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THE ROLE OF MOODLE IN EDUCATION: A BIBLIOMETRIC REVIEW

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ABSTRACT

Moodle is a trendy digital learning platform in education widely used to create online courses. Moodle's role in education is crucial because it provides many benefits, including facilitating distance learning, increasing student participation, increasing teaching efficiency, enabling easy assessment, enabling personalized teaching, and so on. There have been many studies on Moodle in the form of articles from year to year. Therefore, in this research, a bibliometric study will be carried out on the roles of Moodle in the world of education, mapping research results, looking at research trends, and looking for possible gaps that can still be studied more deeply. The method used in this research is a Systematic Literature Review using bibliometric analysis with the help of VoS Viewer. The study results show that Moodle is widely used to benefit learning in various fields, especially STEM. Moodle is generally used to digitize learning, including, in this case, the assessment and gamification process in learning.

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1. INTRODUCTION

In the world of education, moodle is used as an online learning platform. Moodle is a web-based Learning Management System (LMS) accessed using any device with an internet connection. Moodle has many features that make it suitable for educational institutions, significantly higher education. Universities in Indonesia have widely adopted this LMS. Some well-known universities in Indonesia, such as UGM (https://elok.ugm.ac.id/), UNESA (https://vinesa.unesa.ac.id/), University of Indonesia

(https://emas.ui.ac.id/login/index.php), UNY (https://besmart.uny.ac.id/v2/) and many other universities use Moodle as a University LMS. It is not surprising that this LMS is very popular LMS among academics both in Indonesia and around the world.

Some of Moodle's advantages include being an open-source, accessible platform. It can be customized according to the capabilities and wishes of the developer, available in the form of a mobile application, supports various languages and can be integrated with various CMS (Content Management Systems) or other learning applications (Kurniawati et al., 2020). A good LMS has at least five features: administrative features, teaching material features, testing features, assessment features, and integrated communication features (Retnoningsih, 2017). These features are already available in Moodle, so this LMS is reasonably complete.

Moodle has an assessment facility that can be used to test students' understanding of the material taught (Triyana et al., 2019). There are various forms of questions, such as multiple choice, true-false, matching, and even essay questions, that can be used as assessments (Chrisnawati et al., 2020). Another advantage is that the STACK plugin facility is available, which can be used for writing complete mathematics (Tomilenko & Lazareva, 2020). Complete math writing facilities are rarely found in quiz maker software or LMS.

Moodle is a platform that can be used as a blended learning medium. Blended learning combines face-to-face learning techniques in class and online learning (Gámiz Sánchez et al., 2014). Online learning itself can be done in two ways, namely synchronously or asynchronously. For asynchronous learning, you can use teaching materials in videos uploaded to the system (Edwards et al., 2019) or other products, such as electronic books in the form of EPUB (Prasetya et al., 2020). Whatever the form, teaching materials stored in the Moodle system can be accessed anywhere and anytime as long as they are connected to the internet.

Currently, LMS is widely used as an asynchronous learning media. Students busy with school activities and want additional lessons but need more time to participate in offline activities prefer online learning (Mursito, 2019). Likewise, students who do not have time to go to college because of certain obstacles can still get material according to what is presented in class.

Apart from functioning as a learning medium, Moodle can be used to measure one's learning independence. Through the activity log in Moodle, student learning activities can be monitored so that tutors/teachers can see how far students are trying to study independently (Pratiwi, 2022).

The literature review above shows that many researchers have discussed Moodle. The reviews vary from development, implementation, effectiveness, assessment, etc. Various research topics on Moodle have been discussed in many articles. As of February 5, 2023, around 1917 articles were recorded in the dimensions database in 2013-2022, specifically for the education sector.

Therefore, in this research, a bibliometric study will be carried out on the roles of Moodle in the world of education, mapping research results, looking at research trends and looking for possible gaps that can still be studied more deeply.

2. METHOD

The method used in this research is a Systematic Literature Review using bibliometric analysis with the help of VoS Viewer. The VoS Viewer software has five analysis types, each with its study unit. The five types of analysis are Co-Authotsip, Co-Occurrence, Citation, Bibliographic Coupling and Co-Citation. In this research, two types of analysis will be used, namely Co-Authorship and Co-Occurrence. The first type will be

studied in a deductive way, namely through the author's partner in terms of the author's country, organization, and between authors. Co-occurrence is a type of analysis that reviews the literature on the occurrence of keywords in articles.

There are many places to retrieve research article databases, including Google Scholar, Web of Science, Scopus, Dimensions, and PubMed. Software that can be used to search for article data without entering the indexer site can use Publish or Perish. However, in this study, the database used was the Dimensions database, whose articles were taken directly from the Dimensions website. There are several sampling considerations in database Dimensions. First, several bibliometric studies on Moodle use the Scopus database, so it is not good to use the same database. The complete metadata of all databases besides Scopus is metadata from web Dimensions. PoP software is not used because publication-type filtering facilities are not available.

The Dimensions database was used for 2013 – 2022, specifically for articles in the form of journals in the field of education that contain the keyword "Moodle". Article data is stored in RIS and CSV formats. Using the VOS Viewer, RIS files are used to analyze co-occurrence based on keywords, while CSV is used to analyze co-authorship in terms of country, organization, and author names.

3. RESULTS AND DISCUSSION

3.1. *Co-Authorship* Analysis (Country)

Articles as many as 1917 data were detected from 101 countries. The minimum number of co-authorships between countries is taken, namely 10, to get 25 countries that comply. These 25 countries are divided into 7 clusters and are marked with colored circles in Figure 1.

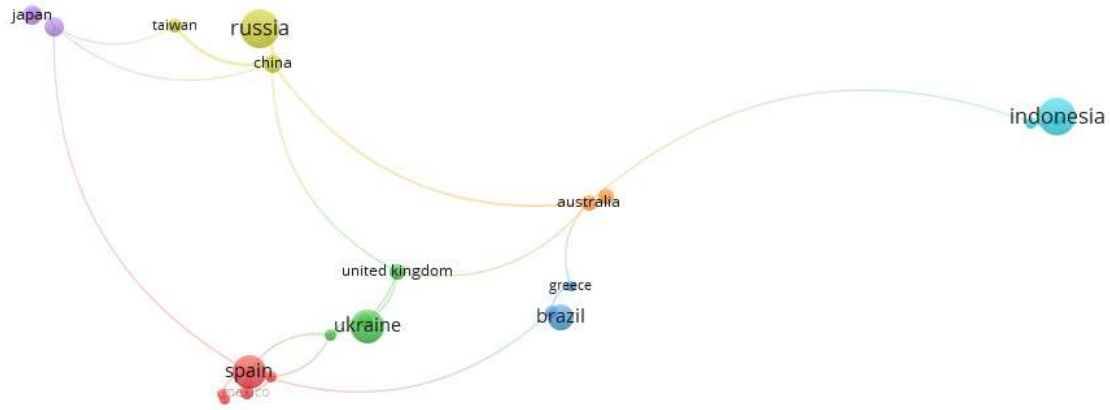

Figure 1. Network Visualization for Co-authors with country units

Each cluster consists of several countries. Cluster 1 Spain (93.1028), Mexico (15.55), Italy (12, 134), Colombia (11.16), Morocco (11.159). Cluster 2 Ukraine (93,230), United Kingdom (20,186), Turkey (18,175), Finland (12,185). Cluster 3 Brazil (56.95), Portugal (15.201), Greece (10.313). Cluster 4 Russia (126,492), China (29,553), and Taiwan (18; 463). Cluster 5 Japan (34; 93), United States (34; 418), Serbia (15; 226). Cluster 6 Indonesia (119; 146), Malaysia (12; 174), Oman (10;71). Cluster 7 Australia (22,325), South Africa (22; 358). The numbers in brackets are the number of documents and citations, respectively. The ten countries with the highest number of documents can be seen in Table 1.

Table 1. 10 Countries With The Most Documents

No	Country	Documents	Citations
1	Russia	126	492
2	Indonesia	119	146
3	Spain	93	1028
4	Ukraine	93	230
5	Brazil	56	95
6	Japan	34	93
7	United States	34	418
8	China	29	553
9	Australia	22	325
10	South africa	22	358

When viewed from the two countries with the most documents, several Russian researchers used Moodle to learn Russian as a foreign language (Samchik, 2021), especially during a pandemic (Berardi, 2021). Moodle is also a distance learning facility for foreigners who will study at universities (Lapuzina & Lisachuk, 2017). Apart from learning foreign languages, moodle is also widely used in learning mathematics (Kaidalova & Gumennikova, 2022) or learning other sciences (Drozdova, 2021).

Moodle is widely used in Indonesia as an LMS for universities or high schools. Various research topics on Moodle were studied. Several teachers and researchers use Moodle as a learning medium with a flipped classroom strategy (Ninda & Mawardi, 2022; Sari & Mawardi, 2022; Sitanggang et al., 2022) or blended learning (Handayani, 2022). Some want to implement Moodle in learning (Fayanto et al., 2019), and some measure student perceptions or attitudes of student acceptance of learning using Moodle (Pramita et al., 2021; Thamrin et al., 2019).

3.2. *Co-Authorship* Analysis (Organisation)

VoS Viewer found 836 organizations from the article database. A minimum of 5 documents and three citations were taken, and only 31 organizations complied. Of the 31 organizations, only three universities have the strongest total links: Financial University, Sechenov University and St Petersburg University.

However, suppose a pair of authors with at least 1 document and 1 citation is taken. In that case, there are 346 clusters, and one of the clusters containing universities in Indonesia can be seen in Figure 2.

Figure 2. Network Visualization for Co-authors with organizational units

Several universities in Indonesia are interconnected, and one is connected to a university in Malaysia. This is under the analysis between countries which place Indonesia and Malaysia in one cluster. The ten universities with the most documents and citations can be seen in Table 2. Two of them are from Indonesia.

Table 2. 10 Universities that Have the Most Documents and Citations

No	Organization	Documents	Citations
1	University of córdoba	13	76
2	State university of Jakarta	11	14
3	University of kwazulu-natal	10	270
4	Tomsk polytechnic university	9	86
5	University of Belgrade	9	157
6	Borys grinchenko kyiv university	8	18
7	Sultan qaboos university	8	30
8	Financial university	7	4
9	Nizhny novgorod state pedagogical university	7	27
10	State university of padang	7	15

3.3. *Co-Authorship* Analysis (Author)

Of the 4,852 authors found, authors with at least four documents and at least two citations were selected. Ten authors were obtained from the specified minimum requirements, which can be seen in the picture. The largest circle indicates the highest number of citations. In this case, the three authors with the most citations are Ahmed Al-Azawei, followed by Garcia then Strang Kenneth.

Figure 3. 10 Authors who Have at Least 4 Articles and at Least 2 Citations

Al-Azawei investigated the satisfaction and intention of students to continue using e-learning or not. The proposed TAM model identified key factors that could explain student satisfaction in mixed learning acceptance in the Middle East (Al-Azawei et al., 2017). He also discussed the correlation of learning styles with student achievement in the blended learning mode using Moodle and the ILS (Index of Learning Styles). No correlation was found between the two (Al-Azawei & Lundqvist, 2015). In addition, he also compared the existing assessments in the model with Virtual Reality (VR) assessments. In terms of student performance, the two methods are no different. However, on the other side, the VR assessment succeeded in increasing student involvement in the evaluation because they were happy with the VR evaluation (Al-Azawei et al., 2019).

Regarding the assessment problem, the second author uses Moodle in conducting peer assessments, and according to Strang, this is also very effective (David Strang, 2015). He also predicts student learning outcomes based on logs of online learning activities recorded in Moodle (Strang, 2017). In this study, learning activity logs cannot be used to predict student performance or learning outcomes.

3.4. *Co-Occurrences* Analysis

The RIS files obtained from 1917 articles were processed through the VoS Viewer. Shared events are reviewed based on the keywords the article uses. By limiting each keyword to occur at least five times, 24 keywords are obtained, which form 6 clusters. Cluster I includes*: assessment, blended learning, feedback, formative assessment, ICT, motivation,* and *student engagement*. Cluster II includes *E-Learning, education, gamification, learning, learning management Systems,* and *satisfaction*. Cluster III includes *covid 19, educational technology, medical education, and online learning*. Cluster IV includes *digital technologies, distance learning, LMS Moodle,* and *mathematics*. Cluster V just only one is *collaborative learning, and the last cluster VI namely machine learning*. The following figure shows the density visualization.

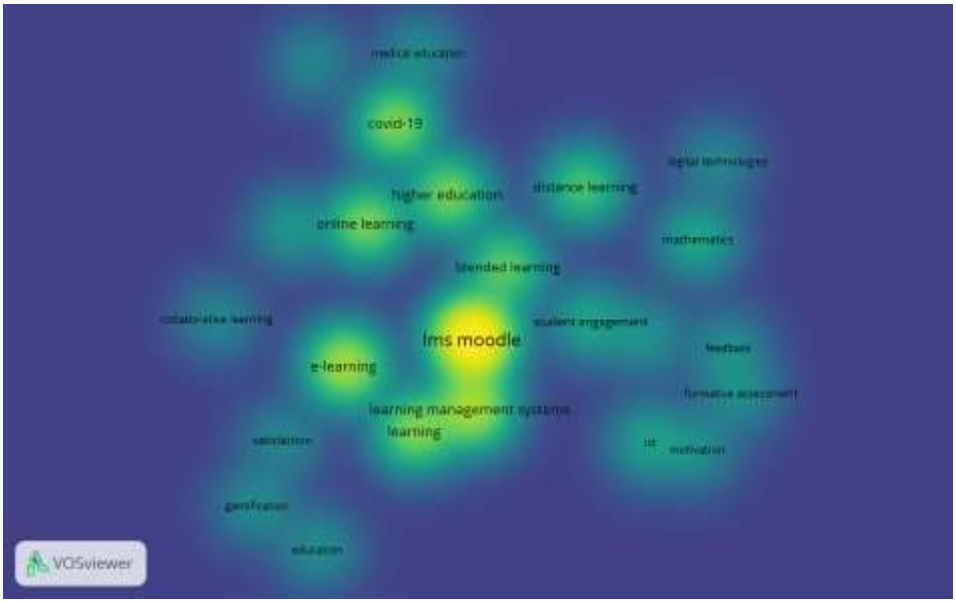

Figure 4. Density Visualization

Of the several clusters, several keywords clearly show that these keywords are the most frequently discussed of all the articles compiled. The brightest buzzword is “LMS Moodle.” This is the main topic discussed in each piece. Then followed by special keywords “Learning Management System.” Moodle is an LMS, but the LMS mentioned in the article is not necessarily Moodle. It could be Schoology, Chamilo, Microsoft Teams, Edmodo, and others.

The third position that is quite bright is “e-learning.” All articles that discuss electronic learning can use these keywords, such as mobile learning, web-based learning, and all forms of knowledge that use electronic aids, including the LMS itself. In fourth place are “Covid-19” and “learning,” which are just as clear. The fifth position is “higher education” and “online learning.” Then there are “blended learning” and “distance learning,” which are starting to fade. All keywords that are dim have the potential to be studied more deeply, but it is necessary to pay attention to the latest items so that research studies always have a new side. Therefore, it requires an overlay visualization display.

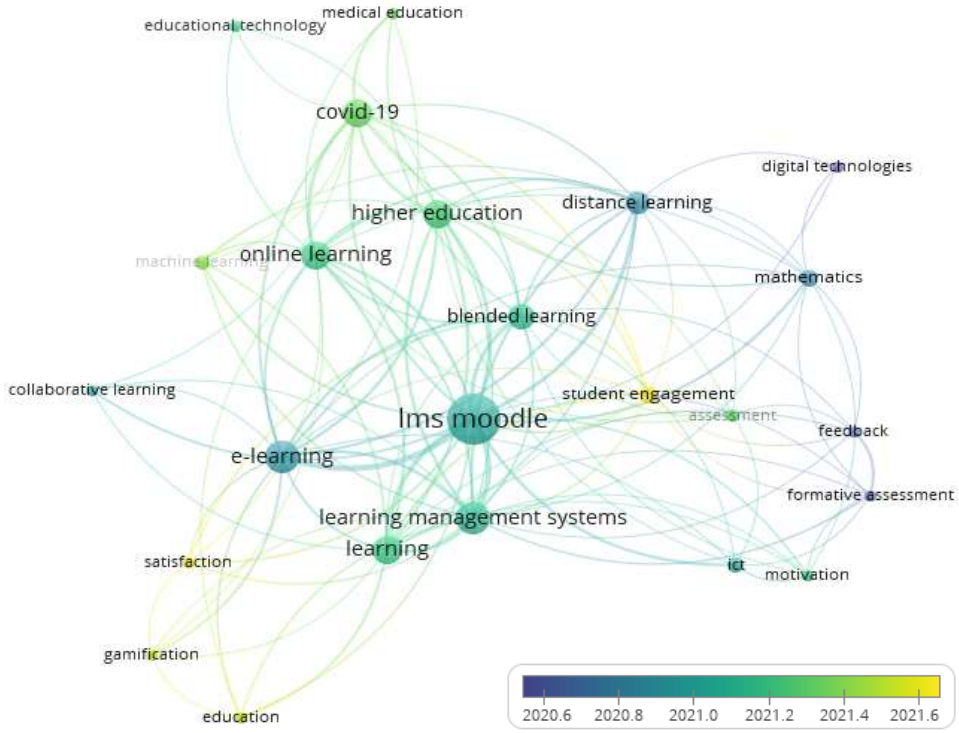

Figure 5. Overlay Visualization

From this visualization, keywords such as education, gamification, satisfaction and student engagement are the most recent keywords among all existing keywords. Included in this is the keyword assessment. All of these new keywords still have the potential to be studied further because the Density visualization section is rarely discussed.

The authors of the articles obtained from the dimension database came from 101 countries. This proves Moodle's use in education is prevalent in various countries. There have also been many collaborations between authors. The research found that Russians, followed by Indonesians, wrote most documents. However, the most cited articles were articles from Spain. There has been no co-authorship between these three countries.

The University of Córdoba from Spain is in the first place which has the most articles. The second place is occupied by the State University of Jakarta from Indonesia. Meanwhile, Padang State University is another university from Indonesia that is included in the category

of 10 universities with the most articles. From this visualization, it can be seen that collaboration between universities is still rare. Most of the authors' affiliations only occur within their respective organizations.

In Indonesia, Moodle is widely used as a university LMS. This platform can generally be used for any learning but mostly focuses on learning science, technology, engineering, and mathematics. This is to the results of research (Gamage et al., 2022), which states that learning using Moodle greatly focuses on the STEM field (Science, Technology, Engineering, and Mathematics).

Based on overlay visualization and density visualization, one of the keywords rarely studied, and relatively new is assessment. Moodle assessment can be developed by collaborating with several devices, for example, Ispring. Ispring is a fairly comprehensive quiz creation tool that can generate importable quizzes for some specialized LMSs such as Moodle. This issue is currently under study.

4. CONCLUSION

The results and discussion show that Moodle is widely used to benefit learning in various fields, especially STEM. Moodle is generally used for digitizing learning, including, in this case, the assessment and gamification process in learning. To get exact keywords, the keywords for each article need to be rechecked. The tool that can be used is Mendeley. However, because too many articles were reviewed, the keywords taken were output directly from the VoS Viewer without further examination. To produce accurate keywords, use a filtering method such as PRISMA to make the examined articles manageable.

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