Journal of Computers for Science and Mathematics Learning
J. Comput. Sci. Math. Learn.
2024, Vol. 1, No. 1, 44–57

Review Article

Bibliometrics Analysis: Trend For Three Decades in Research Article of Web Module or Learning Module

Emia Erliasna

Department of Chemistry Education, Universitas Negeri Jakarta, Indonesia

Abstract
This bibliometric analysis purpose is to find out how research has developed over the years. The aim of this research is to find out how the trend in publication of articles about web modules over the last 3 decades was developed. This article applied quantitative methods to develop and evaluate the bibliometric and vos viewer to mapping the relationship of variables. Bibliometric publications were retrieved from 1994 to 2023 from the scopus bibliographic database. Results: Articles published about web modules have increased over the past 3 decades. The determination value (R2) indicates that the exponential trend line is reliable. The most cited article is written by Happel, 1994 with 209. The most productive author is from Virginia Commonwealth University School of Medicine. The most productive country which published a paper around 1994 to 2023 is the United States with 1331 articles published. The most productive source for publishing articles is Archives of Physical Medicine and Rehabilitation with a total publishing of 161 articles. The top 1 institution is from China, with 63 articles published. From this article, it can be seen that the authors who conducted research on web modules are very diverse. There are no authors working together to write one article. The most frequently used keyword is "E-Learning" with a total of 211 appearances and total link strength 69.

Keywords: Bibliometric analysis, education, learning module, online learning, web module

Emia Erliasna
erliasnaemia@gmail.com

Received
November 9, 2023
Accepted
February 3, 2024
Published
February 29, 2024

Citation: Erliasna, E. (2024). Bibliometrics analysis: Trend for three decades in research article of web module or learning module. *Journal of Computers for Science and Mathematics Learning, 1*(1), 44–57.

1. INTRODUCTION

Higher education throughout the world is starting to realize the importance of utilizing technological innovation in learning activities. Technology is helpful in making innovative modules so that teachers can easily work with. Interestingly, the use of web-based modules is gaining high popularity and is increasingly being implemented in universities. Based on literature it is also said that web modules are useful for improving student achievement in knowledge, skill, and creativity. Nowadays, web modules play a main point to support student learning activity. Since coronavirus has become a disaster and affects many sectors, one of them is education, which makes it difficult for communication between teachers and students (Stanciu et al., 2020).

Online learning is considered to give students greater access to the world of formal learning so that they are more flexible in starting learning activities at any time. The internet and social media are communication sources that are often used in the educational process. This approach makes learning activities more interesting

and efficient and improves the higher education system (Abdullahu & Mustafa, 2021).

Web-based learning is used as a means for education to carry out face-to-face learning. The use of web-based learning increases in direct proportion to the increase in the number of students. This encourages educators to work hard to help students obtain interactive learning content so that it has a significant influence on the learning process. Even so, research in the field of education has not paid sufficient attention to the study of student motivation when using web-based learning. Many efforts can be made to advance technology to the needs of each student's learning style. The 21st century has brought rapid advances in things like the Internet and online learning (El-seoud et al., 2009).

Based on a bibliometric analysis article from Dewantoro et al. (2021), it can be concluded that articles with the keyword e-module in the 2020-2021 period are stated to be able to train various aspects of student skills, such as critical thinking skills.

Learning professional knowledge, skills and attitudes in an online environment is a complex matter in education. This is worthy of further study to increase student potential. Research examining whether online learning is superior to or equivalent to face-to-face interprofessional learning is being developed. From Solomon et al., (2010) research, the use of online modules has positive feedback. The results were consistent in the development of student learning and collaborative group work, even though students came from different institutions and modules addressed different content areas.

1.1 Aim of the Study

Over the past 3 decades, several institutions have been developed to explore the utility of web modules. The research questions (RQs) are appointed in this article as follows:

RQ1: How many article publications about web modules were published from 1994 to 2023?
RQ2. Which are the most cited reference articles about web modules?
RQ3: Who are the most active authors of articles about web modules?
RQ4: Which are the most productive sources publishing articles about web modules?
RQ5: Which are the most productive institutions publishing articles about web modules?
RQ6: Which are the most productive countries publishing articles about web modules?
RQ7: What is the connection between the authors of articles about web modules?
RQ8: What are the most used keywords authors often use in articles about web modules?
RQ9. What is the connection between countries that publish articles about web modules?

2. METHODS

2.1 Study Design

This bibliometric review aims to find out how the publication of articles about web modules has developed. In this article, journals are filtered based on the keywords "web module" or "learning module" through Scopus data. As a result, scientific literature from the Scopus database from 1994 to 2023 was extracted. Procedure for conducting bibliometric mapping analysis based on the PRISMA

protocol. This protocol is implemented to facilitate analysis procedures and report the result of findings in a transparent and credible manner (Moher et al., 2009).

2.2 Procedure

Research and publication trends in an academic field are explored quantitatively using bibliometric analysis methods. Bibliometric analysis provides systematic information that outlines quantitative publications and helps researchers to determine research trends and patterns in a particular field. The articles filtered in this study were taken from the Scopus database on October 17, 2023. Using the advanced search function, the search string included a combination of compound keywords combined with OR operators. The command is as follows: "web module" OR "Learning Module". Criteria for selected articles that contain one of the keywords in the title, abstract or keywords. The variables of this article are publication institution, year of publication, keywords used, documents cited, authors cited, active journals, productive journals, and productive countries. Then the data has extracted the frequency of each variable. To map trends in this area, the index is described quantitatively (Blanco-mesa et al., 2016).

2.3 Data Analysis

To answer all the research questions, the articles extracted from the Scopus database used excel and Vosviewer. The data analyzed with descriptive statistics used vosviewer application and quantitative information. The data processed by excel are informed about the most cited references, the most cited per year, the most active authors, the most active source, the most active institution, the collaboration network of authors, the most productive sources, the most productive countries, the most productive institutions, and the most relevant keywords. The data processed by Vosviewer are informed about the relationship between collaboration network of authors, author keywords co-occurrence, the most productive countries, the visualization network of the country co-authorship, the visualization network of the organization co-authorship, and co-Keyword network visualization (Sharifi et al., 2020).

The results of the articles obtained from Scopus will be classified and the data obtained will be processed using the VOSviewer program. Vosviewer is one of the software developed for scientific mapping analysis, presented in a certain order with visual mapping methods (İyibildiren et al., 2023).

3. RESULTS

3.1 Articles Published from 1994 to 2023

Figure 2 informs about the growth of published articles about web modules in higher education published from 1996 to 2023.

The blue bar graph shows that article publications about web modules have increased over the past 3 decades. The growth of article publications about web modules began in 2014, and increased rapidly in the following years. Before 2014, the number of articles published was less than one hundred. The highest number of publications occurred in 2022, with a total of 546 articles published. Moreover, Figure 2 also shows information about the number of articles cited from year to year.

The orange bar graph shows that the number of article citations about web modules is very unstable. Over the span of four years, the number of citations fluctuated. For example, during 1994 to 1997, the number of articles cited increased from 358 citation to 427 citation in 1994 to 1995. Later, the number of citations in 1996 decreased to 292 citations, then fell again in 1997 to 75 citations. Another

example in 2010 to 2013, the number of articles cited also went up and down. The number of citations increased from 1746 citations to 1976 citations in 2010 to 2011. Later, the number of citations in 2012 to 2013 fell from 1621 citations to 1328 citations.

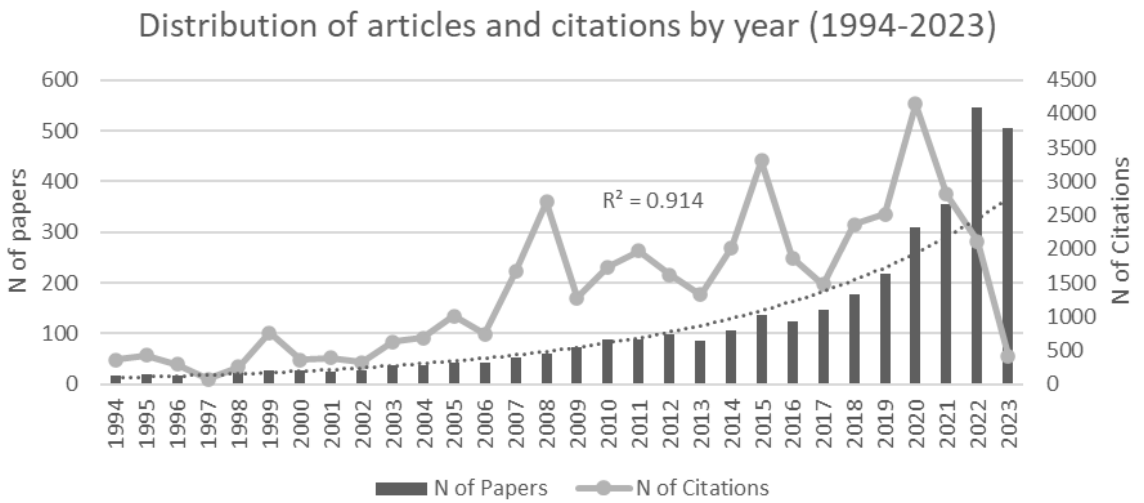

Figure 2. The Publication of Web Module Articles

We can observe this situation from the movement of the orange graph. However, the number of articles cited has decreased in 2023. This number decreased fivefold from the previous year, with 2118 citations. It seems this happened because the article was just published. The determination value (R2) on the graph is 0.9. This value indicates that the exponential trend line is reliable, because it is close to one

3.2 Top 10 Most Cited References

From a total of 3680 articles, we filtered the top ten most cited articles. Filtered articles vary in year of publication. The data is shown in Table 1.

Table 1. The Most Cited References and Cited Per Year

Authors	Title	Source	Cites
Happel et al. (1994)	Design and evolution of modular neural network architectures	Neural Networks	209
Ho et al. (2007)	An effective architecture for learning and evolving flexible job-shop schedules	European Journal of Operational Research	208
Woltering et al. (2009)	Blended learning positively affects students' satisfaction and the role of the tutor in the problem-based learning process: Results of a mixed-method evaluation	Advances in Health Sciences Education	170
McLean et al. (2016)	Flipped classrooms and student learning: Not just surface gains	Advances in Physiology Education	145
Nokelainen (2006)	An empirical assessment of pedagogical usability criteria for digital learning material with elementary school students	Educational Technology and Society	139

Authors	Title	Source	Cites
Shiue et al. (2018)	Real-time scheduling for a smart factory using a reinforcement learning approach	Computers and Industrial Engineering	133
Donnelly (2010)	Harmonizing technology with interaction in blended problem-based learning	Computers and Education	129
Kellman et al. (2010)	Perceptual learning modules in mathematics: Enhancing students' pattern recognition, structure extraction, and fluency	Topics in Cognitive Science	126
Shaffer & Small	Blended learning in medical education: Use of an integrated approach with web-based small group modules and didactic instruction for teaching radiologic anatomy	Academic Radiology	108
Gilbert et al. (2007)	E-Learning: The student experience	British Journal of Educational Technology	108

Table 1 informs about most cited articles based on the number of citations (C) and also informs about average citation per year (C/A). For almost 3 decades, only the 10 most cited articles were selected. Table 1 shows the most cited articles are from 1994, 2004, 2006, 2007, 2009, 2010, 2016 and 2018. The top 1 most cited article is written by Happel, 1994 with 209 citations by title "Design and evolution of modular neural network architectures". Over the past 29 years, this article has been cited 7 times per year. From this table, we can see whose articles are the most popular. The article written by Shiue, et all has 133 citations, even though this article was published in 2018. This article title is "Real-time scheduling for a smart factory using a reinforcement learning approach". This article has been cited approximately 26 times per year.

3.3 Top 10 Authors Who Publish The Most Articles

Table 2 informs of the 10 most productive authors in publishing articles. The number of N is the total article the author published about a web module which was found on data scopus. The number of n total is the total of all articles the author published which was found on scholar.

Table 2. The Most Cited Authors

Author	Institution	Country	N	H-Index
Cifu, David X.	Virginia Commonwealth University School of Medicine	US	14	50
Suppan, Laurent.	Geneva University Hospitals	Switzerland	10	12
Suppan, Mélanie.	Geneva University Hospitals	Switzerland	10	9
Noll, Stephen F.	Mayo Clinic, Rochester	US	10	4
Kellman, Philip J.	University of California	US	9	32
Nahm, Eunshim.	University of Maryland School of Nursing	US	9	22
Nelson, Virginia Simson.	University of Michigan	US	9	20
Fisher, Steven V.	University of Minnesota Medical School	US	9	14
Suparman, S.	University of Ahmad Dahlan	Indonesia	9	9
Kim, Chongtae.	University of Pennsylvania	US	9	7

This data informs the top 10 most productive authors based on the number of total articles they published and value of H-indeks. The results show that ten authors produced more than five documents. We can see that from 10 productive authors, 7 of them are from the United State, but different institutions.

The most productive author is David Cifu from Virginia Commonwealth University School of Medicine. So far, he has published 247 articles, and 4 of them are about web modules. His H-index value is fifty. The second and third most productive, there are two authors with almost similar names. They are Melanie Suppan and Laurent Suppan, and they both come from the same institution. They are from Geneva University, Switzerland. They both have also published 10 articles about web modules, but their h-indexes are different, Laurent with 12 h-index values, while Melanie with 9 h-index values.

3.4 Top 10 Most Prolific Countries

After data on the most active author, we also collected data on countries that are active in publishing journals about web modules in Table 3. Some countries come from Europe, and others from Asia.

Table 3. Top 10 Most Prolific Countries

Country	N of papers	%
United States	1331	36.17
China	690	18.75
United Kingdom	229	6.22
Canada	229	6.22
Australia	207	5.63
Germany	139	3.78
India	119	3.23
Malaysia	110	2.99
Netherlands	81	2.2
Indonesia	75	2.04

This data informs about the most productive country which published a paper around 1994 to 2023. If the most active journal publishing institution comes from China, instead the country that is active in publishing journals about web modules is the United State. The top 1 country is the United States with 1331 articles published about web modules over the last 3 decades. From a total of 3680 articles were processed, 36.17% articles are from the United States. The second is from China with 690 articles published. 18.75% of articles processed are from China. The rest are from the United Kingdom, Canada, Australia, Germany, India, Malaysia, Netherland, and Indonesia. We also represent this data into images.

3.5 Top 10 Most Active Sources

Table 4 informs of the top 10 journal sources and their publishers that are most active in publishing journals about web modules. This data is taken from Scimago Journals Rank. This data informs about the most productive source for publishing articles. Almost all sources for this journal are in the Q1 category. Some journal sources have an SJR value above 1 and others are close to 1, no wonder this source is in the top 10. Top 1 the most active source is Archives Of Physical Medicine And Rehabilitation with total publishing 161 articles about web modules. This journal source has H-index value 206 and SJR value 1.06. This source is also in the Q1 category. If we look at other data, the highest value of H-index is IEEE Transactions on Image Processing journal source. This source has published 26 journals until this

year, but already has H-index value 311. Also this source is already categorized Q1 source, and has the highest value of SJR, 2.36.

Table 4. Top 10 Most Active Sources

Source	N	H-Index	Q	SJR 2022	Publisher
Archives of Physical Medicine and Rehabilitation	161	206	Q1	1.06	W.B. Saunders
IEEE Access	53	204	Q1	0.93	IEEE
BMC Medical Education	40	87	Q1	0.91	BioMed Central
Mededportal The Journal Of Teaching And Learning Resources	33	14	Q3	0.50	Association of American Medical Colleges
Neurocomputing	30	177	Q1	1.48	Elsevier
IEEE Transactions On Circuits And Systems For Video Technology	28	180	Q1	1.49	IEEE
International Journal Of Engineering Education	26	56	Q3	0.26	Tempus Publications
IEEE Transactions On Image Processing	26	311	Q1	2.36	IEEE
Medical Science Educator	25	20	Q2	0.39	Springer
Medical Teacher	24	131	Q1	1.22	Informa Healthcare

3.6 Top 10 Most Prolific Institutions

Table 5 informs the institutions that are most active in publishing journals about web modules.

Table 5. Top 10 Most Prolific Institutions

Institution	Country	Type	N
Chinese Academy of Sciences	China	Public	63
Mayo Clinic College of Medicine & Science	US	Private	61
Ministry of Education of the People's Republic of China	China	Public	45
University of Toronto	Canada	Public	42
University of Chinese Academy of Sciences	China	Public	36
The University of Sydney	Australia	Public	33
University of Washington	US	Public	29
Zhejiang University	China	Public	28
University of Pennsylvania	US	Private	27
Wuhan University	China	Public	26

From a total of 3680 articles were processed, the top 1 institution is from China, with 63 articles published. The institution is named Chinese Academy of Sciences. The Chinese Academy of Sciences is a research institute and the national academy of natural sciences of the People's Republic of China. The Chinese Academy of Sciences is a public university and the world's largest research organization. From the page "The Top 10 Research Institutions for 2018," (2019), this institution was recorded as having the largest growth in publications among the 10 leading institutions and held the position as the main contributor of articles in 2018. With a fractional article value of 1,698.14, this institution was declared as the highest ranking institution in the world based on quality research results. The institute employs around 60,000 researchers, which is almost twice the number of researchers at the French National Center for Scientific Research, which employed 33,000 researchers last year. The institute spent 32.23 billion yuan on science and

technology in 2018. In the Nature Index 2019 Annual Tables, Chinese Academy of Sciences topped articles in the physical sciences, chemistry, earth and environmental sciences, and government agencies categories.

The second most active is Mayo Clinic College of Medicine & Science from the United States. This source is from a private university and has published 61 articles. The last source is from China too. This source is from Wuhan University which published 26 articles.

3.7 Collaboration Network of Authors

From Figure 3, we can see that not a single author has a collaboration network. The number of minimum documents of an author was set 2, and the number of minimum citations of an author was set 25. The result is shown in Figure 3.

Figure 3. The Collaboration Network of Authors

This data informs about the relationship collaboration network between authors. This data is processed by Vosviewer, an application by visualizing the data. Of the 3634 existing authors, the threshold was 10 authors. From this data it can be seen that the authors who conducted research on web modules are very diverse. There are no authors working together to write one article. However, from this data we can also get information on authors who publish in more than one article about web modules.

There are 10 authors that were filtered. The red circle authors are kumar, et all, they published three articles with number citation is 57. The rest of the authors have published two articles. The green circle author is Donnelly, has the highest number of citations, 180 citations. The peach circle authors are Romanov, et all, has the number of citations, 76 citations. The yellow circle author are hsu, et all, has the number of citations, 66 citations. The lilac circle author is Sadaghiani, has the

number of citations, 65 citations. The blue circle author are Gaikwad, et all, has the number of citations, 48 citations. The pink circle author are Saini, et all, has the number of citations, 41 citations. The purple circle author is Hamalainen, has the number of citations, 38 citations. The tosca circle author are Pereira, et all, has the number of citations, 27 citations. The orange circle author is Robson, has the number of citations, 26 citations.

3.7 The Visualization of Co-Occurrence of Author Keywords

This Figure 4 informs about the keywords frequently used by the author of all this article. The number minimum co occurrence of an author keyword set 6. Of the 8931 keywords, the threshold was 264 keywords. Then, we filtered again the keywords that best suit “web module”. The results obtained were 22 keywords, and there were 7 clusters.

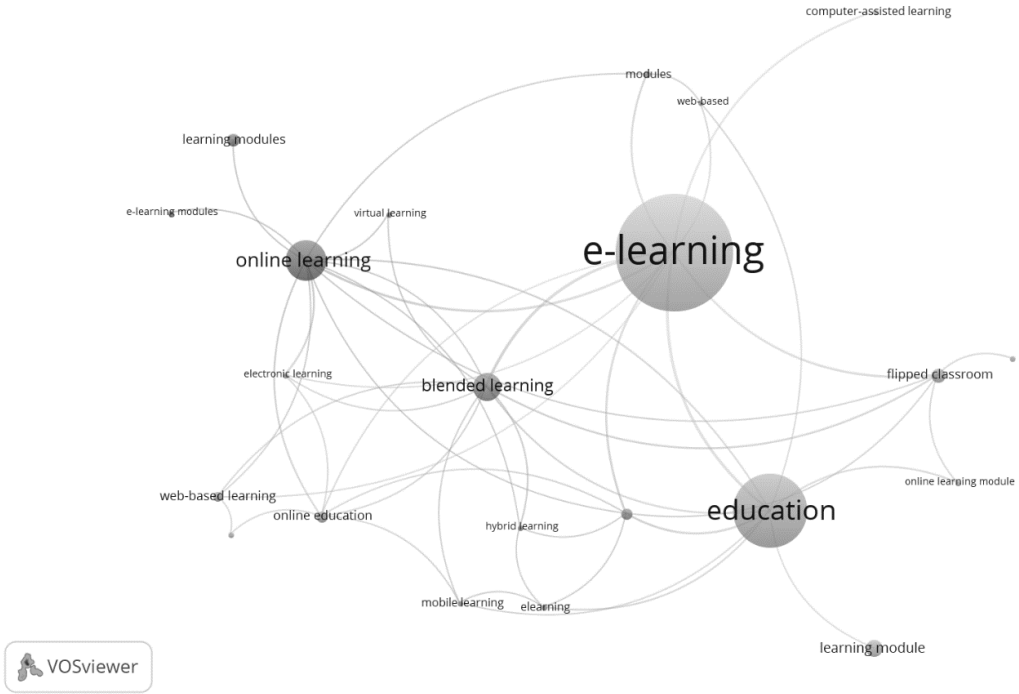

Figure 4. The Visualization of Co-occurrence of Author Keywords

The most frequently used keyword is “E-Learning” with a total of 211 appearances and total link strength 69. The different colors reveal the publication’s different cluster of keywords. The first cluster is red and has 5 keywords: blended learning with occurrence 52, computer assisted instruction with occurrence 22, elearning with occurrence 11, hybrid learning with occurrence 6, and mobile learning with occurrence 8. The second cluster is green and has 4 keywords: e learning modules with occurrence 7, learning modules with occurrence 23, online learning with occurrence 74, virtual learning with occurrence 7. The third cluster is blue and also has 4 keywords: electronic learning with occurrence 6, online education with occurrence 20, web-based education with occurrence 6, web-based learning with occurrence 18. The fourth cluster is yellow and has 3 keywords: e learning module with occurrence 8, flipped classroom with occurrence 25, online learning module with occurrence 7. The fifth cluster is purple and has 2 keywords: computer-assisted learning with occurrence 11, e-learning with occurrence 211. The sixth cluster is

tosca and also has 2 keywords: education with occurrence 133, learning module with occurrence 30. The seventh cluster is orange and has 2 keywords: modules with occurrence 13, web-based with occurrence 6.

3.7 The Visualisation of The Bibliographic Coupling of Most Productive Countries

This Figure 5 informs about the collaboration of all countries. The minimum number of documents of a country is 22. The minimum number of citations of a country is 20. The results obtained were 22 countries, and there were 4 clusters.

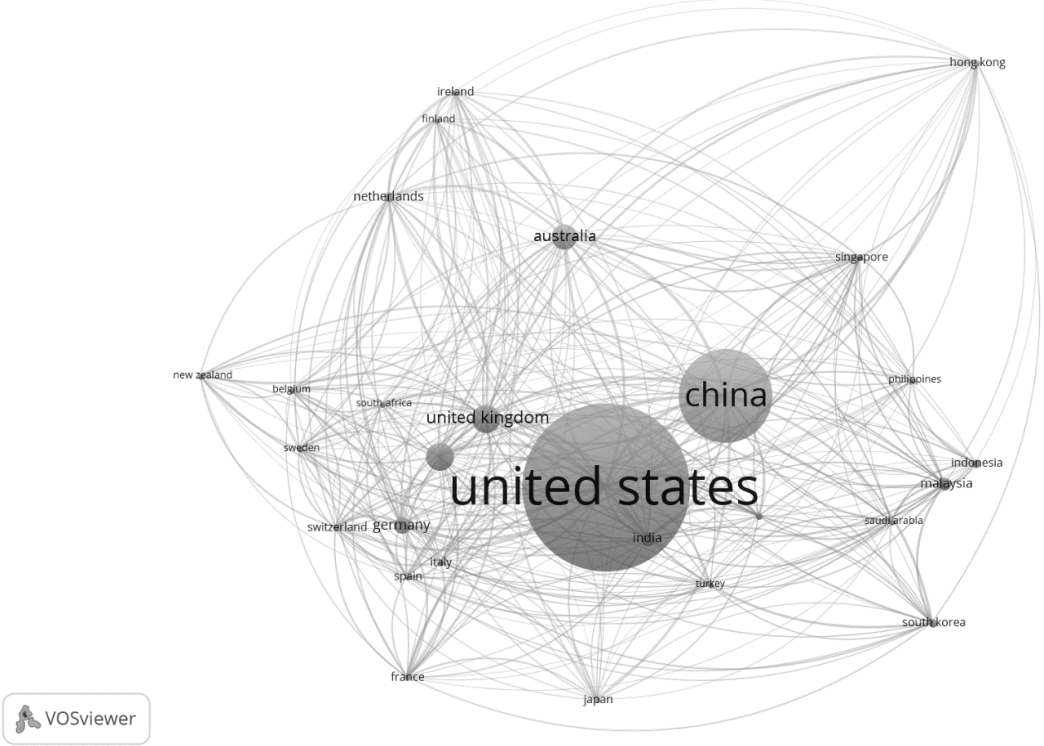

Figure 5. The Bibliographic Coupling of Most Productive Countries

As the data from Table 5, the most published article is the United States, and then China. The different colors reveal the publication's different clusters of countries. The first cluster is red and has 12 countries: Belgium, Canada, France, Germany, Italy, New Zealand, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States. The second cluster is green and has 9 countries: India, Indonesia, Malaysia, Philippines, Saudi Arabia, Singapore, South Korea, Taiwan, Turkey. The third cluster is blue and also has 4 countries: Australia, Finland, Ireland, Netherlands. The fourth cluster is yellow and has 3 countries: China, Hong kong, Japan.

4. DISCUSSION

By establishing trends, patterns and relevant publications, bibliometrics can improve the quality of literature reviews. The bibliometric approach provides content for researchers to see the extent of published literature, identify the scope of research based on keywords, authors, institutions and countries. Using this method can help facilitate the quality of literature reviews, increase understanding of one issue or area and identify research gaps that need further study. This bibliometric review used the Scopus database to overview and visualize the publications article about web

modules over the last three decades, 1994 to 2023. Based on the filtered article, we have a total of 3680 articles. These selected articles have been filtered according to what we need. English language articles (articles from all over the world), journals (no proceedings), and others.

The growth of published articles about web modules over the last three decades has increased in the following years. The number of articles published in 2022 has the highest number, 546 articles. That year is the year when the coronavirus disaster hit the world. Because of the urgent need regarding the use of technology to support online learning or independent learning, this is one of the factors why the number of articles about web modules has increased drastically. The development of teaching and learning online comes with various significant phases over the past one decade. Activity-based learning and the use of tools and web applications have significantly increased over the past one and a half to two decades. Numerous applications and tools are utilized to boost student participation, interest, motivation, and concentration levels. Moreover, revision and repetition of topics are also being done innovatively. This research study is based on the evaluation of a teaching and learning tool Socrative.

This finding is in accordance with El-seoud et al., (2009) research. The increasing number of uses of e-learning in educational institutions has brought system changes to higher education activities. Based on the findings, there was an increase of around 12-14 percent annually in online learning enrollment over the five year period: 2004-2009 after secondary education. The determination value (R2) yields 0.9 revealing that the exponential trend line is reliable. R squared is a number that ranges from 0 to 1 which indicates the magnitude of the influence of the independent variable on the dependent variable. The independent variable is year publication, and dependent variables are the number of articles and the number of citations. Hair et al stated that the R square value more than 0.75 included in the strong category. For the last 30 years, article publications about web modules have increased over time. The most cited article is from Happel, et all, with 108 citations. Although this article is almost three decades old, it's still popular. However, the average citations by each article are less in recent years because these articles are new in the scopus, which means the article has not been widely cited.

H-index is a metric used to measure the impact of an article and the productivity of a researcher. H-Index value can be found in scopus web. The top one most active author is Cifu from Virginia Commonwealth University School of Medicine. He has published 14 articles, and his H-index value is fifty. The most frequently cited articles are articles by Shiue authors with 26.6 cited per year. Although the most cited article is by Happel author with 209 citations, this article was published in 1994. If we calculate, it's only 7,2 cited per year. Beside that, author's Mélanie are published the most articles about modules of all the articles she has ever published. Melanie published 10 of 23 articles about module.

While discussing authors, we also inform about authors who are most productive over the years. We refer to H-Index data and the number of articles published. H-index is a metric used to measure the impact of an article and the productivity of a researcher. The h-index is a useful metric for assessing scientific impact which takes into the number of papers an author has published and the number of times those papers have been cited by other researchers. H-Index value can be found in scopus web (Hirsch, 2005).

The most active of all the authors is David Cifu from the United States with 14 articles published. This author's H-index value is 50 which means that, of the total 247 articles he published, 50 of them have been cited 50 times. If we calculated the

data of N article, N total article and h-indexes value, the second most productive author was Kellman from the University of california. He has published 106 articles, and 9 of them are about web modules. His H-index value is thirty two, which means that of the total 106 articles he published, 32 of them have been cited 32 times.

From Table 2, we can also see that of the top 10 productive authors, most of them come from the United States. We prove it with additional information in Table 3, the top 10 most prolific countries. The most active country published articles about web modules is the United States with 1331 articles. Of the total 3680 articles, 36.17 % are from the United States. While the second most active country is China, 1875% of all articles published. From the analysis results, United States and China become the top 2 countries that publish journals.

Beside from the h index, to see the quality of the journal we also took information from the SJR value and Q category. Q1 is a journal that has a high quality category. SJR is a numerical value that indicates the weighted average number of citations received during a particular year per document published by that journal during the previous three years. Journals with an SJR value > 1.0 have above average citation potential. The value of sjr dan Q can be found in Scimago journal ranking. Scimago provides reference that this source belongs to category Q1. Archives Of Physical Medicine and Rehabilitation source has a SJR value 1.06 which means this source is above average citation potential. If we look more closely, actually the best source is IEEE Transactions On Image Processing. This source has only been published in 26 journals until this year, but this source already categorized Q1 source, and the value of SJR 2.36.

Different from Table 2, we can see on Table 3 that the most active institution is from china. Chinese Academy of Science. A university that is focused on research on education and science. If we look at all the countries on Table 3, the results were dominated by the United States and China. These results can also be seen in Figure 5, the most productive countries with the large circle are the United States and china. Beside that, we also inform, the first cluster comes from various countries. The article was published from Europe, North America, Oceania, and africa. The second cluster is only from asia. The third cluster are from Europe and oceania. The fourth cluster is from east asia.

The last data we analyze is about keywords that the author used. Based on Figure 4, the top three most used keywords are e learning, education and online learning. This keyword is the most popular among authors, while the web module keyword is the smallest. Moreover, other keywords are blended learning, computer assisted instruction, hybrid learning, mobile learning, e learning modules, learning modules, virtual learning, web-based learning, e learning module, flipped classroom, online learning module, computer-assisted learning, learning module, modules.

5. CONCLUSION AND IMPLICATIONS

The number of article publications about web modules published from 1994 to 2023 was increasing from year to year. The most cited reference articles about web modules is by Happel and the most popular is by Shiue. The most active author of published articles about web modules is David Cifu with 14 articles. The most productive source publishing articles is Archives of Physical Medicine and Rehabilitation source with 206 articles published. The most productive institution publishing articles about web modules is the Chinese Academy of Sciences from China with 63 documents, while the most productive country publishing articles about web modules is the United States. No one of these authors has connections between the other authors. The most relevant keywords do writers often use in

articles about web modules are e learning, education and online learning. The connections between countries that publish articles about web modules comes from various countries. The most connected countries are from Asia and Europe.

This article is useful for writers who are writing articles related to web modules. The trend for web modules is increasing, which means that this research is still much in demand and will continue to be developed. When writing keywords about web modules, use the most popular keywords, online learning so another researcher will easily find those articles. If we want to collaborate or look for information related to the web module, we can contact the author above, the most active author.

Conflict of Interest

The authors declare no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

Abdullahu, C. S., & Mustafa, B. (2021). Implementatıon Of Onlıne Learnıng In Hıgher Educatıon And Accountıng Modules. *Academy of Accounting and Financial Studies Journal*, *25*(4), 1–10.

Blanco-mesa, F., Gil-lafuente, A. M., Yager, R. R., Lafuente, G., & Merigo, J. (2016). Thirty Years of the International Journal of Intelligent Systems: A Bibliometric Review. *International Journal of Intelligent Systems*, 1–34. https://doi.org/10.1002/int

Dewantoro, Sofianto, Misbah, & Munawaroh. (2021). Physics e-module : A review and bibliometric analysis. *Journal of Physics: Conference Series*. https://doi.org/10.1088/1742-6596/2104/1/012008

El-seoud, M. S. A., Seddiek, N., El-khouly, M. M., & Nosseir, A. (2009). E-Learning and Students ' Motivation : A Research Study on the Effect of E-Learning on Higher Education. *International Association of Online Engineering*, 20–26. https://doi.org/10.3991/ijet.v9i4.3465

Hirsch, J. E. (2005). An index to quantify an individual ' s scientific research output. *PNAS*, *102*(46), 16569–16572. https://doi.org/10.1073_pnas.0507655102

İyibildiren, M., Eren, T., & Ceran, M. B. (2023). Bibliometric analysis of publications on web of science database related to accounting information system with mapping technique Bibliometric analysis of publications on web of science database related to accounting. *Cogent Business & Management*, 1–25. https://doi.org/10.1080/23311975.2022.2160584

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, T. P. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses : The PRISMA Statement. *PLoS Medicine*, *6*(7). https://doi.org/10.1371/journal.pmed.1000097

Sharifi, A., Dahlia, S., & Kaneko, S. (2020). Three decades of research on climate change and peace: a bibliometrics analysis. *Sustainability Science*, *16*, 1079–1095. https://doi.org/10.1007/s11625-020-00853-3

Solomon, P., Baptiste, S., Hall, P., Luke, R., Orchard, C., Rukholm, E., Carter, L., King, S., & Taraba, G. (2010). Students ' perceptions of interprofessional learning through facilitated online learning modules Students ' perceptions of interprofessional learning through facilitated online learning modules. *Medical Teacher*, *32*, 391–398. https://doi.org/10.3109/0142159X.2010.495760

Coman, C., Țîru, L. G., Stanciu, C., & Bularca, M. C. (2019). Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students' Perspective. *Sustainability, 12*(24), 10367. https://doi.org/10.3390/su122410367

The top 10 research institutions for 2018. (2019). In *Nature Index*. Springer Nature.