A Bibliometric Analysis of Moodle E-learning: Evidence from 2011 to 2021

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Abstract

Moodle e-learning is a suitable solution for learning in the technology era. The research purpose was to present a comprehensive literature review on Moodle e-learning in teaching and learning. The Articles were gained via Publish or Perish Software. The study analyzed 29 articles from 2011 to 2021 from the Scopus database. The Software of Mendeley was utilized to arrange the articles. The Software of Vosviewer is applied to review and identify the articles. The study showed the two clusters of group words that appear most often. The first cluster consisted of six items (application, e-learning, effective, elementary school, Moodle, and study) and the second cluster consisted of three items words (design, development, and Moodle). This cluster represents the research streams of Moodle e-learning.

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Introduction

The bibliometric analysis of e-learning has been widely discussed in many articles to identify, clarify, and analyze large numbers of scientific articles that enable the researchers to explain the evolutionary nuance of a particular field, explore the intellectual structure of a specific domain in the vast literature, and also to uncover emerging trends in many articles. The research of bibliometric analysis of e-learning, such as global investigation activity on e-learning in health sciences teaching: a bibliometric analysis (Sweileh, 2021), two decades of study in e-learning: a deep bibliometric analysis (Sobral, 2021)(Sobral, 2021), categorization of e-learning as a developing discipline in the world publication system: a bibliometric study in Scopus (Tibaná-Herrera et al., 2018), tendencies of e-learning study from 2000 to 2008: apply of text mining and bibliometric (Hung, 2012), a bibliometric analysis of the adoption and utilization of e-learning in higher education (Martin, 2021), and comprehending the association between e-learning and web 2.0: A bibliometric and thematic analysis from 2006 to 2020 (López-Robles et al., 2020). In contrast, the research is concentrated on the bibliometric analysis of Moodle e-learning.

Moodle is a software whose acronym is *modular object-oriented dynamic learning environment* as a free source of the software platform used in learning (Brandl, 2005; Costa et al., 2012; Ismail et al., 2020; Rice, 2015; Soliman, 2014; Sun, 2014), which has several features available for teachers to assist them in teaching (Deepak, 2017). While Oproiu (2015) puts forward that Moodle is a virtual learning environment (VLE), considered a new learning framework based on constructivist pedagogy, the learning process is carried out online and uses open source software to support a collaborative learning environment and creates information.

Moodle can be applied to increase academic achievement in some essential specific aspects: declarative knowledge, strategies of learning, the approach of learning, self-regulation, and statistically significant distinctions in academic results (Núñez et al., 2011), enhance EFL reading comprehension (Ismail et al., 2020), develop students' motivation, participation, competence, and qualification of utilizing Moodle multiple choice test and traditional classroom exams (Novo-Corti et al., 2013), significant effect to progress English language learning skills (Yang et al., 2013), prepare beneficial to predict the students' academic results (Romero et al., 2021), improve formative assessments (Cohen & Sasson, 2016), and help traditional teaching (Romero et al., 2013).

Many previous researches about Moodle e-learning were MoodleREC: a recommendation system for designing courses utilizing the Moodle e-learning platform (De Medio et al., 2020), evaluation of Moodle features at Kajaani University of applied sciences-case study (Deepak, 2017), a research about employing e-learning platform (Moodle) in University teaching process (Oproiu, 2015), The effect of Moodle e-learning material on EFL reading comprehension (Ismail et al., 2020), Moodle and Socrative quizzes as formative aids on theory teaching in a chemical engineering subject (Romero et al., 2021), implementation of training programs in self-regulated learning strategies in Moodle format: Results of an experience in higher education (Núñez et al., 2011), before and during Covid-19: a cohesion network analysis of students' online participation in Moodle courses

(Dascalu et al., 2021), and introducing an open-source course management system (Moodle) for Blended learning on infectious diseases and microbiology: A pre-post observational study (Lebeaux et al., 2021). Therefore, this research aims to review Moodle e-learning.

Methodology

The study used quantitative research of journal articles and concentrated on bibliometric analysis. The five stages of bibliometric analysis were modified and applied in this research. They define appropriate search terms, early search results, refine the search results, compile statistics on the early data, and conduct data analysis (Fahimnia et al., 2015).

Defining the appropriate search term

The articles search was carried out in October 2021 by applying "Moodle e-learning" as a keyword. The Publish or perish Software with the Scopus database was employed to elicit the articles. The process was initiated by entering "Moodle e-learning" into the Publish or Perish Software. Then, the authors arranged to publish names with 'journal', title word with "Moodle e-learning", and years with '0-0'. 117 articles were found in the early search from 2007 to 2021 (14 years).

Early search results

In this stage, the authors did not adjust the year range. The oldest article on Moodle e-learning was published in 2007, entitled analyzing users' access logs in Moodle to improve e-learning. The Publish or Perish Software recognized the ten top articles.

Table 1. *The ten tops articles (unregulated search)*

Authors	Titles	Publication years
Baruque et al.	Analyzing users' access logs in Moodle to improve e-learning	2007
Limongelli et al.	Configuration of personalized e-learning courses in Moodle	2007
Minović et al.	Usability issues of e-learning systems: Case-study for Moodle learning management system	2008
Siirak	Moodle e-learning environment - An effective tool for the development of a learning culture	2008
Romero et al.	Evolutionary algorithms for subgroup discovery in e-learning: A practical application using Moodle data	2009
Tuparov, at al.	The "jigsaw" collaborative method in e-learning environment Moodle	2009
Braccini et al.	Users' perception of the quality of open source e-learning platform: The case of Moodle	2009
Amaral and Almeida	Usability and E-learning: Moodle assessment	2009
Gergely and Pohl	Eye tracking study of the E-Learning environment Moodle: Investigation of user-behavior	2009
Cuadrado-García and RuiZ-Molina	University students' satisfaction on virtual platforms: An international E-learning program based on Moodle	2009

Refinement of the search results

In this stage, the authors controlled the range of years (2011-2021) and set publication names (journals). 29 articles were found over ten years. The distinction between the result of the early search and the refinement search can be exhibited in table 2.

Table 2. *Comparison metrics*

| Metrics data	Initial search	Refinement search
Query	Journal, Moodle e-learning	Journal, Moodle e-learning from 2011 to 2021 (10 years)
Source	Scopus	Scopus
Papers	117	29
Citations	760	210
Years	(2007-2021) 14 years	(2011-2021) 10 years
Cites/year	54.29	21.00
Cites/paper	6.50	7.24
Authors/paper	1.00	1.00
h_index	14	7
g_index	24	14
hI_norm	14	7
hI_annual	1.00	0.70
hA_index	7	4

Compiling Initial data statistics

Twenty-nine articles found in the refinement search result were downloaded and saved into the Software of Mendeley in the form of RIS format to regulate vital information related to the articles, such as title, author's name, abstract, publication year, journal publisher, volume, issue, and page. Afterward, the articles identified the publication trend year and source of publication.

Figure 1. *Publication trend years*
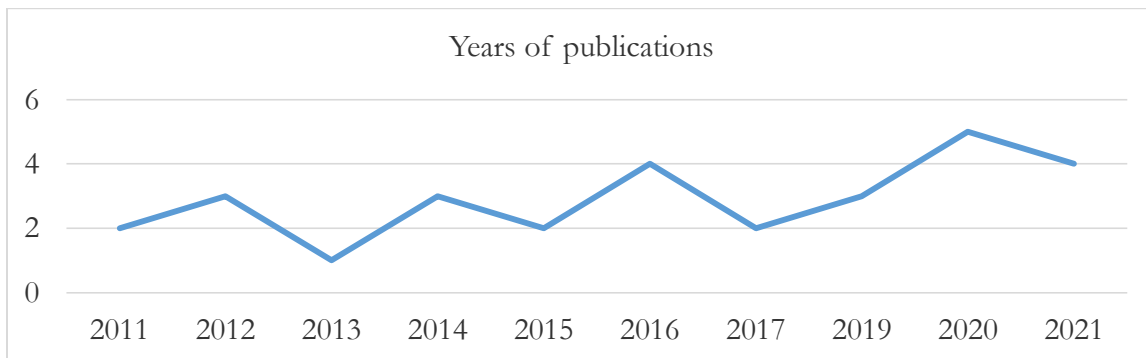
The publications trend on Moodle e-learning in the last ten years is in 2011 was two articles published in the Scopus-indexed journal. In 2012 were three articles. In 2013 was only one article. In 2014 were three articles. In 2015 were two articles. In 2016 were four articles. In 2017 were two articles. In 2019 were three articles. In 2020 were five articles. And, in 2021 were four articles.

Figure 2. *Journal in which articles in analysis appeared*
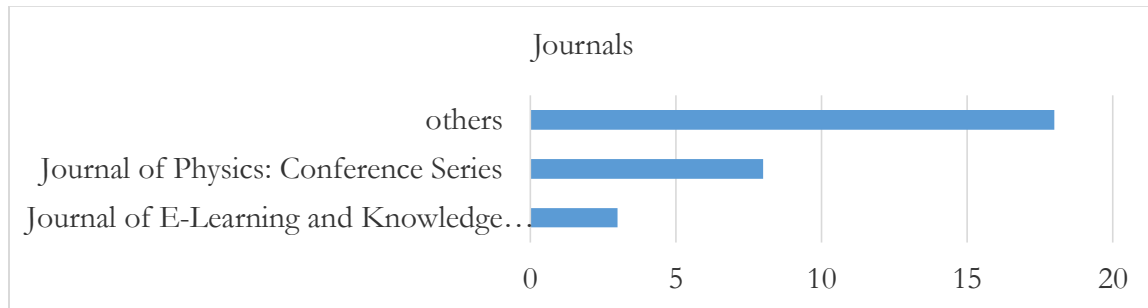
Eighteen journals have only published one article on the "Moodle E-learning" theme. The 18 journals are the Academy of Strategic Management Journal, Desidoc Journal of Library and Information Technology, Eurasia Journal of Mathematics, Science and Technology Education, International Journal for Lesson and Learning Studies, International Journal of Advanced Computer Science and Applications, International Journal of Innovation and Learning, International Journal of Instruction, International Journal of Mobile and Blended Learning, International Journal of Morphology, International Journal of Scientific and Technology Research, International Journal of Technology Enhanced Learning, Journal of Information Systems Education, Journal of Information Technology Education: Research, Journal of Internet Technology, Journal of Network and Computer Applications, Journal of Statistical Software, Journal of Turkish Science Education, and Turkish Online Journal of Distance Education. In total 20 journals discussed issues related to Moodle e-learning.

Data analysis

This research explores the term "Moodle e-learning", which is analyzed using bibliometric analysis from the database of Scopus. The bibliometric review was carried out through version 7.33.3388.7819 of Publish or Parish Software. The authors elicited 117 articles in the early result and 29 in the regulated result. The data regarding citations changes with 210 citations and 21.00 citations/year.

Findings and Discussions

This study highlights the matrix's significant impact on citations on articles published in Scopus-indexed journals. The most cited paper is titled. The first is Student-oriented planning of e-learning contents for Moodle", written by Caputi and Garirdo, published in

the Journal of Network and Computer Applications in 2015, and cited by 54 authors. The second is personalized e-learning in Moodle: The Moodle_LS system, written by De Medio et al. (2020), was published in the Journal of E-Learning and Knowledge Society in 2011 and cited by 44 authors. The third is the analysis of selected aspects of students' performance and satisfaction in a Moodle-based e-learning system environment," written by Umek, et al., published in the Eurasia Journal of Mathematics, Science and Technology Education in 2015, and cited by 32 authors. The fourth is what drives successful social media in education and e-learning? A comparative study on Facebook and Moodle, written by A. Al-Azawei, published in the Journal of Information Technology Education: Research in 2019 and cited by 17 authors. And the fifth is An assessment of the effectiveness of Moodle e-learning system for undergraduate Public Administration education, written by Umek, et al., published in the International Journal of Innovation and Learning in 2017, and cited by 10 authors.

The five most cited articles have strengths and weaknesses. The first, the strength of an article written by Valentina et al. is they designed student-oriented learning content according to the student's background and learning objectives in Moodle and the weakness in the teaching and learning process used entirely online. The second, the strength of an article written by De Medio et al. is that they develop an innovative learning content delivery system based on personalization of the learning experiences. The weakness is that learning content is still in the experimental stage. The third, the strength of an article written by Umek et al. is found a positive relationship between Moodle e-learning platform and students' performance. The weakness is that they don't create e-learning because they undertake student surveys. The fourth, the strength of the article written by Al-Azawei is that the students were more focused on system and quality of information on Facebook than on Moodle. The weakness is that he used a convenience sampling approach, so the result was not generalizable.   And the fifth, the strength of an article written by Umek et al. is knowing the positive impact of Moodle in Education. The weakness is that they do not consider other individual factors (motivation) and the content quality in Moodle.

Figure 3. *Mapping of Network visualization*
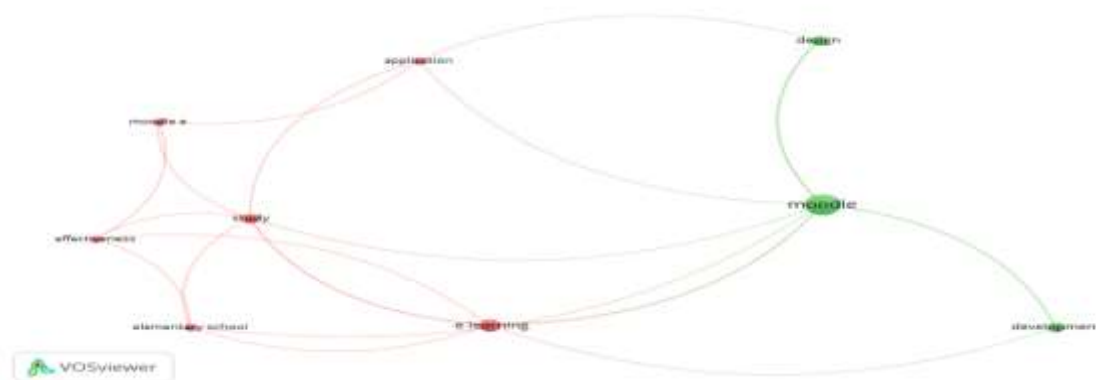
Note: two colors in figure 3 state four clusters of Moodle e-learning.

After finding the citation frequency, the output from the publish or Perish Software is analyzed using Vosviewer Software to visualize bibliometric analysis maps and identify keywords that appear frequently. The result of Vosviewer software displays bibliometric mapping in three diversity visualizations, namely network visualization, overlay visualization, and density visualization.
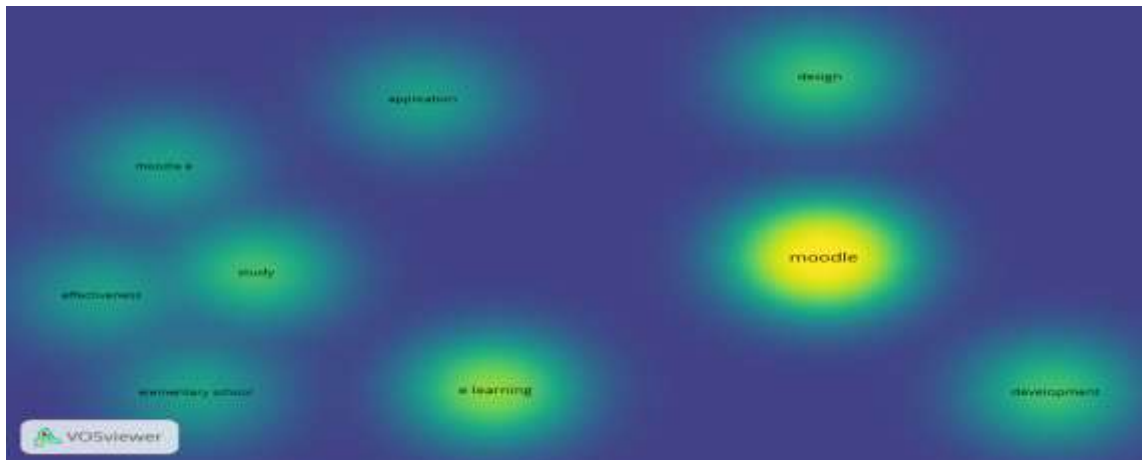
Figure 4. *Mapping of density visualization*

Figure 4 shows nine-word items that meet the threshold of the 104 terms from the title fields extracting and full counting with the minimum number of occurrences set to 2. The author also found two clusters identified, namely cluster 1 consisting of six items: application, e-learning, effective, elementary school, Moodle, and study; cluster 2 consisted of three items words, such as design, development, and Moodle.

The authors of the 29 articles analyzed in this research are: 1) Valentina et al. researched about student-oriented planning of e-learning contents for Moodle in 2015; 2) De Medio et al. about personalized e-learning in Moodle: the Moodle_LS system in 2011; 3) Umek et al. about the analysis of selected aspects of students' performance and satisfaction in a Moodle-based e-learning system environment in 2015; 4) Al-Azawei about what drives successful social media in education and e-learning? A comparative study on Facebook and Moodle in 2019; 5) Umek et al. about an assessment of the effectiveness of Moodle e-learning system for undergraduate public Administration education in 2017; 6) Jordan about comparison of International Baccalaureate (IB) chemistry students' preferred vs actual experience with a constructivist style of learning in a Moodle e-learning environment in 2013; 7) Jainul et al about development of e-learning courses for subjects about 'learn and learning' with Moodle-based for prospective teacher in Indonesia in 2020; 8) Konaru about exploring Moodle functionality for managing Open Distance Learning e-assessments in 2017; 9) Chen et al. about a study of investigating the learning effectiveness of applying the MOODLE E-learning in Taiwan's elementary school in 2014; 10) Schultz about information security trends and issues in the Moodle e-learning platform: An ethnographic content analysis in 2012;

11) Zeileis et al. about flexible generation of e-learning exams in R: Moodle quizzes, OLAT assessments, and beyond in 2014; 12) Bucarey about anatomy contents in learning designs displayed in LAMS and integrated to Moodle in 2011; 13) Berizzi et al about Moodle my style: E-learning improves attributional style for cancer-diagnosed children in 2016; 14) Santo and Meo about e-training for the Clil teacher: E-tutoring and cooperation in a Moodle-based community of learning in 2016; 15) Hawagamag et al about m-learning not an extension of e-learning:" Based on a case study of Moodle VLE in 2012; 16) Bansode and Kumbhar about e-learning experience using open source software: Moodle in 2012; 17) Widyaningsih about the development of the hots test of physics based on modern test theory: Question modeling through e-learning of Moodle LMS in 2021; 18) Lisnani about designing Moodle features as e-learning for learning mathematics in COVID-19 pandemic in 2020; 19) Arianti about the development of e-learning use Moodle as a multimedia learning medium in 2020; 20) Hasan about on examining user experience of Moodle e-learning system in 2021; 21) Syarif about using Moodle learning management system in teaching from distance learning to the e-learning 5.0 of new technology in 2021; 22) Dewantara about the principles of blended learning design with heutagogy approach through e-ganesha Moodle in Indonesian language learning in 2021; 23) Putri about Moodle as e-learning media in physics class in 2020; 24) Nurjanah about Moodle-based e-learning development based on mathematical solving of high school students in 2020; 25) Ariesta about enhancing science learning outcomes through Moodle-based e-learning in elementary schools in 2019; 26) Dhika about the study of the use and application of the Moodle e-learning platform in high school in 2019; 27) Magonava about e-learning practice using Moodle by leading universities in the Russian region in 2016; 28) Manzo about design and performance evaluation of a virtualized Moodle-based e-learning environment in 2016; and 29) Yalman about the design, application and evaluation of a web-based e-learning system (Moodle) in 2014.

Table 3. *Article with two or more citations*

No	Citations	Per year	Authors	Title	Year	Publication
1	54	09.00	Caputi, and Garirdo	Student-oriented planning of e-learning content for Moodle	2015	Journal of Network and Computer Applications
2	44	04.40	De Medio, et al.	Personalized e-learning in Moodle: The Moodle_LS system	2011	Journal of E-Learning and Knowledge Society
3	32	05.33	Umek, et al.	Analysis of selected aspects of students performance and satisfaction in a Moodle-based e-learning system environment	2015	Eurasia Journal of Mathematics, Science and Technology Education
4	17	08.50	A. Al-Azawei	What drives	2019	Journal of

				successful social media in education and e-learning? A comparative study on Facebook and Moodle		Information Technology Education: Research
5	10	02.50	Umek, et al.	An assessment of the effectiveness of Moodle e-learning system for undergraduate Public Administration education	2017	International Journal of Innovation and Learning
6	8	01.00	Jordan	Comparison of International Baccalaureate (IB) chemistry students' preferred vs actual experience with a constructivist style of learning in a Moodle e-learning environment	2013	International Journal for Lesson and Learning Studies
7	7	07.00	Zainul et al.	Development of e-Learning Courses for Subjects about 'Learn and Learning' with Moodle-based for Prospective Teacher in Indonesia	2020	Journal of Physics: Conference Series
8	7	0,09375	Koneru	Exploring Moodle functionality for managing Open Distance Learning e-assessments	2017	Turkish Online Journal of Distance Education
9	7	01.00	Chen et al.	A study of investigating the learning effectiveness of applying the MOODLE E-learning in Taiwan's elementary school	2014	Journal of Internet Technology
10	6	0,046528	Schultz	Information security trends and issues in the Moodle	2012	Journal of Information Systems

				e-learning platform: An ethnographic content analysis		Education
11	4	00.57	Zeileis et al.	Flexible generation of E-learning exams in R: Moodle quizzes, OLAT assessments, and beyond	2014	Journal of Statistical Software
12	3	00.30	Bucarey	Anatomy contents in learning designs displayed in LAMS and integrated to Moodle	2011	International Journal of Morphology
13	2	00.40	Berizzi, et al.	Moodle my style: E-learning improves attributional style for cancer-diagnosed children	2016	International Journal of Technology Enhanced Learning
14	2	00.40	Santo and Meo	E-training for the Clil teacher: E-tutoring and cooperation in a Moodle-based community of learning	2016	Journal of E-Learning and Knowledge Society
15	2	00.22	Hewagamage et al.	"M-learning not an extension of e-learning:" Based on a case study of Moodle VLE	2012	International Journal of Mobile and Blended Learning
16	2	00.22	Bansode and Kumbhar	E-learning experience using open source software: Moodle	2012	DESIDOC Journal of Library and Information Technology

Conclusions, implications, and suggestions

This research reviewed 29 articles related to the term Moodle e-learning. The Publish or Perish Software version 7.33.3388.7819 with the Scopus database was utilized for collecting the articles. These 29 articles were found from a more extensive original set of 117 articles gained from the early result. The number of data citations is 760 citations and 54.29 citations/year, whereas the refinement result is 29 articles, cited by 210 authors and 21.00 citations/year. The most cited article on Moodle e-learning is written by V. Caputi entitled student-oriented planning of e-learning contents for Moodle. The article was written in 2015, published in the Journal of Network and Computer Applications, and cited by 54 authors.

Most importantly, as studies showed the two clusters of words that appear most often. The first cluster consisted of six items (application, e-learning, effective, elementary school, Moodle, and study) and the second cluster consisted of three items words (design, development, and Moodle). Finally, because the keywords used to search for articles in this study were limited to Moodle e-learning, the results displayed are only those related to Moodle. Therefore, future researchers are advised to use other forms of e-learning as keywords to find articles to be analyzed.

Disclosure statement

The author reported no potential conflict of interest.

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