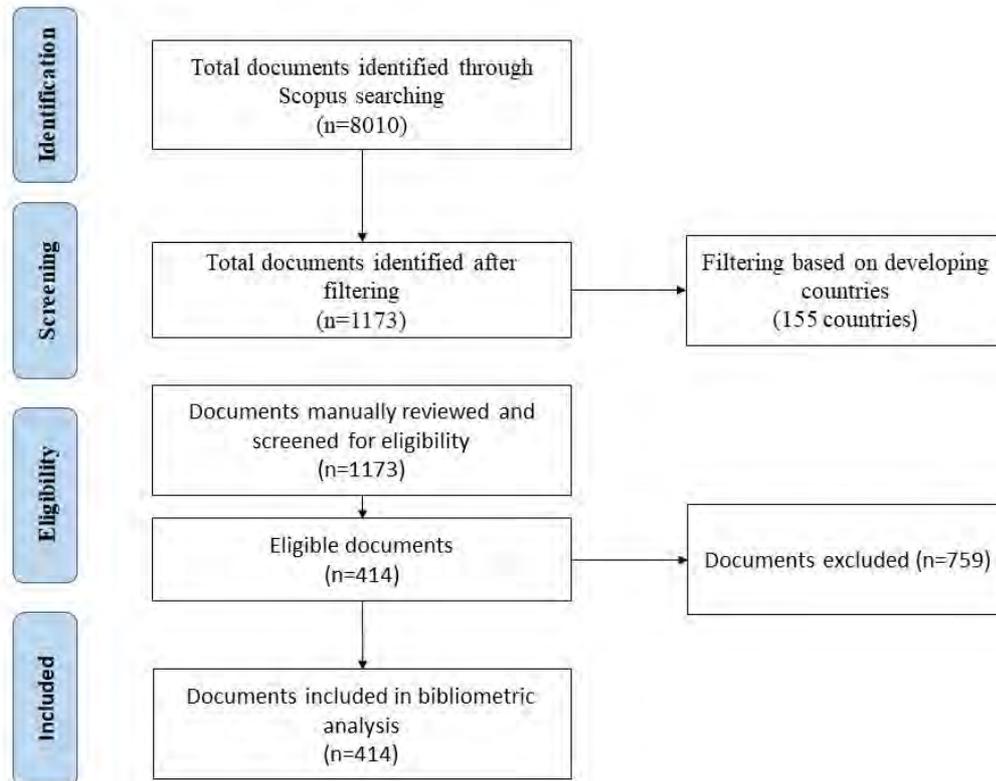


Figure 1. The PRISMA Diagram Demonstrating the Data Collection Process of the LMSiDC Literature Extracted From the Scopus Database

Our first search generated 8,010 results. We then narrowed down our geography allocation to developing countries (155 countries) which is based on the list published by the International Monetary Fund (2018). The topical relevance of documents was also checked for fitness through their titles and abstracts. Due to our search term “lms” (which is short for “learning management system”) can also stand for “least mean square” or “latent model structure”, there were many off-topic documents (e.g., Dimitruk et al., 2007; Li et al., 2010). After our process of filtering, the final database composes 1,173 documents.

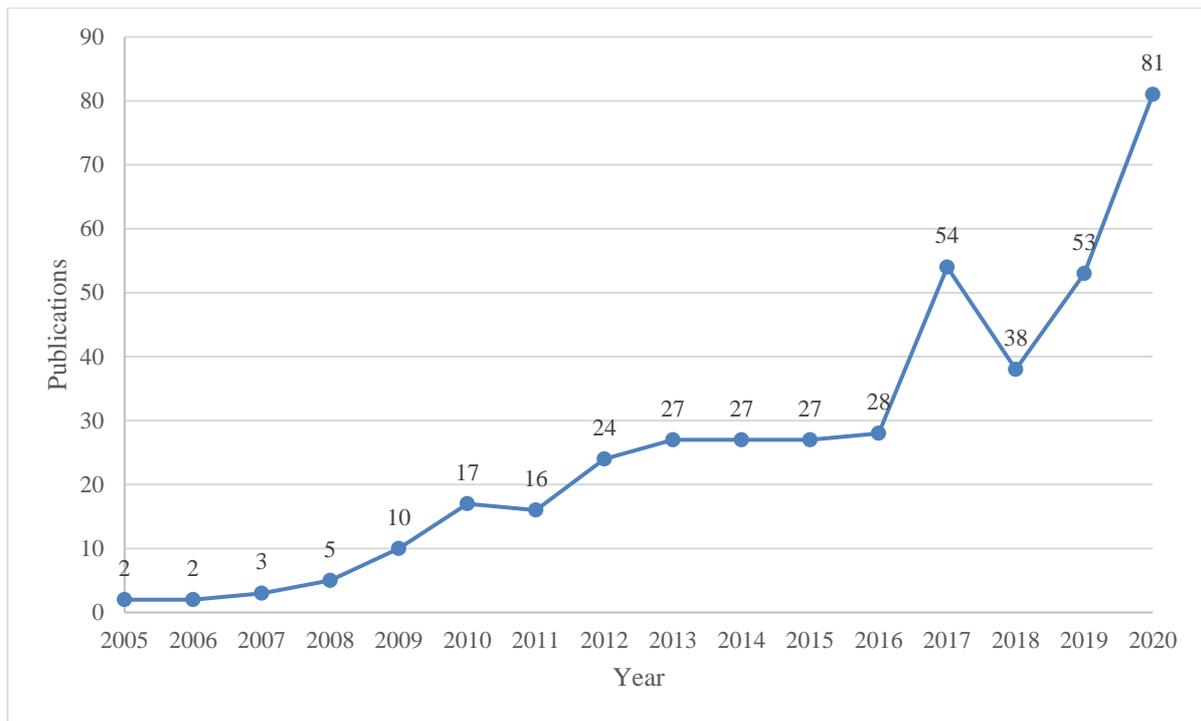
#### Data Analysis

Bibliographic data of documents (including authors, title affiliations, citations, references, keywords, and abstracts) were stored in an Excel file. Descriptive statistics and advanced bibliometrics statistics (including co-authorship, cooccurrence, co-citation) were performed by VOSviewer bibliometric software (Van Eck & Waltman, 2017).

## Results

#### Growth Trajectory, Volume, and Geographical Distribution

Answering the first research question, we attempt to map out a comprehensive picture of the LMSiDC literature. Overall, there are 414 publications that delve into the topic of LMSiDC. Regarding publishing type, there are 233 journal articles, 159 conference papers, and 21 book chapters.



*Figure 2. Growth Trajectory of the LMSiDC Literature (2005 - 2020)*

Firstly, the expansion of the topic is examined across time. Figure 2 illustrates the developing timeline of the literature, with 2005 marking the earliest papers recorded in the Scopus database (see: Fabijanić & Skočir, 2005; Nleya, 2005). The number of publications quickly reached the tens in 2009 and hitherto has risen moderately, except for a sudden drop in 2018. Exponential growth has been observed in recent years, with more than half of the total publications being produced in the 2017 - 2020 period. 2020 was the peak year with 81 publications.

Secondly, we inspect how the LMSiDC literature spread across the globe. Figure 3 exhibits the geographical distribution of the literature contributed by seventy-seven countries. Although it scatters widely all over the world, Asian and African countries seem to outperform. Table 1 lists the top 9 countries contributing the most to the literature. Malaysia takes up the largest share with 62 publications, accounting for 15% of the total documents. The United States and the United Kingdom are the only two representatives of the Global North appearing on the list, whereas nearly all of their publications are collaborations with authors from the Global South.

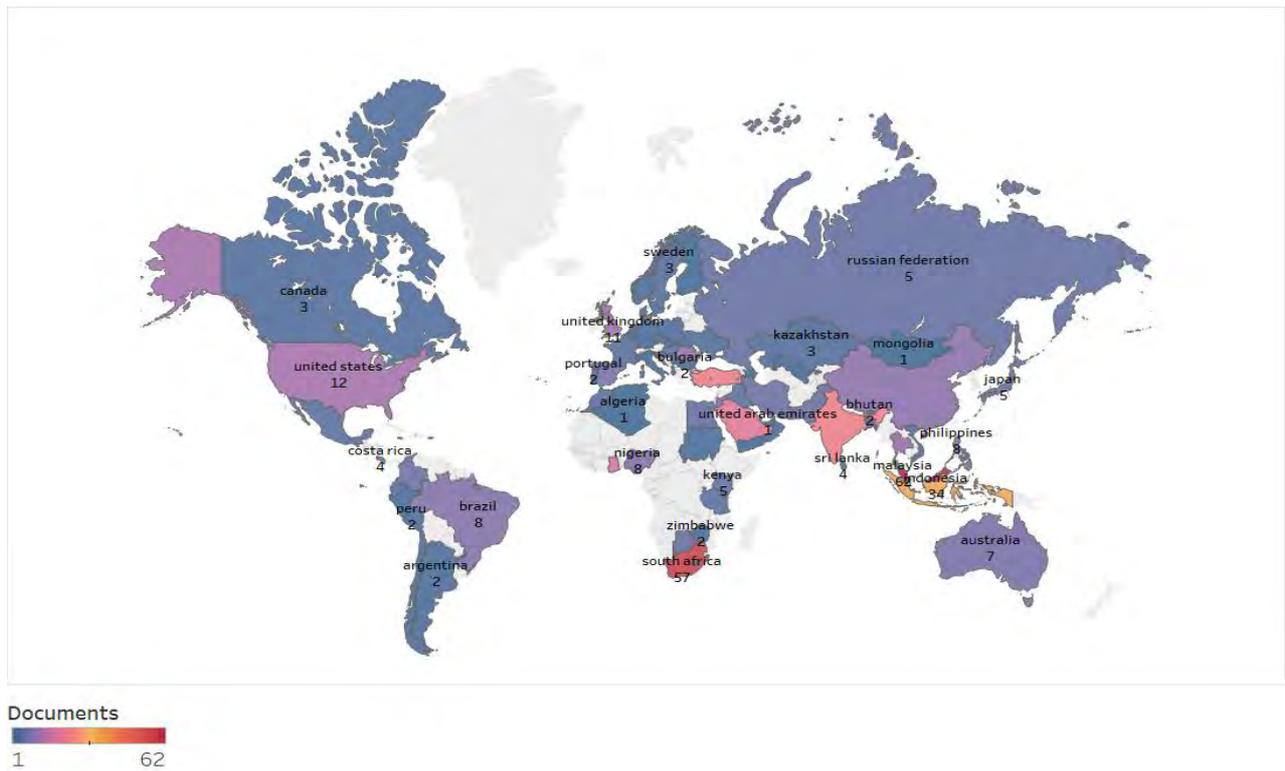


Figure 3. Geographical Distribution of the LMSiDC Literature

Table 1. Top Countries by Publications

Countries	Documents	Link strength
Malaysia	62	11
South Africa	57	1
Indonesia	34	6
India	23	9
Turkey	23	4
Saudi Arabia	20	9
Ghana	17	5
United States	12	10
United Kingdom	11	9

Using the co-authorship by countries analysis, we look at the international collaboration network more thoroughly. Figure 4 was obtained after setting the minimum number of papers per country to 2. Malaysia continues to top the list with 11 international collaborations. The United Kingdom and Saudi Arabia form the strongest connection with three joint papers. The rest of the countries have fairly diverse partnerships with others.

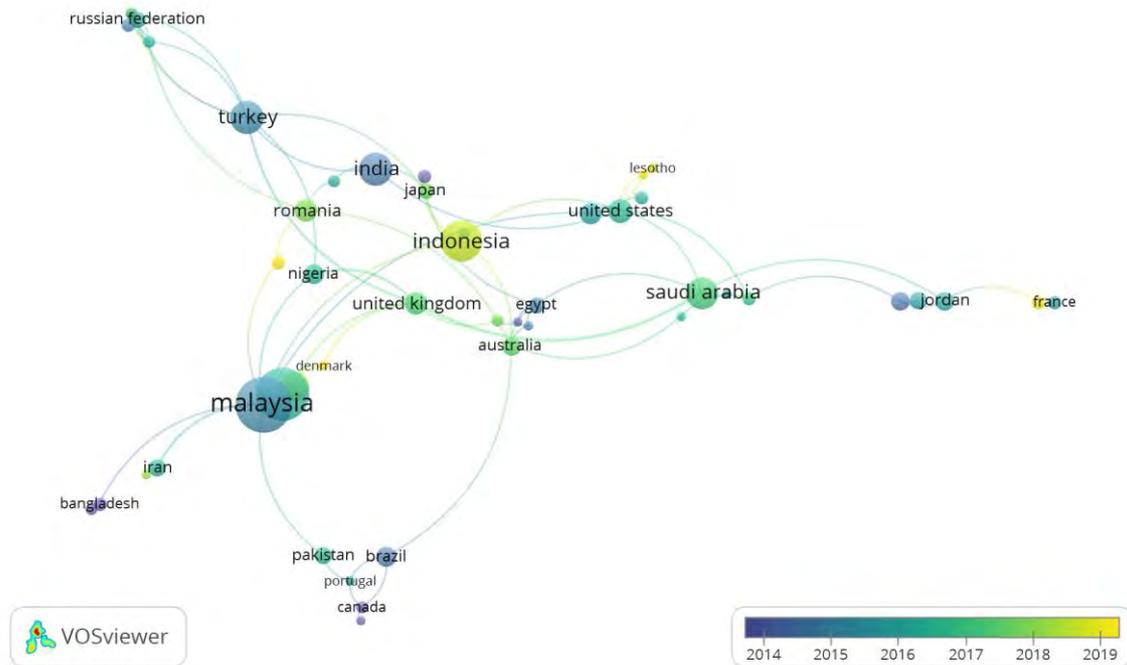


Figure 4. Network of International Collaboration (threshold 2 papers, display 48)

Another way to interpret the result is to look at the colour of the nodes. Countries represented by a node whose colour goes toward the light - yellow of the spectrum are newcomers in the world of LMSiDC publications. These include Indonesia (34 documents; average published year: 2018.47), Ukraine (3; 2018.67), Zimbabwe (2; 2019), Iraq (2; 2019), Morocco (4; 2019), Denmark (2; 2019.50). In contrast, countries represented by dark-blue nodes, namely, Sweden, Bangladesh, Canada, United Arab Emirates, Bhutan, Germany, are those merely concerning about this topic in the past. Notably, these countries each produced only a modest number of papers on this topic. This indicates that their interest in the matter seems to cease quite early. Noticeably, Bhutan and Bangladesh are two representatives from developing regions.

In terms of publishing sources, the papers are dispersed across a total of 257 individual sources. On average, each source contributes 2 papers, with the Proceedings of the international conference on e-learning (ICEL) topping the list by 16 publications. Table 2 displays the most prolific sources, whose scopes are predominantly in e-learning/distance learning and educational technology. Two exceptions are Proceedings - frontiers in education conference - FIE and Procedia, with the former covers articles concerning education in general and the latter being interested in all of the disciplines of the social sciences.

Table 2. Top Sources by Publications and Citations

No.	Sources	Type of sources	Number of publications	Number of citations	Aim and scope
1	Proceedings of the International Conference on e-learning - ICEL	Conference proceeding	16	19	E-learning/Distance education
2	Proceedings of the European Conference on e-learning - ECEL	Conference proceeding	14	13	E-learning/put the ground on
3	Proceedings - Frontiers in Education Conference - FIE	Conference proceeding	11	53	Education in general
4	Turkish Online Journal of Distance Education	Journal	11	117	E-learning /Distance education
5	Education And Information Technologies	Journal	9	49	Educational Technology
6	International Journal of Emerging Technologies in Learning	Journal	7	27	Educational Technology
7	International Review of Research in Open and Distance Learning	Journal	5	49	Distance education
8	Procedia - Social and Behavioral Sciences (discontinued from Scopus in 2018)	Conference proceeding	5	24	Behaviour science

## Influential Authors and Papers in the LMSiDC Literature

Table 3. The Most Productive Authors in the LMSiDC Literature

No	Author	Affiliation	Country	Documents	Citation	Citation/ paper
1	Harry B. Santoso	Faculty of Computer Science, Universitas Indonesia	Indonesia	7	29	Nis.14
2	Ahmad Fauzi Mohd Ayub	Universiti Putra Malaysia	Malaysia	4	23	May.75
3	Rosnaini Mahmud	Faculty of Educational Studies, Universiti Putra Malaysia	Malaysia	4	15	Mar.75
4	Cedric B. Mpungose	School of Education, University of KwaZulu-Natal, Durban	South Africa	4	14	Mar.50
5	Vuyisile Nkonki	Fort Hare University	South Africa	4	4	1.00
6	Wong Su Luan	Universiti Putra Malaysia	Malaysia	4	14	Mar.50

There are 994 authors in total partaking in the LMSiDC literature. Among them, 902 published one paper, equal to 76.9% of the total publications; 68 published two papers, equal to 11.6% of the total publications; 18 published three papers, equal to 4.6% of the total publications. There are only six authors who went beyond the number of three. The details of these authors are presented in Table 3. The most productive author is Harry B. Santoso from the Faculty of Computer science, University of Indonesia, with seven papers.

Another metric to evaluate the influence of an author is his/her citations. All of the authors in the productive list do not appear in the top 20 most cited authors (not tabled). The top 20 most cited authors led the citations list with just only 1 or 2 papers. The two most cited authors are Yahya Don and Arumugam Raman (Universiti Utara Malaysia), each owned 141 citations, added up of 2 articles: Raman et al. (2014) and Raman and Don (2013).

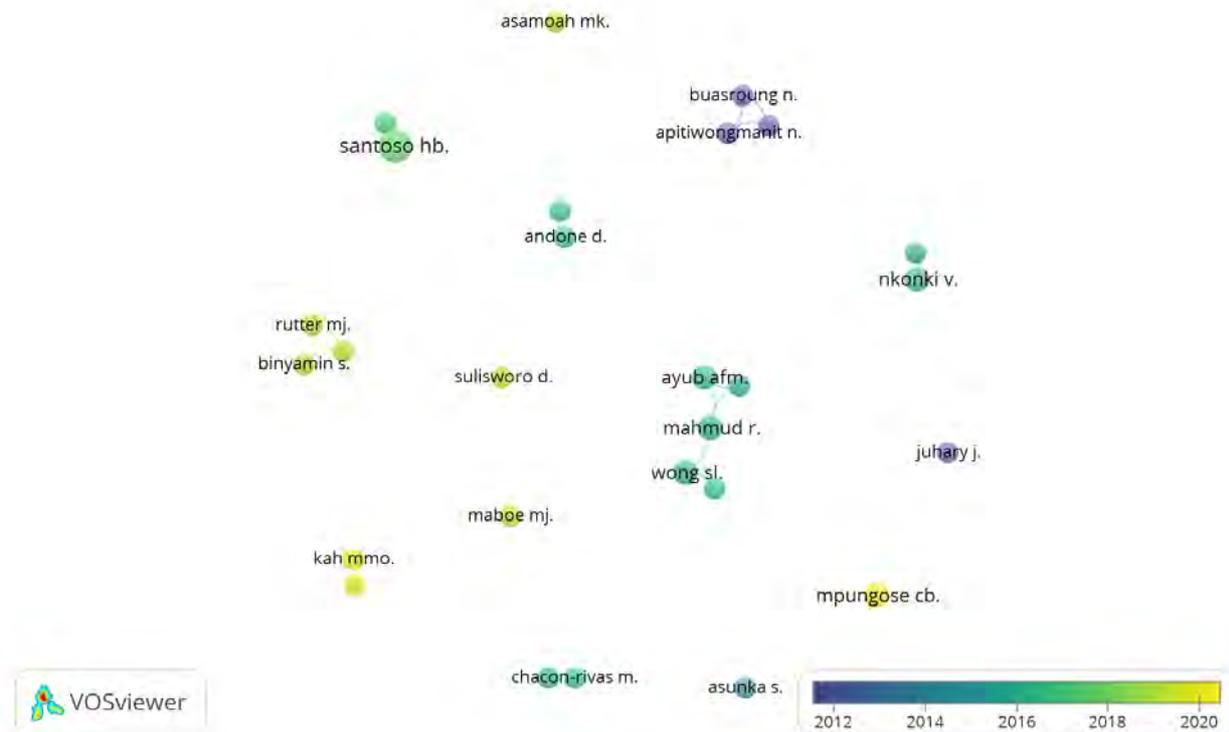


Figure 5. Authors' Collaboration Network (threshold 3 papers; display 27 authors)

The co-authorship analysis was conducted to map out the network of authors by collaboration. As shown in Figure 5, 27 authors are displayed after setting the threshold to 3, i.e., each author has to own at least 3 articles. The cluster's colour indicates the published year of the joined works, with lighter colour representing the emerging research teams. There are 8 distinguished research teams and 6 prominent individual researchers. Bheki Mpungose (School of Education, University of KwaZulu-Natal) and Muhammadou M.O. Kah - Mohammed Nasiru Yakubu (American University of Nigeria) are the two noteworthy teams and individuals whose works have been published recently.

Table 4. Top Influential LMSiDC Papers by Citations

No	Article's title	Author	Source	Citations	Citations/years
1	Preservice Teachers' Acceptance of Learning Management Software: An Application of The UTAUT2 Model	Raman and Don (2013)	International Education Studies	114	14.25
2	The Implementation of a Flipped Classroom in Foreign Language Teaching	Basal (2015)	Turkish Online Journal of Distance Education	51	8.May
3	The Effect of Flipped-Problem Based Learning Model Integrated With LMS-Google Classroom for Senior High School Students	Ramadhani et al. (2019)	Journal For the Education of Gifted Young Scientists	47	23.May
4	A Mobile E-Learning Environment for Developing Countries: The Bangladesh Virtual Interactive Classroom	Grönlund and Islam (2010)	Information Technology for Development	43	Mar.91
5	Antecedents Of Continued Usage Intentions of Web-Based Learning Management System in Tanzania	Lwoga and Komba (2015)	Education And Training	42	7.00
6	Drivers Of Learning Management System Use in A South African Open and Distance Learning Institution	Venter et al. (2012)	Australasian Journal of Educational Technology	34	Mar.78
7	Using Social Media As A Tool For Improving Academic Performance Through Collaborative Learning In Malaysian Higher Education	Al-rahmi et al. (2015)	Review Of European Studies	34	May.67
8	Climate Risk and State-Contingent Technology Adoption: Shocks, Drought Tolerance and Preferences	Holden and Quiggin (2016)	European Review of Agricultural Economics	31	Tem.75
9	The Effectiveness and Experiences of Blended Learning Approaches to Computer Programming Education	Deperlioglu and Kose (2013)	Computer Applications in Engineering Education	30	Mar.75
10	Usage Of Learning Management System (Moodle) Among Postgraduate Students: UTAUT Model	Raman et al. (2014)	Asian Social Science	27	Mar.86

The most influential publications are ranked based on their citation counts. As presented in Table 4, the most cited article with 114 citations is "Preservice teachers' acceptance of learning management software: an application of the UTAUT2 model" by Raman and Don (2013). All of the most cited publications are journal articles. Furthermore, it should be noted that the number of citations displayed is the accumulated citations of a paper in the whole Scopus database.

### The Intellectual Structure of the LMSiDC Literature

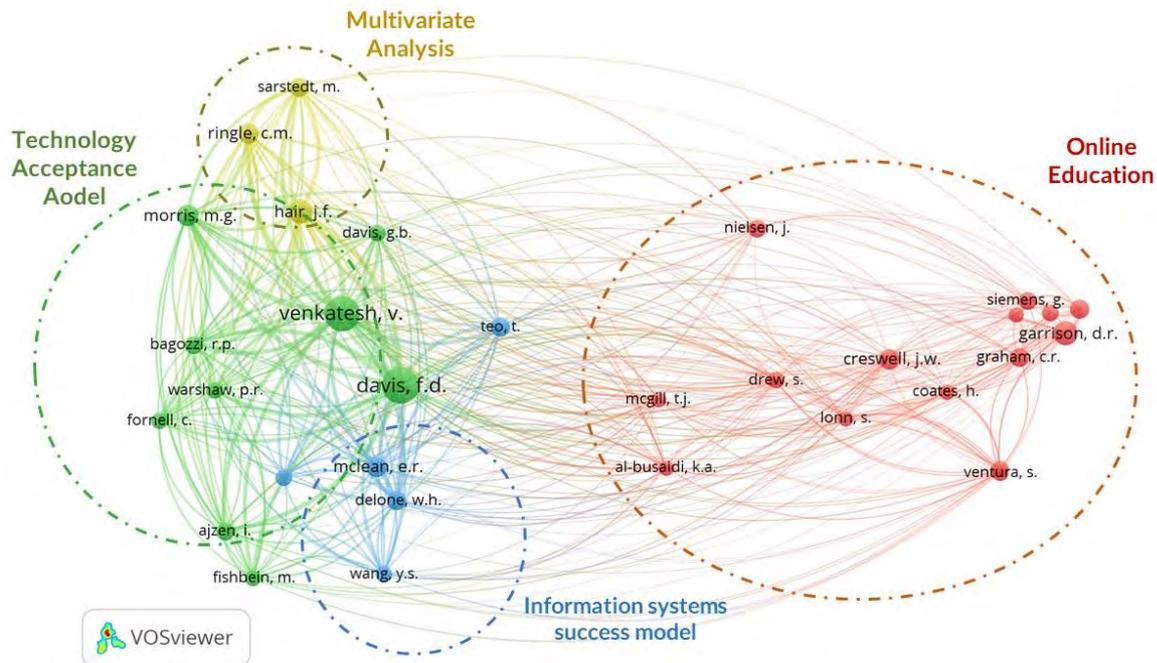


Figure 6. The Intellectual Structure of the LMSiDC Literature (threshold 20, display 32 authors)

### The Contemporary Topics in the LMSiDC Literature

The third research question aims to capture the intellectual structure of the topic. In other words, we seek to understand the fundamental theoretical background on which the LMSiDC literature was based. The result obtained from using the co-citation cited-authors method can be seen in Figure 6.

Thirty-two authors are displayed after setting the threshold to 20 (i.e., the authors appearing in Figure 6 are cited at least 15 times by the papers in the dataset). Four dominant schools of thought are identified, namely, "Technology acceptance model," "Information systems success model," "Multivariate analysis," and "Online education". The most highly cited authors are Davis F.D (112 citations) and Venkatesh (102 citations); both are part of the "Technology Acceptance Model" school of thought. The two authors lead the citation numbers with a big gap compared to the rest of the authors.

The green cluster is labeled "Technology Acceptance Model" (TAM), including big names associated with the widely used model. Along with Fres David, the original author of the model, there are Morris M G (39 citations), Venkatesh V (102 citations), Bagozzi (28 citations), who are devoted researchers of the model. In addition, there are Ajzen and Fishbein, authors of the Theory of Reasoned Action, the theory that TAM was based on.

The blue cluster entitled "Information systems success model" is led by McLean and Delone, who are famous for the model. It also includes Wang Yi-shun, whose works firmly focused on the IS model, notably the ELSS scale (Wang et al., 2007). However, the cluster also includes Timothy Teo, whose research focuses on applying TAM to understand pre-service teachers' technology usage. Timothy Teo's node is also located at the junction of three clusters, as his works relate to both models as well as education field.

The yellow cluster, also the smallest one, represents the "Multivariate analysis" school of thought. Authors in this cluster are Joseph F. Hair, Jr., well-known for his works of multivariate analysis; Marko Sarstedt and Christian M. Ringle, prominent researchers studying PLS-SEM - one of the most popular multivariate data analysis methods.

The most crowded cluster, the red one, represents the "Online Education" school of thought. This cluster stays the most separated from the rest of the clusters. Authors included in this cluster study various topics revolving around online education. Eminent names are D. Randy Garrison, whose research orientation is distance education in higher education (e.g., Garrison, 2000); Charles R. Graham, who studies blended learning in higher education (e.g., Graham, 2006) and George Siemens, being well-known for his works about educational data mining (e.g., Siemens & Baker, 2012).

After examining how the literature distributes across different aspects, the author keyword co-occurrence analysis is used to examine how it is constructed internally. The threshold was set to three, i.e., the keywords exhibited in the map must be used at least three times by the authors. Aside from the main keyword "learning management system," the most prevailing keywords are "e-learning" (77 occurrences), "moodle" (43), "higher education" (33), and "blended



Along with the geographical distribution which centralizes in developing countries, the results show that authors from the Global South are fairly well-represented in the LMSiDC literature. This is a somewhat optimistic and unique trend considering the fact that the educational research field is usually dominated by Western authors (Silova et al., 2020). Authors from Malaysia take the leading position. This result is not surprising considering the nation's enthusiasm, as stated above. On the other hand, Indonesia stands out as a noticeable rising hub in the LMSiDC literature as it showed that Indonesian authors had produced a substantial number of papers in just a few recent years. Furthermore, the empirical data reveals that, in general, there are few documents co-authored by authors from different countries. Specifically, authors from Malaysia and the UK appear to have the most collaborations in LMS studies. Nevertheless, the highest link strength between these two countries is only three, which means that only three LMS-related documents were co-authored by at least two authors from these two countries (see Figure 4). Apart from authors from developing countries such as Malaysia and South Africa, their colleagues from developed countries like the US and the UK also participate in researching LMS. Nevertheless, the participation of these developed countries was still limited, with only 23 papers, all of which are collaborations studies. The finding pertaining to co-authoring patterns among different countries is similar to what was observed pertaining to co-authoring patterns among different authors. Indeed, these findings contrast with many other topics in educational research in developing countries in which strong collaborations (among different countries and among co-authors) have been established (e.g., Grosseck et al., 2019). In other words, these above findings imply that LMS in developing countries is still under-researched, and there are potential rooms for further scholars to investigate, especially when the LMS market is quickly expanding in every part of the world (Chaw & Tang, 2018).

As to the sources, it can be seen that most publications on LMS are from those with focus on the areas of e-learning/distance learning and educational technology. This emphasizes the nature of implementing LMS with an indispensable role of technological component. It is also well noticed that the top three sources that produce the most LMSiDC papers are all conference proceedings. Notably, the two leading conferences by publications are both facilitated by the Academic Conferences International (ACI) institution and were recently merged.

Apart from the school of thought of "multivariate analysis," which refers to methodology, the three others appear to refer to educational technology-related matters. This finding is, indeed, in line with the mentioned finding that identifies top LMSiDC sources by publications and citations, which have their scopes focusing on educational technology or e-learning. The results from author keyword co-occurrence analysis refer to a number of generic terms related to LMS which illustrates the multifarious aspects of the system and its implementation. Furthermore, the most trending topic as explored is "Covid-19", proving the tremendous impacts of the pandemic on the whole educational systems (Murphy et al., 2020)

### Conclusions

To the best of our knowledge, this study is the first-ever attempt to review all LMS-related articles in developing countries, using bibliometric analysis. Specifically, we analyzed 414 Scopus-indexed papers on LMS in developing countries, and several findings are withdrawn:

LMS has received increasing attention from educational scholars in developing countries over the past 15 years from a longitudinal perspective. The number of publications on LMS in developing countries experienced a gradual increase during the first decade since its first publication in 2005. The topic even attracts more interest from scholars during the last five years. It appears that educational institutions in developed countries have adopted LMS more thoroughly between developed and developing countries. Nevertheless, as accounted in the extant literature, we also find the number of studies on LMS from developing countries which can be the results of governmental policies prioritizing LMS in education system and the impacts of the Covid-19 pandemic.

In terms of the geographical distribution, it is apparent that Malaysia is the leading country with the most publications, while in recent years Indonesia has emerged with significant growth in LMSiDC literature. As to the collaborations, however, the analysis from the data of co-authoring patterns among different countries and co-authoring patterns among different authors shows quite low link strength.

Regarding the list of top 10 LMSiDC articles according to citations, it is noted that all these ten articles are co-authored by at least one scholar from developing countries. This finding follows the co-authoring pattern, which unveils the contribution of "internal" scholars rather than "external" counterparts in LMSiDC studies.

As to the intellectual structure of the LMSiDC literature, our study reveals four dominant schools of thought, including "Technology acceptance model," "Information systems success model," "Multivariate analysis," and "Online education."

Last but not least, our study reveals the key topics of LMSiDC and how these key topics co-occurred over the longitudinal time, as shown in Figure 7. Generally speaking, the topics of interest in the LMSiDC literature are relatively diversified, as the author's keywords map is highly scattered, and seemingly, there are no dominant themes.

### Recommendations

These topics may provide suggestions for future scholars who want to conduct further investigation on LMSiDC. In terms of levels of education, the keyword map shows that the LMS-related issue in the tertiary context received much greater attention than in the K-12 setting. This is because LMS studies, in general, have long been drawn toward the higher education context (Veluvali & Surisetti, 2021) since university students possess better digital capacity, and the dissemination of LMS in this context is far easier cost-wise (Read & Geurtz, 2012). Nonetheless, this result suggests that future researchers should pay more attention to the K-12 education scene, as the pandemic forced us to re-imagine the future of in-person schooling. Furthermore, the benefits of implementing LMS in K-12 schools are previously well-recorded (Badia et al., 2019).

Also from research results on the topics of interest in the LMSiDC, there is much room for future research. Specifically, the topics with the colour yellow have formed a new avenue of LMSiDC research that future scholars, without doubt, should take into consideration while forming their research problems relating to LMSiDC. Notably, some important topics (e.g., adult learning/lifelong learning, special education, pedagogy, social network-based LMS), acknowledged their importance from a practical perspective, seem to be underrepresented in our science mapping. Therefore, future scholars may also put more effort into examining these topics and considering how to connect them with the topics that appeared in Figure 7.

### Limitations

The current study has several limitations that need to be acknowledged. Firstly, the results and their interpretations are constrained to some extent due to the nature of the scientometrics method. As the primary purpose of this method is to map out an overall picture of the research topic, a thorough analysis of the research content is not considered. Likewise, the insights derived from the authors' keyword analysis might be inadequate as they cannot fully reflect the main idea of the selected papers. Nonetheless, this study can serve as a valuable start for researchers interested in the related topics. The second limitation is the use of only English-written papers. Considering that this study's focus is developing countries, where English is not the popular first language, taking into account papers written in other languages could create a different picture and obtain more profound indigenous knowledge. Finally, the literature search was limited to the Scopus Dataset, which may neglect the other sources of data relating to the topic. Although data on the educational field of study on Scopus is significantly comprehensive, data analysis from more sources is recommended for future studies.

### Authorship Contribution Statement

Pham: Conceptualization, design, writing. Do: Data analysis, drafting manuscript, supervision and editing. L. C. Nguyen: Data acquisition, data analysis. T.-T. Nguyen: Critical revision of the manuscript, editing/review and final approval.

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