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Bibliometric Using Vosviewer with Publish or Perish (using Google Scholar data): From Step-by-step Processing for Users to the Practical Examples in the Analysis of Digital Learning Articles in Pre and Post Covid-19 Pandemic

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A B S T R A C T S

The purpose of this study is to analyze and demonstrate step-by-step bibliometric data analysis using VOSViewer completely and systematically. Step-by-step analysis was provided to make first-time users easily following the way how to use VOSviewers. This report allows and provides an easy way of data analysis by utilizing mapping tools and provide analysis of research developments regarding digital learning media. The method used in this research is to perform bibliometric analysis to produce network visualization of co-work maps and density maps of co-works. The analysis was carried out with the number of publications obtained, relating to the predetermined topics totaling 88 documents in 2017-2021. As practical examples, we evaluated the analysis of digital learning articles in pre and post covid. We found that VOSviewer can be used to give suggestions in the data analysis results.

A R T I C L E   I N F O

1. INTRODUCTION

Analysis of bibliometric data that is displayed visually through mapping tools is very much needed in this era of technological growth which is developing so rapidly as it is today (Nandiyanto et al., 2020a; Nandiyanto et al., 2020b). Mapping tools are used to get the results of the description and various information on the development of the field of science and the performance of research that has been carried out. One of the tools that can be used to perform bibliometric data analysis mapping and an example of mapping tools is VOSViewer (Gracia, 2020).

VOSViewer is a computer program developed to build and view bibliometric maps (Van Eck & Waltman, 2010). VOSViewer offers a text-mining function that can be used to build and visualize a correlation in a citation of an article or publication (Shen & Wang, 2020). The publication map can be displayed in several ways and functions, such as mapping the zoom system, scrolling, and searching. Thus, articles can be mapped in more detail. VOSviewer presents and represents specific information about bibliometric graphic maps (Baier-Fuentes et al., 2019).

VOSViewer is very popularly used lately in analyzing the position of the research to be carried out and measuring the novelty of a study (Triwahyuningtyas et al., 2021). We can display a large bibliometric map in an easy way to interpret a relationship via the VOSViewer. VOSViewer has several characteristics, including being able to map various types of bibliometric analysis, supporting several major bibliographic databases, ignoring the time dimension, being limited to analyzing small to medium amounts of data, intended for text-processing functions, using layout and cluster techniques, using overlay and density visualization features.

Many studies on VOSViewer include research discussing the manual VOSviewer (Van Eck and Waltman, 2013), research on the VOSViewer software survey as a bibliometric mapping computer program (Van Eck and Waltman, 2010), research regarding the grouping of citation-based publications with CitnetExplorer and VOSViewer (Van Eck and Waltman, 2017), trend analysis and convergence of science and technology using VOSViewer (Jeong & Koo, 2016), bibliometric analysis and visualization of scientific publications on atlantoaxial spine surgery based on Web of Science and VOSviewer (Xie et al., 2020), and research on bibliometric analysis of Covid-19 research using VOSviewer (Hamidah et al., 2020). However, no research discusses how to make a Bibliometric analysis using VOSViewer which is discussed in detail with several pictures of the steps with providing examples of analysis regarding the use of digital learning before and after Covid-19.

Therefore, this research was conducted to be able to display the steps of bibliometric data analysis regarding research on digital learning before and after Covid-19 using VOSViewer completely and systematically to see the development of research on this matter from 2017-2021 and provide a way easy data analysis with the use of mapping tools. Thus, it is hoped that this research can be used as a reference to be able to do big data analysis more easily with the use of VOSViewer. This report can be also used as a reference by first-time users since we provided step by step process when using VOSviewer.

2. METHOD
2.1. Analysis Tool Preparation

In conducting data analysis using VOSViewer, we must prepare several applications. First, we used namely the Mapping tool, which can be obtained from the open-source application VOSviewer (**Figure 1**). In this study, VOSviewer is used as a tool that can visualize the analyzed

data to be mapped. The second tool to set up is a references manager application. References manager applications that can be used include Publish or Perish as shown in **Figure 2** and Mendeley as shown in **Figure 3**. This reference manager application is used to collect research data which will later be analyzed bibliometrically using VOSviewer.
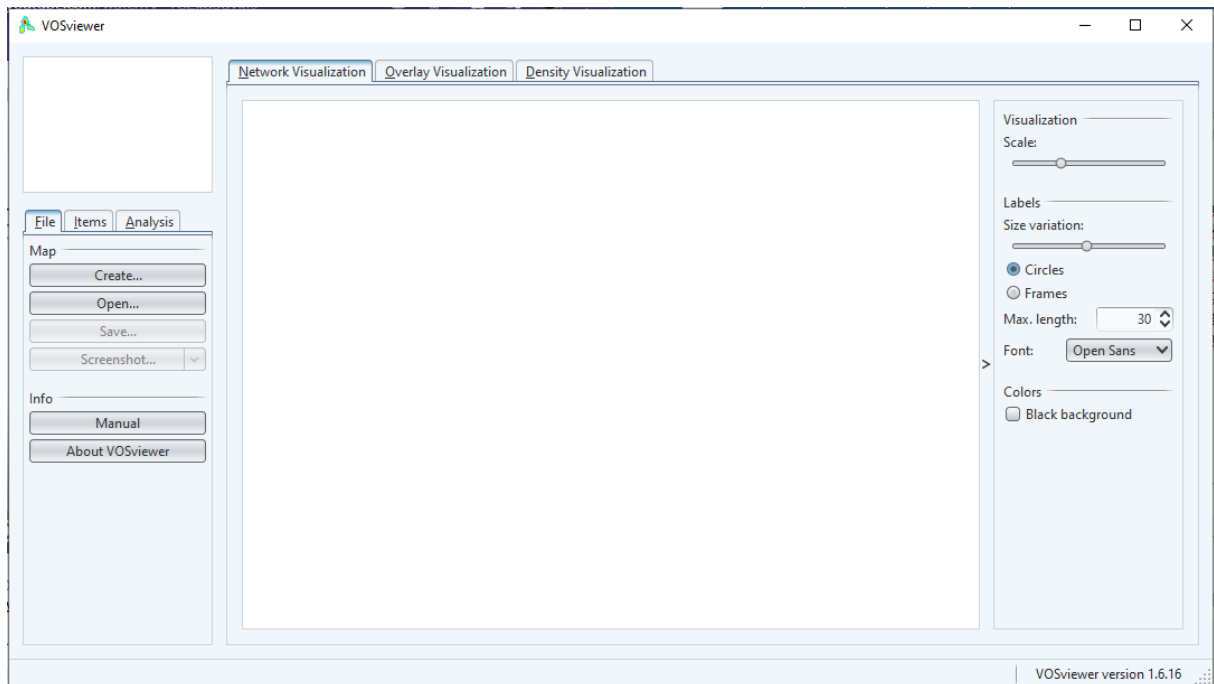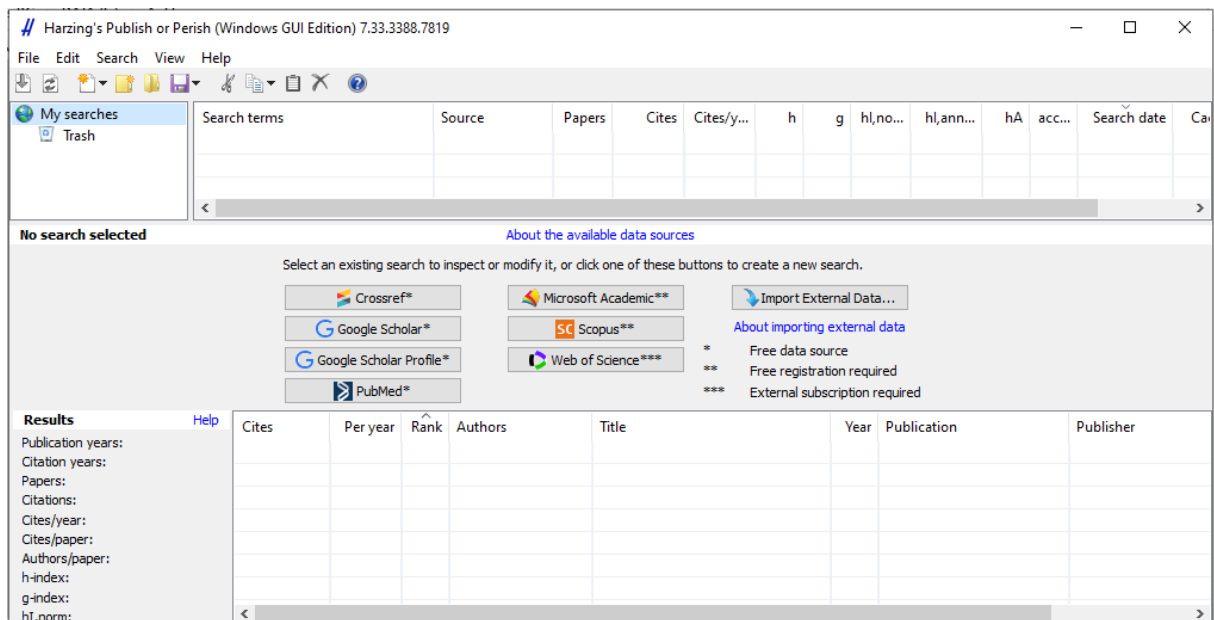

Figure 1. VOSviewer application.

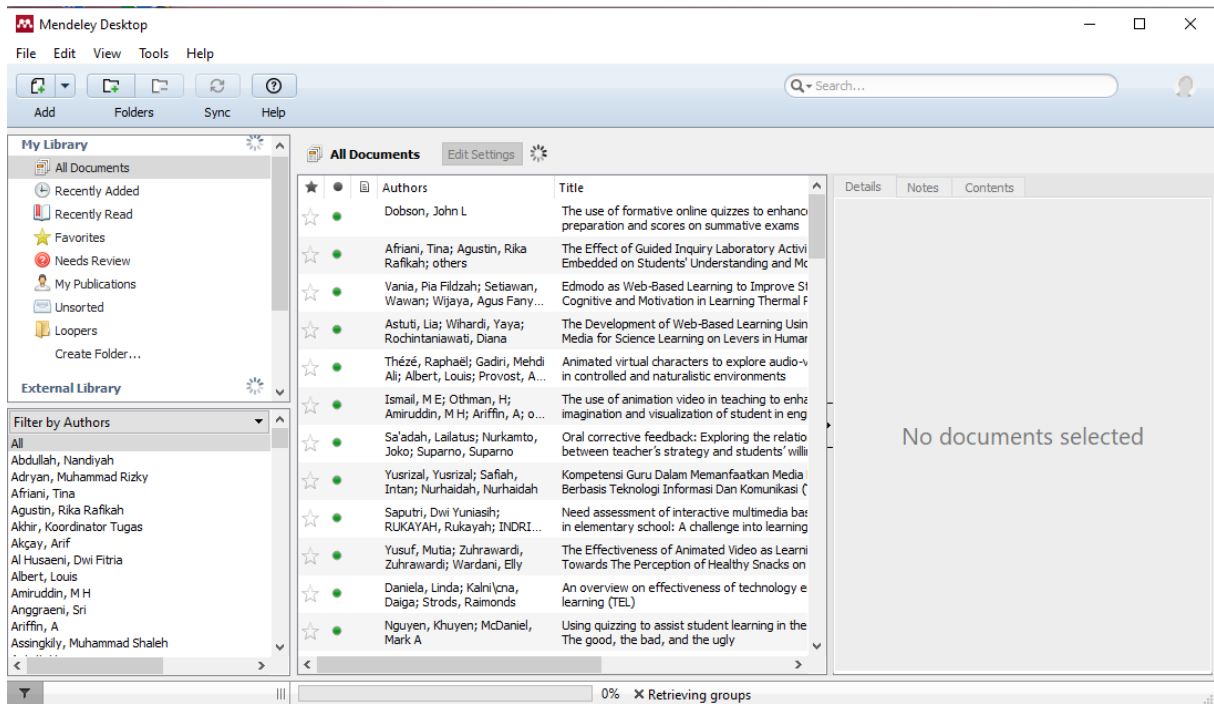**Figure 2.** Publish or Perish application.

Figure 3. Mendeley Application.

2.2. Data Retrieval

The data used in this study is journal publication data on digital learning media in Indonesia which was obtained by using the reference managers application. The reference manager application used in this research is Publish or Perish. Publish or Perish is used to conduct a literature review of the chosen theme. Thus, so that a database of similar research themes is obtained.

Publish or Perish is used to find out which author is cited the most, the oldest and most recent year of an article and we will get a bibliometric record of each research that will be used. Publish or Perish provides several choices of research data sources to be used such as from Crossref, Google Scholar, Google Scholar Profile, PubMed, Microsoft Academic, Scopus, and Web of Science as shown in **Figure 4**. In this study used data from the Google Scholar database.

2.3. Research Data Mapping

The data mapping in this study used a digital mapping application that is VOSviewer. The data that has been obtained is processed in such a way that it matches the desired keywords. After that the data is inputted into the VOSviewer application which will then convert the data into an interconnected data map.
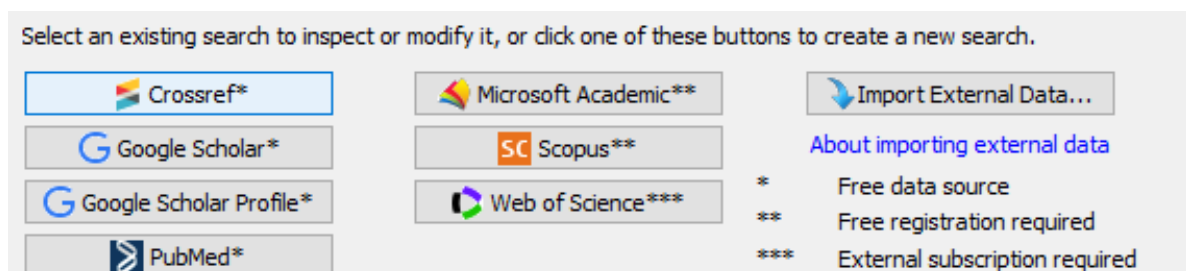

Figure 4. Choice of data sources on Publish or Perish.

3. RESULTS AND DISCUSSION

This section discusses how to analyze the results of data mapping using VOSviewer with data on the development of the number of journal publications with the main theme of digital learning media in the Google Scholar database from 2017-2021.

3.1. Data Used

As an example of this research, the data will be taken through Google Scholar. This means that every data article contained in Google Scholar and in accordance with the theme search needed in this study will be backed up into a file that will be used in using VOSviewer. The steps to get the data are as follows.

a. Open the Publish or Perish App

The first step to get data via publish or perish is to open the application as shown in the **Figure 5**. After publish or perish is open, we can see the initial application window as shown by the **Figure 6**.
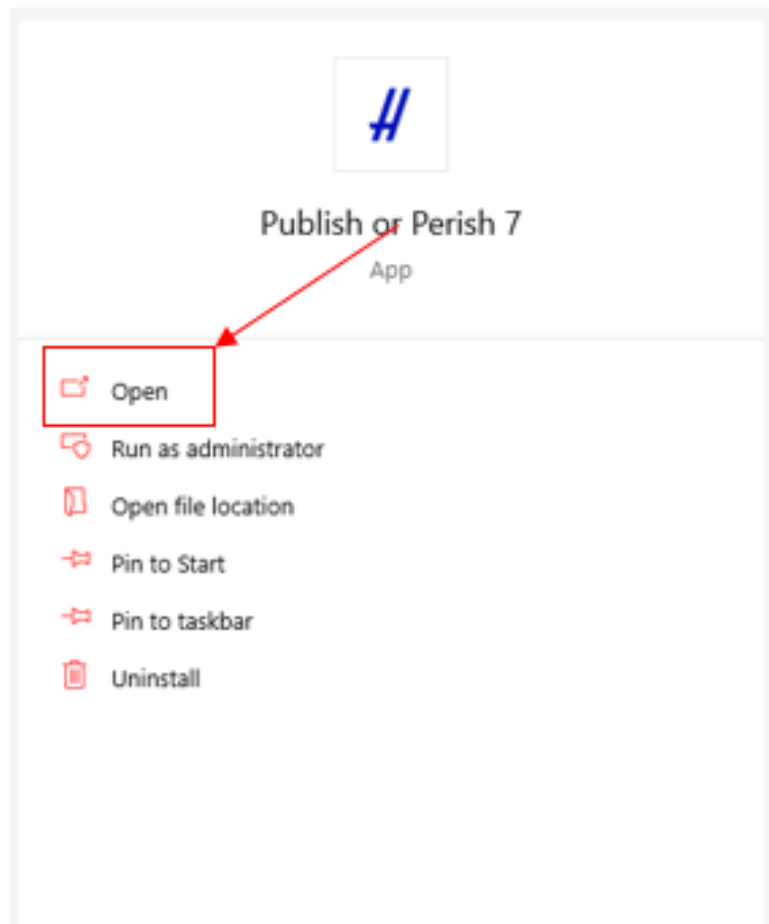

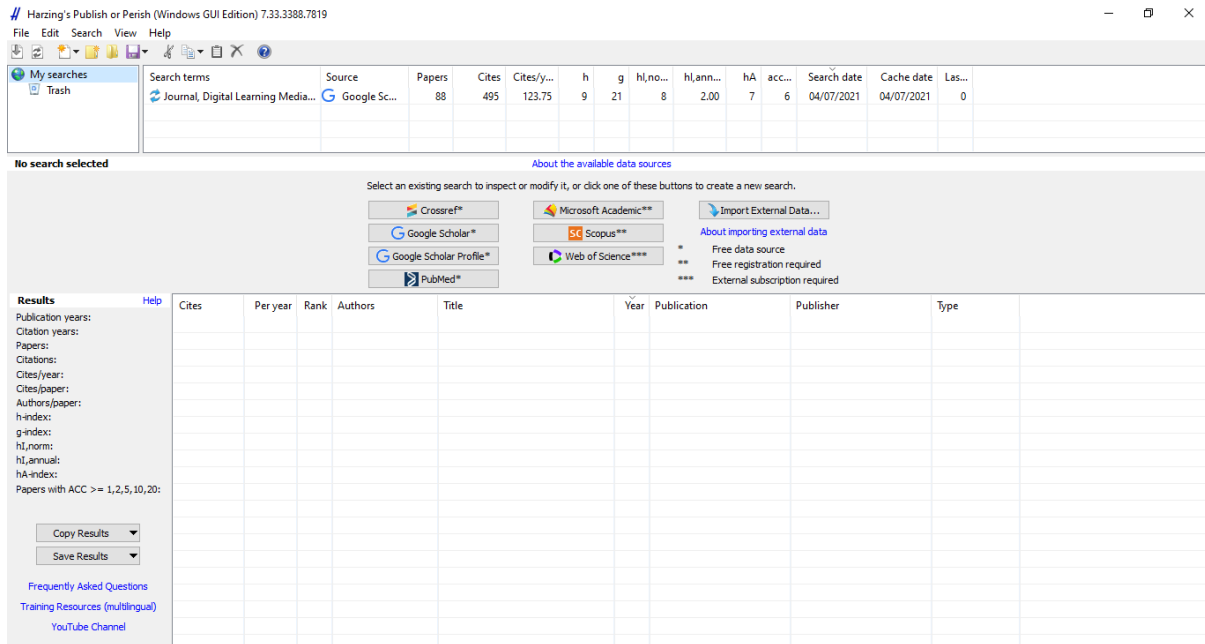**Figure 5.** Open the Publish or Perish app.

Figure 6. The initial window of publish or perish.

b. Click on the Google Scholar button

   Figure 7 shows the location of the Google Scholar button on Publish or Perish. The step that must be done at this stage is to press the button.

c. Fill in Google Scholar Search

   As shown in **Figure 8**, there are several sections in Google Scholar Search, including author, publication name, title word, and keywords. In this study, the theme sought is digital learning media with a range of years from 2017-2021 or research conducted 5 years ago. The publication name is filled with Journal. Next, we can set the maximum number of results. In this research, the maximum number of papers produced is 200 articles.

   If the required fields on the Google Scholar search form have been completed, click the search button in the upper right corner as shown in **Figure 8**. After the display on Publish or Perish as shown in **Figure 9**, we just have to wait for the search process to complete.

d. Search result

   Figure 10 shows the search results from Publish or Perish. If we look at the results section which is on the left side of the screen, **Figure 10** shows some data information from the data that has been obtained. In this study, it is known that the publication years from 2017-2021, Citation years for 4 years, namely (2017-2021).
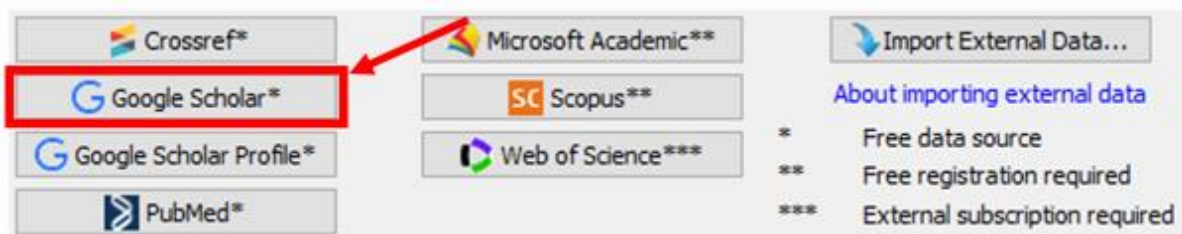

Figure 7. Location of the Google Scholar button.
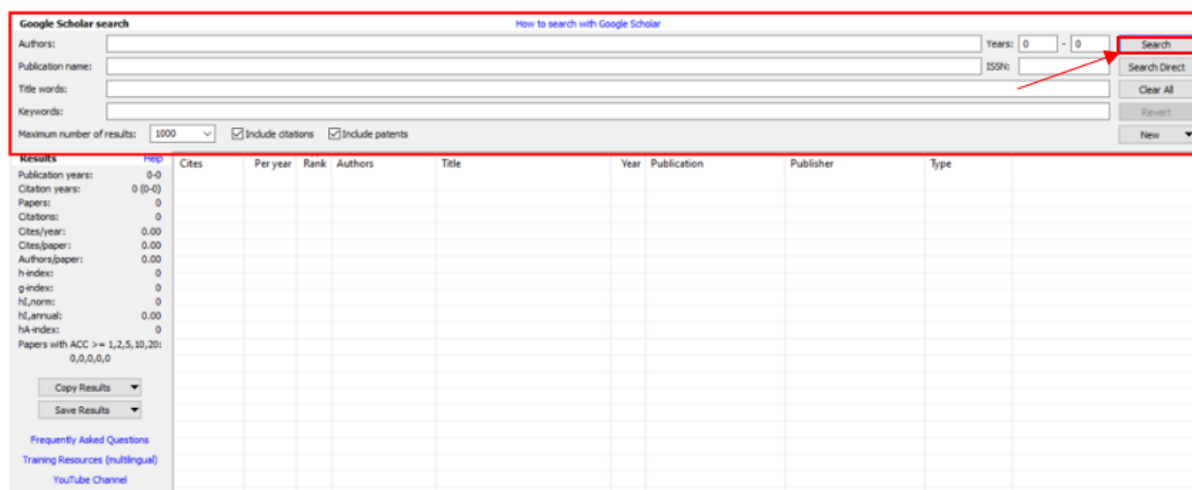
Figure 8. Google Scholar Search Section.
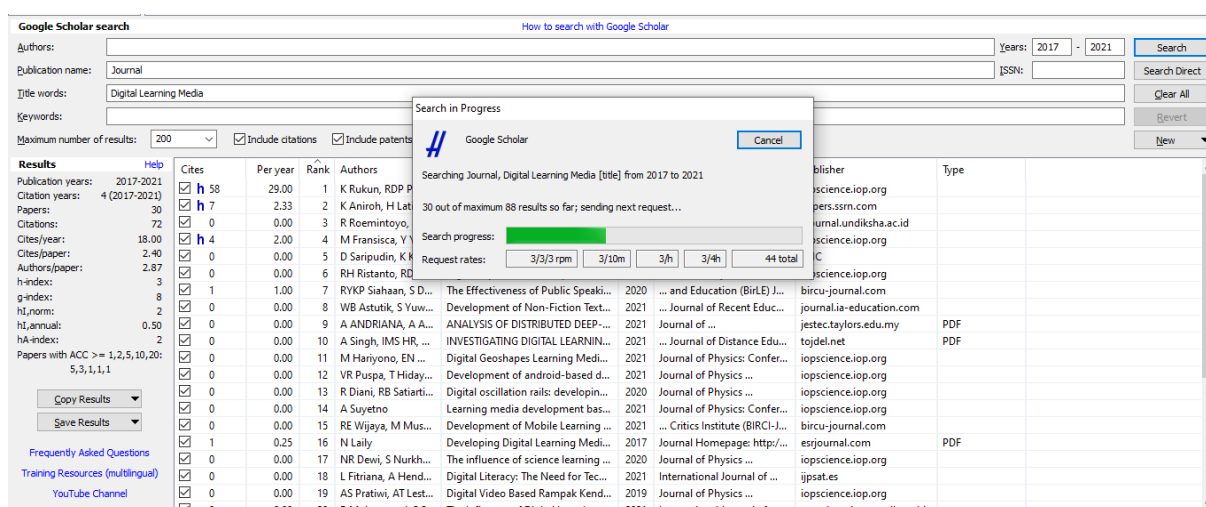
Figure 9. The process of searching for articles on Publish or Perish.

Figure 10. Search results by Publish or Perish

e. Save Data from Publish or Perish

The next step is for each result that is saved by clicking the Save Result button. After that save the result in the form of RIS (**Figure 11**). Because the file is in the form of RIS which can be read by VOSviewer.
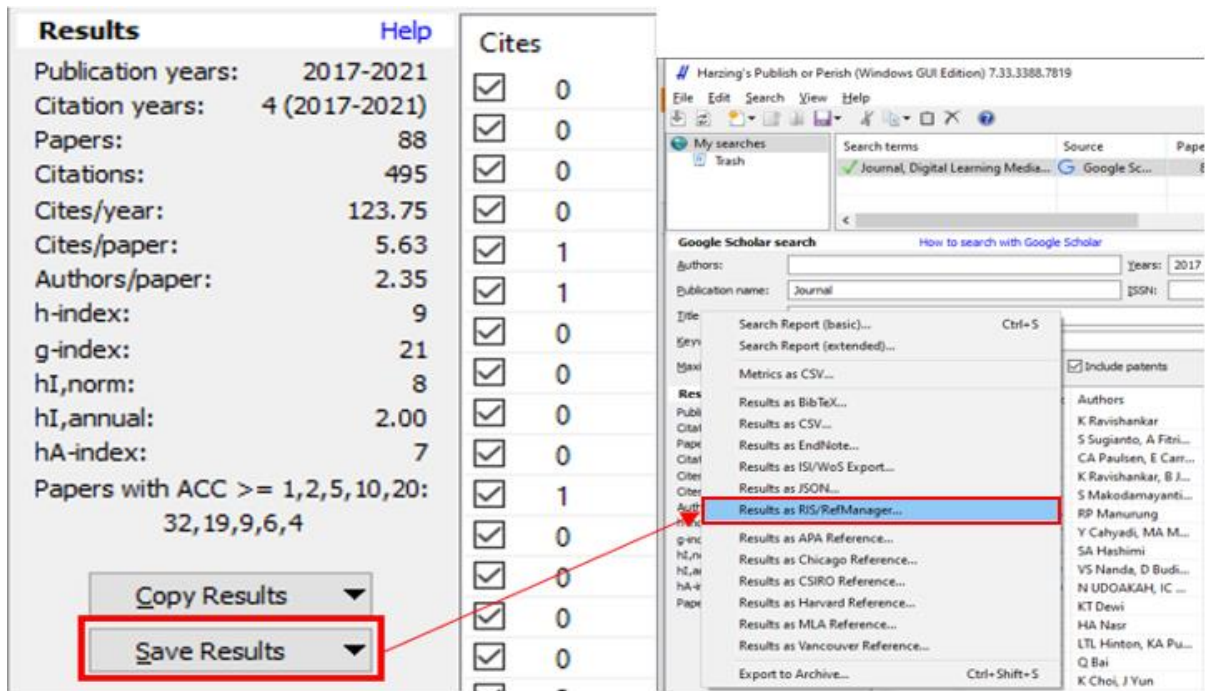
Figure 11. How to save search data Publish or Perish.

The articles found in Publish or Perish are mapped using VOSviewer. The data displayed in Publish or Perish is in the form of metadata, not full-text, namely the author's name, title, year, the journal that publishes it, and also the publisher of the article that has been found.

Table 1 shows a data of search from publish or perish that used in the VOSviewer analysis of this study. We got 88 articles, the number of citations is 495, the number of citations per year is 123.75, the number of citations per article is 5.63, the author of each article is 2.35, the h-index is 9, the g-index is 21, h1, the annual is 2.00, the h-index is 7.

Table 1. Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
1	EM Dalton	Beyond Universal Design for Learning: Guiding Principles to Reduce Barriers to Digital & Media Literacy Competence.	2017	1	35.00	0.38	35.00
2	A Widodo, Y Wiyatmo	Benda Tegar Pocket Book Learning Media Development Based On Digital Android To Increase Interest And Outcomes Learning Of Physics Students	2017	2	12.00	3.00	6.00
3	AM Leach	Digital media production to support literacy for secondary students with diverse learning abilities	2017	1	8.00	2.00	8.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
4	JV Pavlik	Experiential Media and Disabilities in Education: Enabling Learning through Immersive, Interactive, Customizable, and Multi-sensorial Digital Platforms.	2017	1	7.00	0.09	7.00
5	VE Meidasari	The Using of Digital Media to Enhance Teaching and Learning English on the Well-being of Indonesian Students	2017	1	7.00	0.09	7.00
6	M Matijević, T Topolovčan, V Rajić	Teacher assessment related to the use of digital media and constructivist learning in primary and secondary education	2017	3	7.00	0.09	2.00
7	D Herro, M Qian, L Jacques	Increasing digital media and learning in classrooms through school–university partnerships	2017	3	5.00	0.06	2.00
8	N Laily	Developing Digital Learning Media in Accounting	2017	1	1.00	0.02	1.00
9	AM Wijaya, N Suryani	Digital Media Based Macromedia Flash to Increase the Historical Learning Interest of Senior High School Students	2017	2	1.00	0.02	1.00
10	R Cole, D McHugh, FH Netter	Assessing Emotional Stress, Active Recall and Digital Spaced-Learning Media in the Study of Thoracic Gross Anatomy by Medical Students	2017	3	0.00	0.00	0.00
11	LD Rohmatunnisa	Developing Character-Based Digital Magazine as A Learning Media For Accounting Cycle of Service Company on Accounting Students	2017	1	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
12	P Pérez-Paredes	Mobile Learning through Digital Media Literacy	2017	1	0.00	0.00	0.00
13	B Gleason, S Von Gillern	Digital citizenship with social media: Participatory practices of teaching and learning in secondary education	2018	2	125.00	41.67	63.00
14	B Huber, K Highfield, J Kaufman	Detailing the digital experience: Parent reports of children's media use in the home learning environment	2018	3	41.00	0.59	14.00
15	K Aniroh, H Latifah, A Abdul Ghoffar Ariyanto	The effectiveness of YouTube Live streaming as digital learning media in tourism and guiding subject	2018	3	7.00	0.11	2.00
16	MO Finucane, L Seiter, NC Gehlert	Teaching Social Justice: Intergenerational Service Learning in a Digital Media Course	2018	3	2.00	0.05	1.00
17	R Sefriani, I Wijaya, P Radyuli	Development of android based learning media on the subjects of digital photo composition for vocational high school student	2018	3	0.00	0.00	0.00
18	V Oberoi, F Hosseini, M Doroudi, L Vo	Anatomy in a New Curriculum: Using Digital Media to Facilitate the Learning of Anatomy in the Medical Curriculum	2018	4	0.00	0.00	0.00
19	K Ravishankar, B Jeyaprabha, H MoideenBatcha, VRD Sagunthala	Intention And Awareness on Digital Media and E-Learning Solutions Among Management Students In Education	2018	3	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
20	K Choi, J Yun	An Analytic Study about the Effect of Flipped learning Class at Universities used for Digital Media Usage Exploration	2018	2	0.00	0.00	0.00
21	K Rukun, RDP Permatasari, BH Hayadi	Development of Digital Information Management Learning Media Based on Adobe Flash in Grade X of Digital Simulation Subject	2019	3	58.00	1.21	19.00
22	S Pereira, J Fillol, P Moura	Young people learning from digital media outside of school: the informal meets the formal	2019	3	55.00	1.16	18.00
23	M Daumiller, M Dresel	Supporting self-regulated learning with digital media using motivational regulation and metacognitive prompts	2019	2	28.00	0.58	14.00
24	SD Kincey, ED Farmer, CY Wiltsher, D McKenzie, ST Mbiza	From chalkboard to digital media: The evolution of technology and its relationship to minority students' learning experiences	2019	4	10.00	0.21	3.00
25	MI Rahmatullah	Pengembangan Konsep Pembelajaran Literasi Digital Berbasis Media E-Learning Pada Mata Pelajaran PJOK di SMA Kota Yogyakarta	2019	1	9.00	0.20	9.00
26	MB Richards, SW Marshall	Experiential learning theory in digital marketing communication: Application and outcomes of the applied marketing & media education norm (AMEN)	2019	2	8.00	0.17	4.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
27	M Fransisca, Y Yunus, AD Sutiasih, RP Saputri	Practicality of e-learning as learning media in digital simulation subjects at vocational school in Padang	2019	4	4.00	0.08	1.00
28	D Hikmah	Quizlet: A digital media for learning informatics terms	2019	1	4.00	0.08	4.00
29	D Lestari, S Siswandari, C Indrawati	The Development of Digital Storytelling Website Based Media for Economic Learning in Senior High School	2019	3	3.00	0.08	1.00
30	M Chen	Children and families in the digital age: learning together in a media saturated world	2019	1	3.00	0.08	3.00
31	S Radha, J Michael Mariadhas, AK Subramani, N Akbar Jan	Role of e-learning and digital media resources in employability of management students	2019	4	3.00	0.08	1.00
32	M Ranieri	Professional development in the digital age. Benefits and constraints of social media for lifelong learning	2019	1	3.00	0.08	3.00
33	A Basit, RC Puspitarini	Extension of Digital Media to Strengthen Learning Outcome with Online Approach in Inclusive School Students	2019	2	1.00	0.03	1.00
34	D Hikmah	Media For Language Teaching and Learning in Digital Era	2019	1	1.00	0.03	1.00
35	JT Feezell	An Experimental Test of Using Digital Media Literacy Education and Twitter to Promote Political Interest and Learning in American Politics Courses	2019	1	1.00	0.03	1.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
36	F Fujiati, SL Rahayu	Penerapan Digital Game Based Learning Pada Media Pembelajaran "LABIRIN"	2019	2	1.00	0.03	1.00
37	KT Dewi	Developing local wisdom based digital storytelling through blended learning method as an innovative media for teaching writing at eight grade students of SMP Negeri 2 Singaraja	2019	1	1.00	0.03	1.00
38	AS Pratiwi, AT Lestari, B Hendrawan, MF Nugraha, M Nurfitriani, M Nurkamilah, F Nugraha	Digital Video Based Rampak Kendang Learning Media for Deaf Students	2019	4	0.00	0.00	0.00
39	R Mufidah, A Efendi, C Budiyanto	The Effectiveness of Android Based Digital Arithmetic Learning Media with Discovery-Based Learning Model to the Learning Achievement of Computer System Subject of Grade X of Multimedia Class at Vocational High School in Surakarta	2019	3	0.00	0.00	0.00
40	A Yustina, NF Isneni, D Risaldi	The Transition Of I La Galigo Epos Into a Webtoon Serial Form as a Learning Media of Buginese Classical Literature Creation In The Digital Era	2019	3	0.00	0.00	0.00
41	AF Hayati, MA Zona, JE Marna	Pelatihan Media Pembelajaran Berbasis Digital Learning Pada Guru Ekonomi Sekolah Menengah Atas (Sma) Di Kota Padang	2019	3	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
42	L Gales	From Media to Transmedia: Transforming Teaching and Learning Strategies in a Digital Culture	2019	1	0.00	0.00	0.00
43	S Sugianto, A Fitriani, S Anggraeni, W Setiawan	Media needs of plant anatomy practicum on digital microscope blended learning system on student naturalist intelligence	2019	4	0.00	0.00	0.00
44	Q Bai	Media Assisted Teaching Environment on Students Digital Media Music Education Cooperative Learning and Learning	2019	1	0.00	0.00	0.00
45	A Dutta	Impact of digital social media on Indian higher education: alternative approaches of online learning during Covid-19 pandemic crisis	2020	1	25.00	1.04	25.00
46	D Gandasari, D Dwidienawati	Evaluation of Online Learning with Digital Communication media during the COVID 19 Pandemic	2020	2	6.00	0.25	3.00
47	N Hazizah, I Ismaniar	Teachers' Strategies in Preparing Online Learning Digital Media for Developing Children's Literacy Skills	2020	2	3.00	0.13	2.00
48	L Miculescue	Digital Media: Friend or Foe? Preschool teachers' experiences on learning & teaching online"	2020	1	3.00	0.13	3.00
49	S Waljinah, K Dimyati, H Joko	The Study of Euphemism in Social Media: Digital Learning Media Innovation	2020	3	2.00	0.08	1.00
50	RYKP Siahaan, S Daulay, W Hadi	The Effectiveness of Public Speaking Learning Media Based on Digital Multimodal in Indonesian Language Courses at Politeknik Pariwisata Medan	2020	3	1.00	0.04	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
51	DFK Dwiputra, TM Budiyanto, TA Dzakiyyah, M Igbal	Textbooks Transformation Into Digital Comics As Innovative Learning Media for Social Science Studies in Junior High School	2020	3	1.00	0.04	0.00
52	S Makodamayanti, D Nirmala, C Kepirianto	The Use of Digital Media as a Strategy for Lowering Anxiety in Learning English as a Foreign Language	2020	3	1.00	0.04	0.00
53	RP Manurung	The utilization of WhatsApp media as a student's digital literation media in distance learning in SMA Private Santo Thomas 2 Medan	2020	1	1.00	0.04	1.00
54	R Diani, RB Satiarti, N Lestari, NB Haka, D Reftyawati, A Padillah, H Komikesari	Digital oscillation rails: developing physics learning media to determine the acceleration value of earth's gravity	2020	5	0.00	0.00	0.00
55	NR Dewi, S Nurkhalisa, EN Savitri, I Dwijayanti, SWA Wibowo	The influence of science learning media based digital storytelling towards metacognition ability	2020	4	0.00	0.00	0.00
56	N Khairani, H Maksum	Development of Android-Based Learning Media in Simulation and Digital Communication Subjects	2020	2	0.00	0.00	0.00
57	SM Ulfa, AW Sinrang, S Syarif, AN Usman	The Use Of Digital Partograph As A Learning Media For Normal Childbirth Care	2020	4	0.00	0.00	0.00
58	R Purnamasari, Y Suchyadi, N Karmila, N Nurlela, M Mirawati, R Handayani, D Kurnia	Student Center Based Class Management Assistance Through The Implementation of Digital Learning Models and Media	2020	4	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
59	C Saxena	A Study on Digital Learning for Media Students in The Covid-19 Outbreak	2020	1	0.00	0.00	0.00
60	EA Rachma, R Nurdiana, A Ghofur	The Effect of The Implementation of Google Classroom Digital Media for the Easy of Teachers In Assessing Learning Outcomes	2020	3	0.00	0.00	0.00
61	Y Cahyadi, MA Mansyur, H Hasanah	Digital Media Based Stad+ 3r as an Innovative Methods For Writing Explanation Text Teaching Learning	2020	3	0.00	0.00	0.00
62	SA Hashimi	Enhancing the creative learning experience through harnessing the creative potential of digital and social media platforms in art and design educational contexts	2020	1	0.00	0.00	0.00
63	VS Nanda, D Budimansyah	Strengthening of Digital Media Literacy-Based Character Education on Hoax News Spreading to Students (Case Study on Citizenship Education Learning in SMP Negeri 2 Bandung)	2020	2	0.00	0.00	0.00
64	N Udoakah, IC Nda	Acquisition and Utilisation of Digital Media in the Teaching and Learning of Mass Communication in Tertiary Institutions in Akwa Ibom State. Nigeria	2020	2	0.00	0.00	0.00
65	HA Nasr	Competences in digital online media literacy: Towards convergence with emergency remote EFL learning	2020	1	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
66	LTL Hinton, KA Putra	Reclaiming and Learning Indigenous Languages on Social Media with Digital Activists: Insights from Lampung. Mayangna and Miskitu Youth	2020	2	0.00	0.00	0.00
67	C Nolkhom, Y Saifah	Effect of Using Social Media Activities Package Based on Phenomenon-based Learning and Reflective Thinking on Digital Literacy Behavior for Primary School Students	2020	2	0.00	0.00	0.00
68	K Ravishankar	Impact of digital Media and E-Learning Solutions on Contemporary Management Education–Faculty Perspective	2020	1	0.00	0.00	0.00
69	JW Wicaksono, M Japar, E Utomo	Development of Digital Based Comic Media for Primary V-Class Student Learning	2021	3	1.00	0.04	0.00
70	R Roemintoyo, MK Budiarto	Flipbook as Innovation of Digital Learning Media: Preparing Education for Facing and Facilitating 21st Century Learning	2021	2	0.00	0.00	0.00
71	D Saripudin, K Komalasari, DN Anggraini	Value-Based Digital Storytelling Learning Media to Foster Student Character.	2021	3	0.00	0.00	0.00
72	RH Ristanto, RD Mahardika	Digital flipbook immunopedia (DFI): A learning media to improve conceptual of immune system	2021	2	0.00	0.00	0.00
73	WB Astutik, S Yuwana	Development of Non-Fiction Text Digital Learning Media in Narrative Writing Skills for Fourth Grade Elementary School Students	2021	2	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
74	A Andriana, A Ana, H Puspita, IY Wulandari	Analysis of Distributed Deep-Learning Based Digital Learning Media Using Thin Client Devices For Inclusion Vocational School Students	2021	4	0.00	0.00	0.00
75	A Singh, IMS HR, S Singh	Investigating Digital Learning Media For Skill Enhancement Programmes	2021	3	0.00	0.00	0.00
76	M Hariyono, EN Widhi, N Ulia	Digital Geoshapes Learning Media In Supporting Mathematics Education II PGSD	2021	3	0.00	0.00	0.00
77	VR Puspa, T Hidayat, B Supriatno	Development of android-based digital determination key application (e-KeyPlant) as learning media for plant identification	2021	3	0.00	0.00	0.00
78	A Suyetno	Learning media development based on CNC simulator as the digital tool to support the CNC practice learning during COVID-19 new normal	2021	1	0.00	0.00	0.00
79	RE Wijaya, M Mustaji, H Sugiharto	Development of Mobile Learning in Learning Media to Improve Digital Literacy and Student Learning Outcomes in Physics Subjects: Systematic Literature Review	2021	3	0.00	0.00	0.00
80	L Fitriana, A Hendriyanto, S Sahara, FN Akbar	Digital Literacy: The Need for Technology-Based Learning Media in the Revolutionary Era 4.0 for Elementary School Children	2021	4	0.00	0.00	0.00
81	B Muhammad, S Sumargono	The Influence of Digital Learning Media Towards Students' Historical Learning Interests	2021	2	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
82	IB Ma'arif, I Sunniyah	Developing English Digital Book as Learning Media For Xi Grade Students	2021	2	0.00	0.00	0.00
83	S Syahminan, CW Hidayat	Development of digital engineering learning with proteus software media and emulators department of informatics engineering Kanjuruhan University	2021	2	0.00	0.00	0.00
84	RA Rahma, S Sucipto, Y Affriyenni, M Widyaswari	Cybergogy as a digital media to facilitate the learning style of millennial college students	2021	4	0.00	0.00	0.00
85	NV Stanley	Poetry and digital media for improving upper elementary African American science learning	2021	1	0.00	0.00	0.00
86	NC Phillips, VK Lund	Leveling Up: Connected Mentor Learning in a Digital Media Production After-School Space	2021	2	0.00	0.00	0.00
87	AI Citra, AH Pulungan, M Oktora	Developing English Digital Conversation Media for Speaking Activities Based on Task-Based Learning	2021	3	0.00	0.00	0.00
88	CA Paulsen, E Carroll, O, Paulsen, JR Adrews	Engaging Children and Families in Active. Environmental Science Learning through Digital Media	2021	4	0.00	0.00	0.00

3.2. The Development of Publications Regarding Digital Learning Media

Based on the search results on the Google Scholar database, it shows that the development of research on digital learning media is shown in **Table 2**. From the table data, it can be seen that there are 90 studies on digital learning media. The number of studies on learning media fluctuated but tends to increase as shown by **Figure 12**. there was only a decrease in research interest on this theme in 2018, namely from 12 studies throughout 2017 to 8 studies in 2018. Throughout 2019 and 2020, there were many studies on the same topics. The number of studies in 2019 is 25, and the number is likely to increase in 2021. This is because there are researches on digital learning media.

The level of research interest in digital learning media which increased rapidly in 2019-early July 2021 was due to the current condition of society which was in the period of the Covid-19 pandemic. Learning is done at home which causes the need for the use of digital learning media so that teaching and learning activities can still be carried out. without a time limit. place and distance (Scully et al., 2021).

3.2. Bibliometric Map Research on Digital Learning Media

From the search results through the Google Scholar database, 88 research documents related to digital learning media were obtained. then the document is exported to RIS format. inputted and analyzed with VOSViewer. There are several steps to doing research mapping using VOSviewer, which are as follows:

a. Open the VOSviewer App

The first step that must be done is to open the VOSviewer application that is already installed on the device. Once you open it, the initial VOSviewer window will appear as shown in **Figure 1**.

b. Click the create button to start creating a new mapping

After opening the VOSviewer click create to start creating a new mapping. As shown in **Figure 13**, there are three choices of data types, namely making maps based on network data, bibliographic data, and text data. In this study, the map was made based on text data, because in this study the research mapping was carried out based on the research title. After that, click the next button.

Table 2. The development of research on digital learning media.

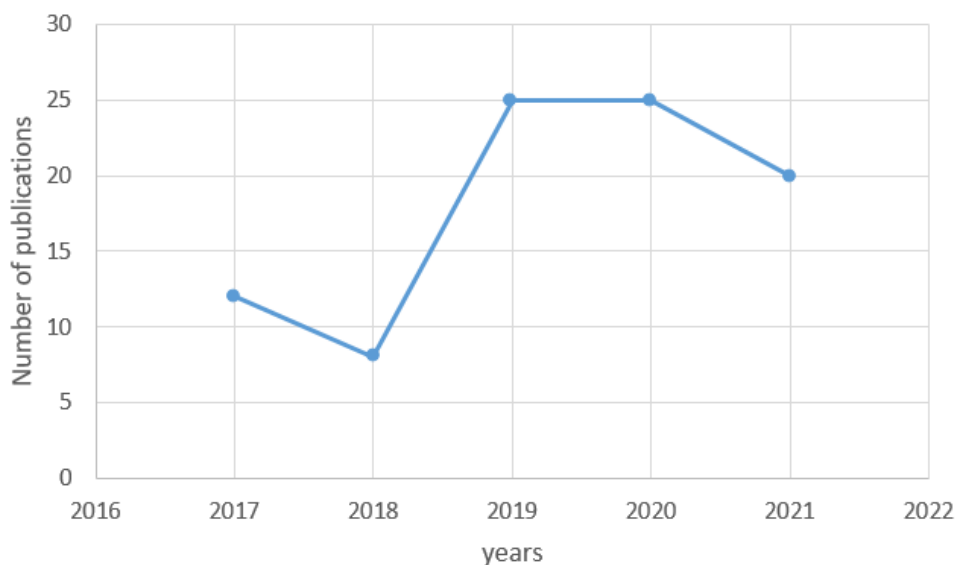| Years of Publication	Number of Publication
2017	12
2018	8
2019	25
2020	25
2021	20
Total	**90**

Figure 12. Graph of the level of research development on digital learning media.
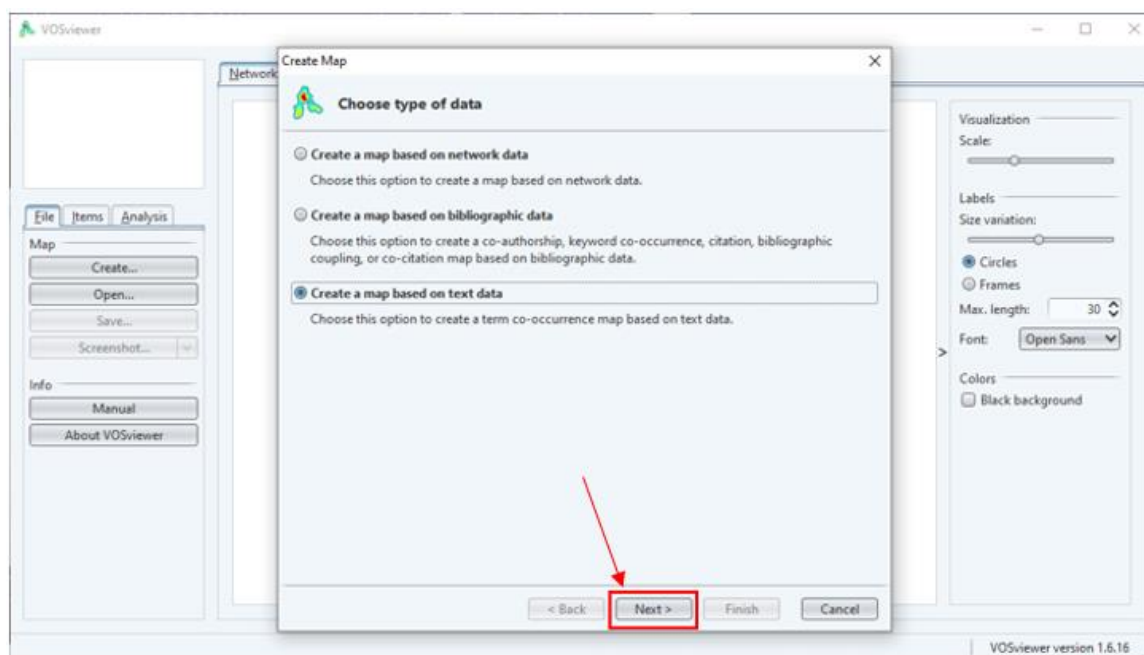
Figure 13. Create a map in VOSviewer.

c. Choose and select data source

Figure 14 shows the next step in making a research map, there are 4 choices of data sources, namely reading data from VOSviewer files, bibliographic database files, reference manager files, and downloading data via API. In the previous data retrieval stage, we used the Publish or Perish application which is one of the reference manager applications, and the type of data that we saved previously was in the form of RIS. Thus, in this section, we select read data from reference manager files, then click Next.

In the section shown in **Figure 15**, select the RIS section and enter the file that has been obtained via Publish or Perish, by pressing the three dots button. Then click the next button to proceed to the next stage.

d. Choose fields to extract

Next, the Choose field page appears as shown in **Figure 16**. This page displays 3 types of data options that can be extracted, namely title and abstract fields, title fields, and abstract fields. In this study, the title and abstract data from the articles that have been collected are used. Thus, VOSviewer maps each keyword taken from the titles and abstracts of articles that have been collected. Once done, the next step is to click the next button.

e. Choose counting method

Figure 17 shows the selection of the calculation method. There are two methods, namely binary counting and full counting. Binary counting displays data in the form of a value of 0 or 1, meaning that if the same word appears in the title repeatedly, it is counted as one. While the full count method means that in this method the total number that appears is still counted as much as it appears.

f. Choose Threshold

Figure 18 shows the Choose Threshold page. This page is used to set the minimum number of words that appear so that they can be presented in a folder. In this study, the number of words that appear at least three times, so that the appropriate keywords and the number of occurrences of 3 or more times are included in the mapping. Then the number of words found is 51, and for the part shown in **Figure 19,** we maximize the data display by 51.
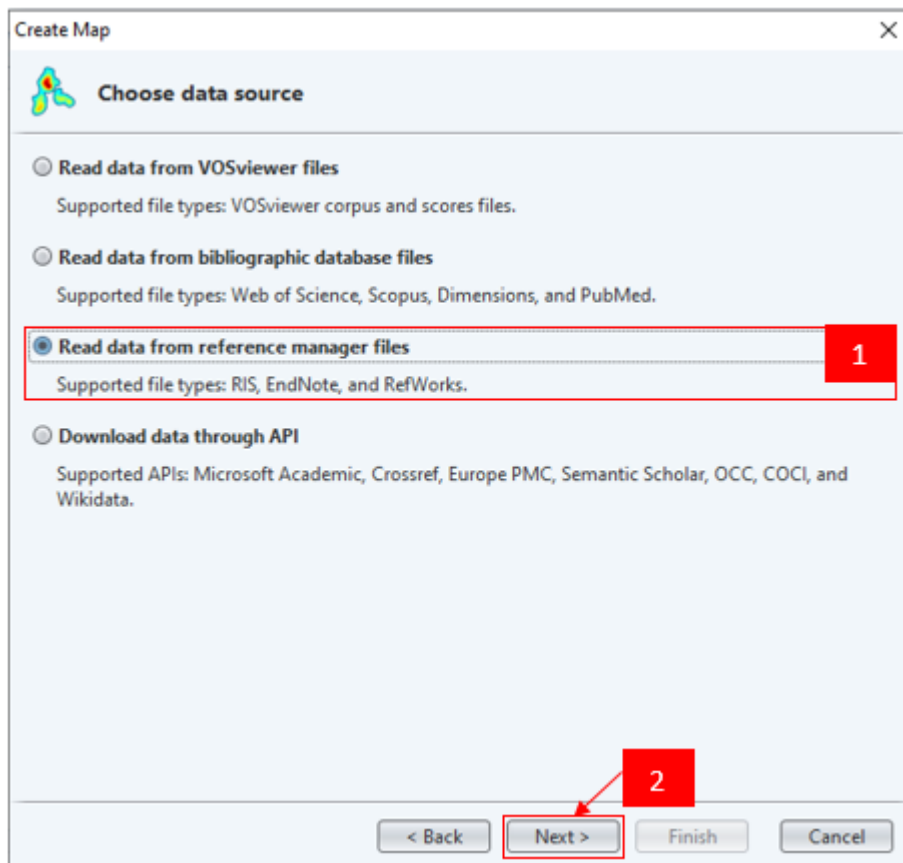
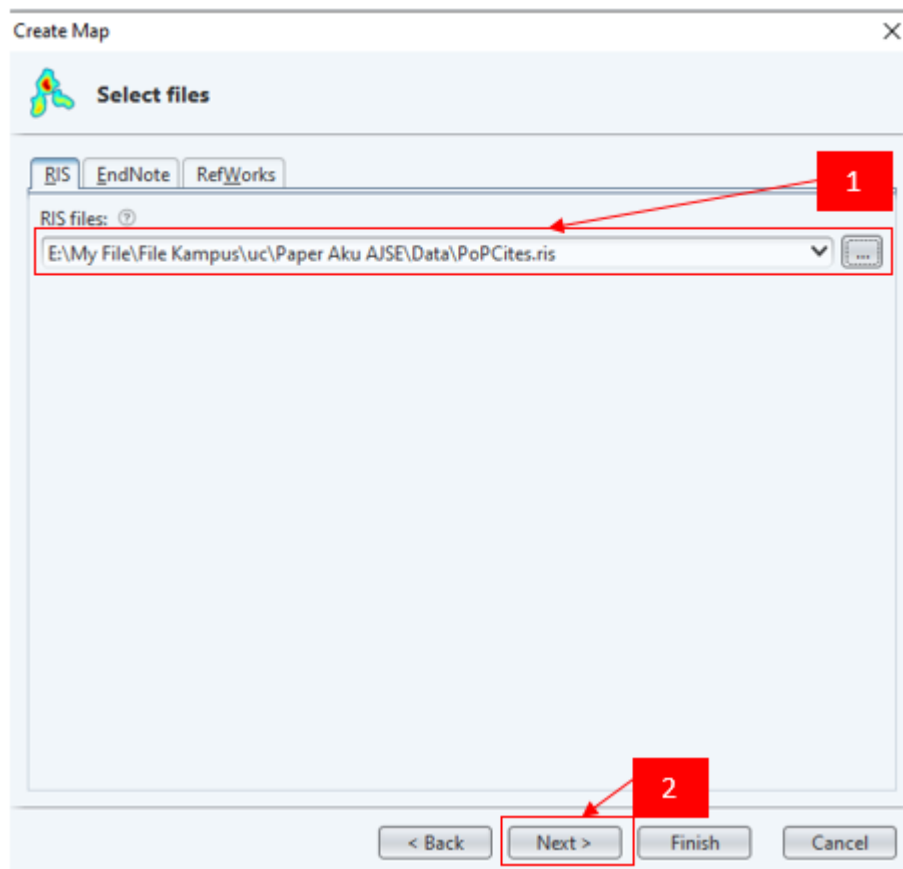**Figure 14.** Selection of data sources on VOSviewer.

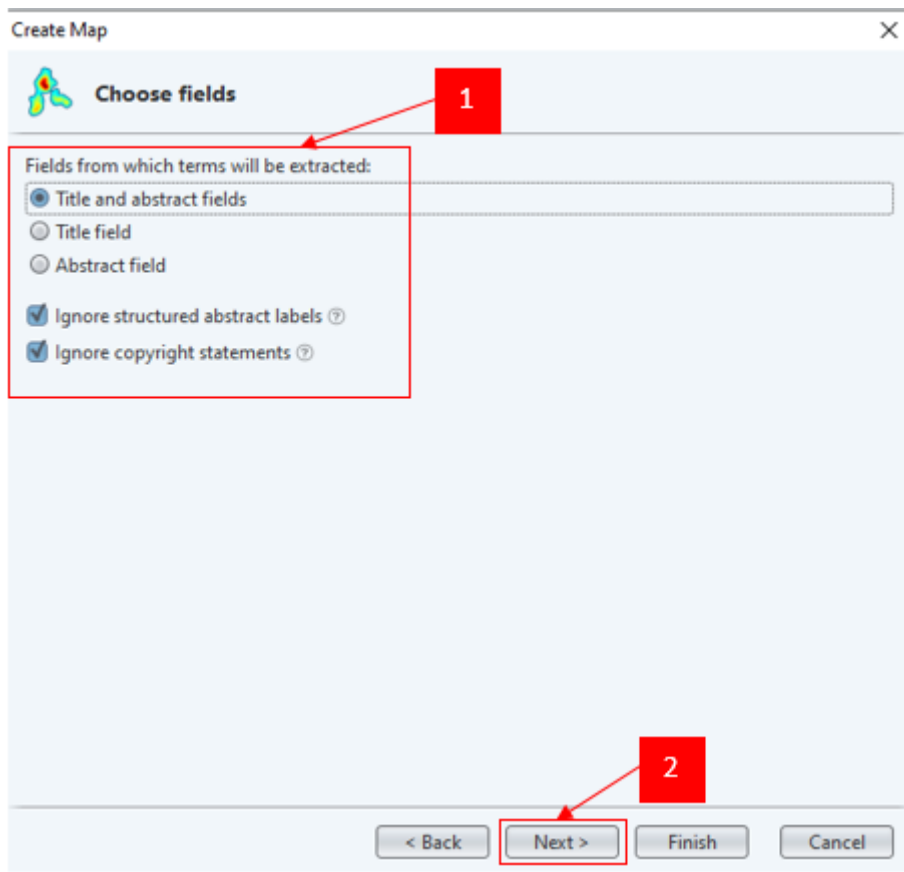**Figure 15.** Selection of the file to be used as the source of mapping data in VOSviewer.

Figure 16. Selection of the type of data to be extracted into a map on VOSviewer.
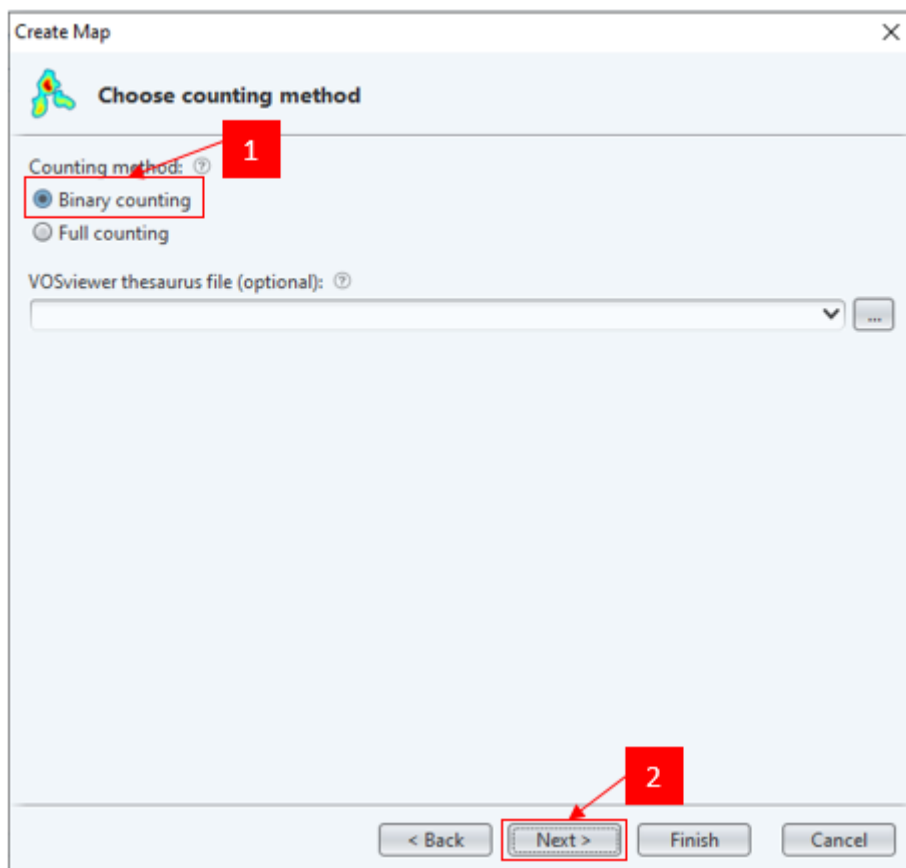
Figure 17. Choosing the counting method in VOSviewer.
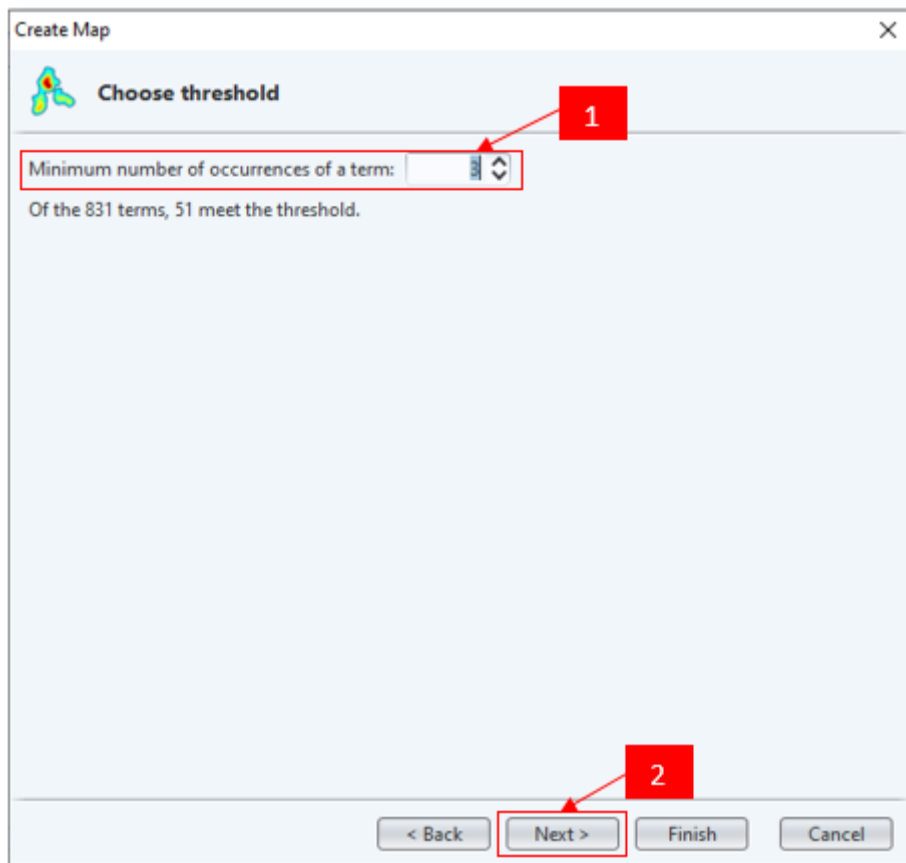
Figure 18. Choosing the threshold section on VOSviewer.
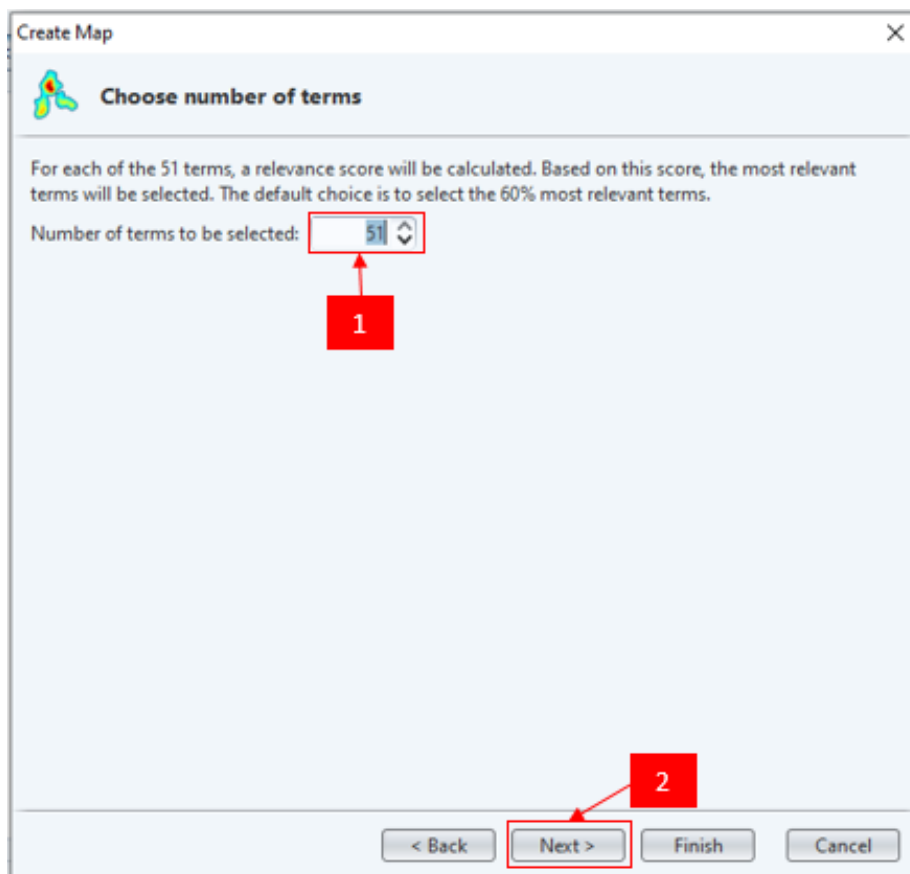
Figure 19. Putting the number of terms.

g. Verify selected terms and Click Finish Button

In **Figure 20**, we choose the words that are used and appear on the research mapping created, then click the finish button. After that, we can see the results of the mapping of the research theme regarding digital learning media that showed in **Figure 21**.
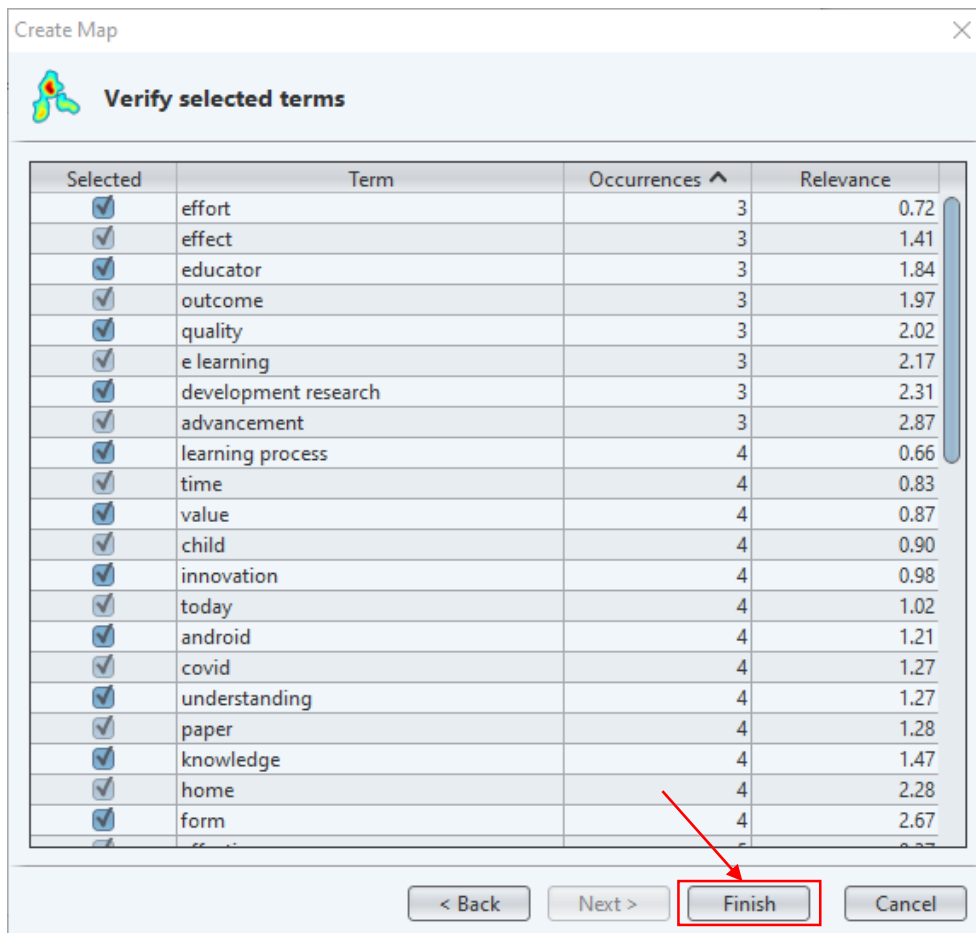
Figure 20. Verification of word selection on VOSviewer.
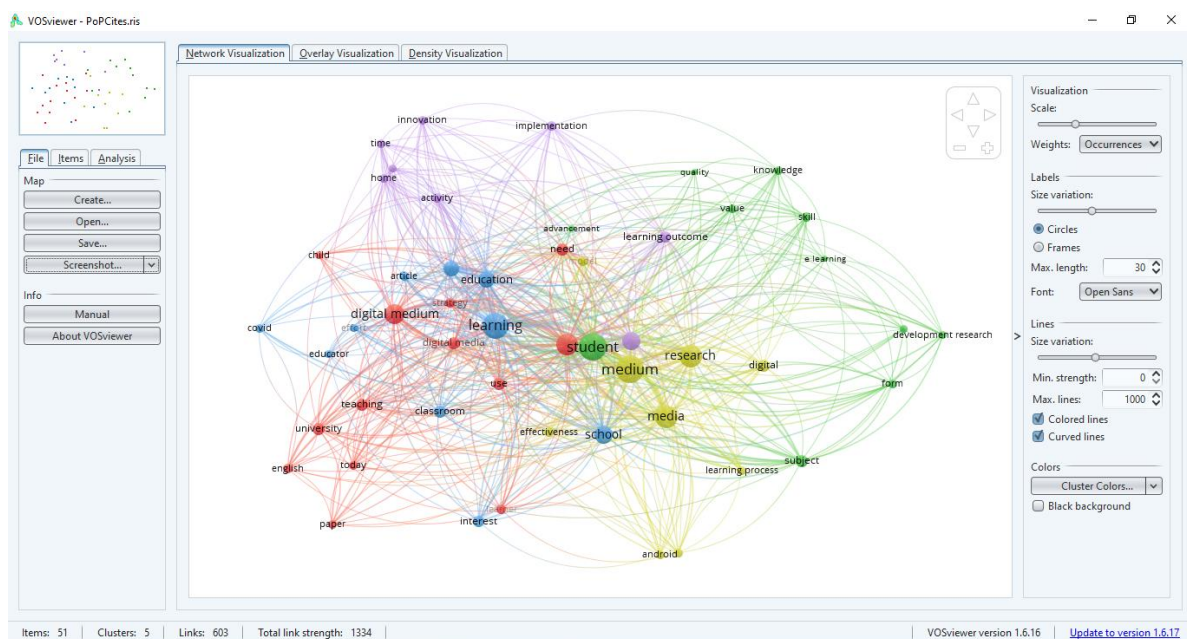
Figure 21. The results of the mapping of the research on VOSviewer.

3.2.1. Co-Word Map network visualization

The results of the visualization of the co-word map network of research developments regarding digital learning media are divided into 5 clusters as shown in **Figure 22** below.

- Cluster 1. The red color consists of 13 items including child, digital media, digital medium, English, learner, need, paper, strategy, study, teaching, today, university and use.
- Cluster 2. Green color consists of 11 items including advancement, development research, e-learning, form, knowledge, outcome, quality, skill, student, subject and value.
- Cluster 3. Blue color consists of 10 items including article, classroom, covid, education, educator, effort, interest, learning, school and technology.
- Cluster 4. Yellow color consists of 9 items, namely android, digital, effectiveness, learning process, media, medium, model, research and understanding.
- Cluster 5. Purple color consists of 8 items including activity, development, effect, home, implementation, innovation, learning outcome, and time.

3.2.2. Co-Word map density visualization

The cluster density view are items that are marked the same as the visible item. The item point has a color depending on the density of the item at the time. It can identify that the color of the dots is fixed depending on the item associated with other items. Density Co-Word maps are useful for obtaining an overview of the general structure of bibliometric maps by showing which items are considered important for analysis (Muñoz-Leiva et al., 2021). Based on the research results shown in **Figure 23**, it can be interpreted that the most widely used keywords in a publication that show the visualization of the density map co-word research developments on digital learning media.

Figure 23 shows a density map which is the result of an analysis using all articles on digital learning media in 2017-2021. The density map means that the more yellow the color is with the diameter of the largest circle, the denser the keyword means it appears more often and if the color fades, it blends in with the green background, the less often it occurs (Tupan, 2019).
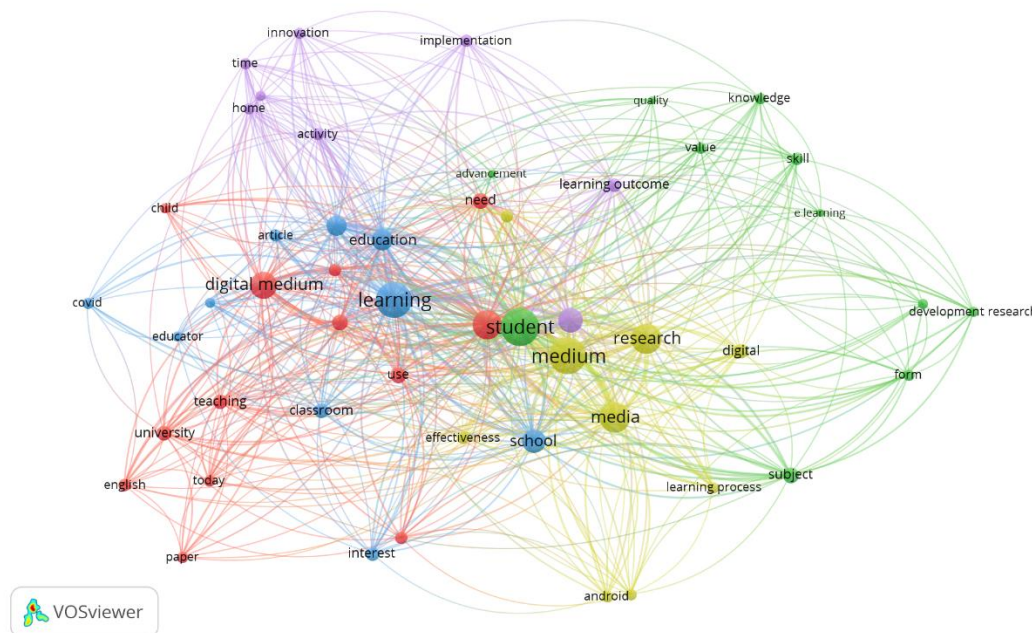
Figure 22. Co-word map network visualization

Figure 23. Co-Word Map Density Visualization.

4. CONCLUSION

Based on the results and discussion above, it can be concluded that VOSviewer can be used as a mapping tool to analyze data bibliometrically. In this study, the data used in analyzing data with VOSviewer is research on digital learning media taken from the Google Scholar database. The number of publications obtained and related to the theme amounted to 90 documents with a range of years from 2017-2021. Changes in the number of publications in this period experienced fluctuating changes but tended to increase rapidly from 2019 to 2021. Through network visualization, it is shown that the development map of research on digital learning media is divided into 5 clusters. Cluster 1 consists of 13 topics, cluster 2 consists of 11 topics, cluster 3 consists of 10 topics, cluster 4 consists of 9 topics and cluster 5 consists of 8 topics.

5. ACKNOWLEDGMENTS

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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