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Analisis Bibliometri Menggunakan Vosviewer dan Publish or Perish (menggunakan data OpenAlex): Trend dan Visualisasi Penelitian Soft Computing dalam Natural Language Processing

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A B S T R A K

Penelitian ini bertujuan untuk menganalisis dan mendemonstrasikan langkah-langkah analisis data bibliometri menggunakan VOSViewer secara lengkap dan sistematis. Panduan analisis langkah-demi-langkah disediakan agar pengguna baru dapat dengan mudah mengikuti cara menggunakan VOSViewer. Makalah ini memungkinkan dan memberikan cara mudah dalam analisis data dengan memanfaatkan alat pemetaan dan memberikan analisis perkembangan penelitian terkait penggunaan komputasi lunak dalam bidang natural language prosessing. Metode yang digunakan dalam penelitian ini adalah melakukan analisis bibliometri untuk menghasilkan visualisasi jaringan peta kerja sama dan peta kepadatan kerja sama. Analisis dilakukan dengan jumlah publikasi yang diperoleh, terkait dengan topik yang telah ditentukan sebanyak 238 dokumen dalam periode 2023. Sebagai contoh praktis, kami mengevaluasi analisis artikel terkait penggunaan komputasi lunak dalam natural language processing. Hasil penelitian menunjukkan bahwa VOSViewer dapat digunakan untuk memberikan saran dalam hasil analisis data.

A R T I C L E I N F O

1. PENDAHULUAN

Analisis data bibliometrik yang ditampilkan secara visual melalui alat pemetaan sangat diperlukan di era pertumbuhan teknologi yang berkembang begitu pesat seperti saat ini.(Nandiyanto et al., 2020a; Nandiyanto et al., 2020b). Alat pemetaan digunakan untuk mendapatkan hasil gambaran dan berbagai informasi mengenai perkembangan bidang ilmu dan kinerja penelitian yang telah dilakukan. Salah satu tools yang dapat digunakan untuk melakukan pemetaan analisis data bibliometrik dan salah satu contoh tools pemetaannya adalah VOSViewer (Gracia, 2020).

VOSViewer adalah program komputer yang dikembangkan untuk membuat dan melihat peta bibliometrik (Van Eck & Waltman, 2010). VOSViewer menawarkan fungsi penambangan teks yang dapat digunakan untuk membangun dan memvisualisasikan korelasi dalam kutipan artikel atau publikasi (Shen & Wang, 2020). Peta publikasi dapat ditampilkan dalam beberapa cara dan fungsi, seperti pemetaan sistem zoom, scrolling, dan pencarian. Dengan demikian, artikel bisa dipetakan lebih detail. VOSviewer menyajikan dan mewakili informasi spesifik tentang peta grafik bibliometrik (Baier-Fuentes et al., 2019).

VOSViewer akhir-akhir ini sangat populer digunakan dalam menganalisis posisi penelitian yang akan dilakukan dan mengukur kebaruan suatu penelitian. (Triwahyuningtyas et al., 2021). Kita dapat menampilkan peta bibliometrik besar dengan cara yang mudah untuk menginterpretasikan suatu hubungan melalui VOSViewer. VOSViewer memiliki beberapa karakteristik, antara lain mampu memetakan berbagai jenis analisis bibliometrik, mendukung beberapa database bibliografi besar, mengabaikan dimensi waktu, terbatas pada menganalisis data dalam jumlah kecil hingga menengah, ditujukan untuk fungsi pemrosesan teks, menggunakan teknik tata letak dan cluster , menggunakan fitur visualisasi overlay dan kepadatan.

Banyak penelitian mengenai VOSViewer diantaranya penelitian yang membahas tentang manual VOSviewer (Van Eck and Waltman, 2013), penelitian survei software VOSViewer sebagai program komputer pemetaan bibliometrik(Van Eck and Waltman, 2010), penelitian mengenai pengelompokan publikasi berbasis sitasi dengan CitnetExplorer dan VOSViewer (Van Eck and Waltman, 2017), analisis tren dan konvergensi ilmu pengetahuan dan teknologi menggunakan VOSViewer (Jeong & Koo, 2016), analisis bibliometrik dan visualisasi publikasi ilmiah bedah tulang belakang atlantoaksial berdasarkan Web of Science dan VOSviewer (Xie et al., 2020), dan penelitian analisis bibliometrik penelitian Covid-19 menggunakan VOSviewer (Hamidah et al., 2020). Namun belum ada penelitian yang membahas tentang cara membuat analisis Bibliometrik menggunakan VOSViewer yang dibahas secara detail dengan beberapa gambar langkah-langkahnya serta memberikan contoh analisis mengenai Soft computing pada bidang natural language processing

Oleh karena itu, penelitian ini dilakukan untuk dapat menampilkan langkah-langkah analisis data bibliometrik mengenai penelitian Soft computing pada bidang natural language processing menggunakan VOSViewer secara lengkap dan sistematis untuk melihat perkembangan penelitian mengenai hal tersebut dari tahun 2023 serta memberikan jalan keluarnya. analisis data yang mudah dengan menggunakan alat pemetaan. Dengan demikian diharapkan penelitian ini dapat dijadikan referensi untuk dapat melakukan analisis big data dengan lebih mudah dengan penggunaan VOSViewer. Laporan ini juga dapat digunakan sebagai referensi bagi pengguna pertama kali karena kami menyediakan proses langkah demi langkah saat menggunakan VOSviewer.

2. METODE

2.1. Persiapan Alat Analisis

Dalam melakukan analisis data menggunakan VOSViewer, kita harus menyiapkan beberapa aplikasi. Pertama, kami menggunakan alat Pemetaan, yang dapat diperoleh dari aplikasi sumber terbuka VOSviewer **(Gambar 1)**. Pada penelitian ini VOSviewer digunakan sebagai alat yang dapat memvisualisasikan data yang dianalisis untuk dipetakan. Alat kedua yang perlu disiapkan adalah aplikasi pengelola referensi. Aplikasi pengelola referensi yang dapat digunakan antara lain Publish or Perish seperti pada **Gambar 2** dan Mendeley seperti pada **Gambar 3**. Aplikasi pengelola referensi ini digunakan untuk mengumpulkan data penelitian yang nantinya akan dianalisis secara bibliometri menggunakan VOSviewer.
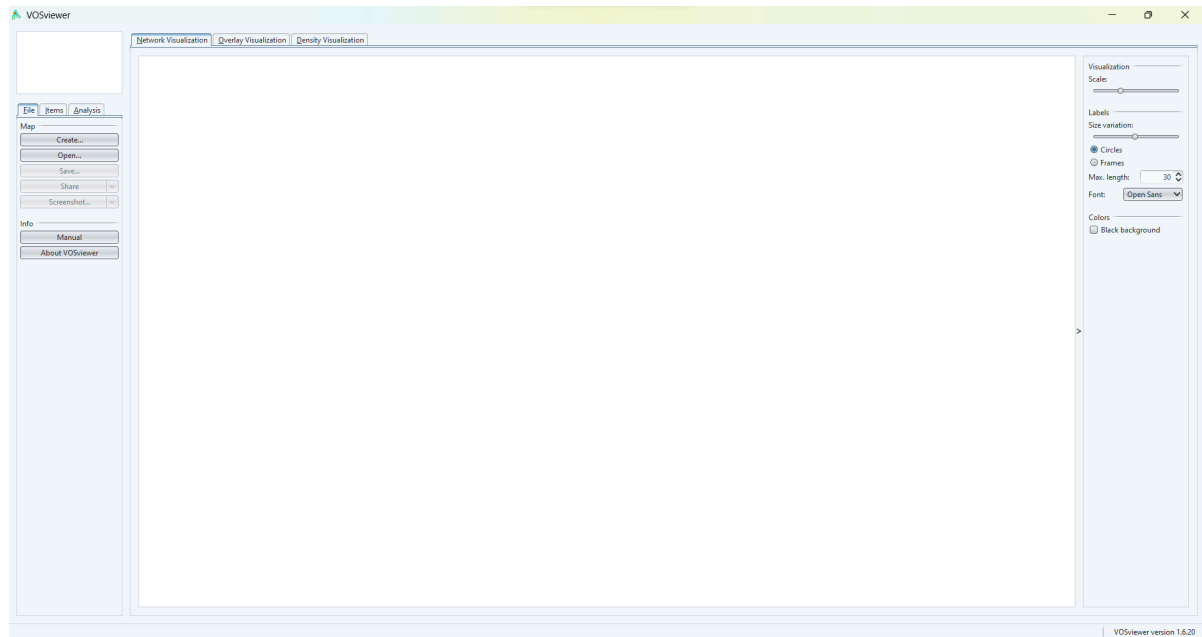
Gambar 1. Aplikasi VOSviewer
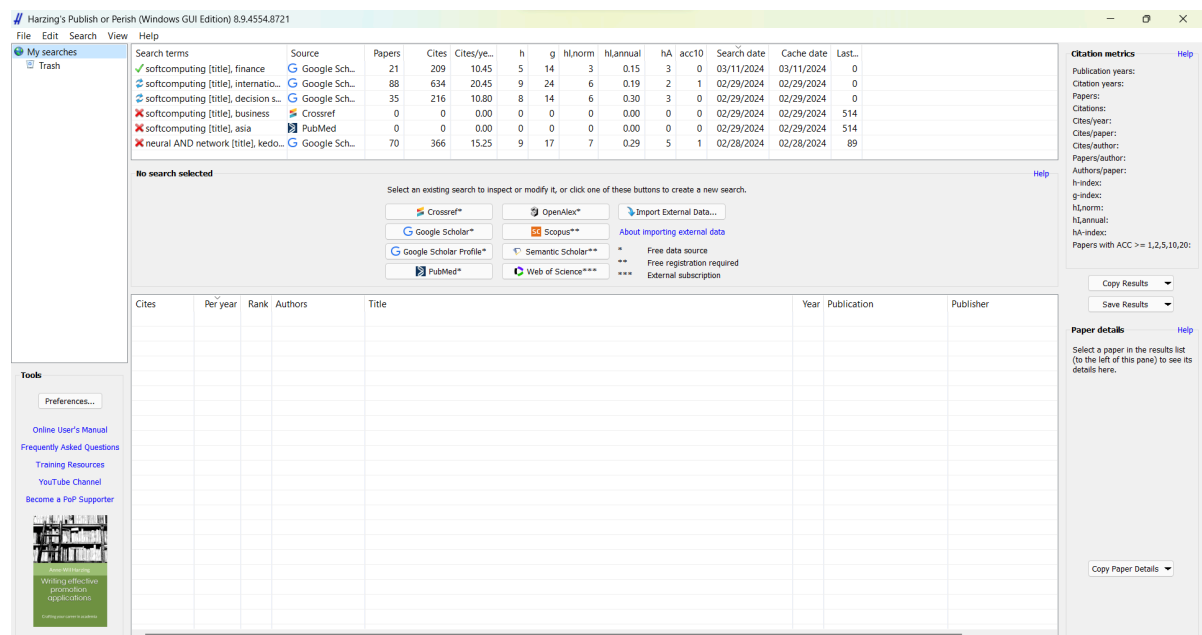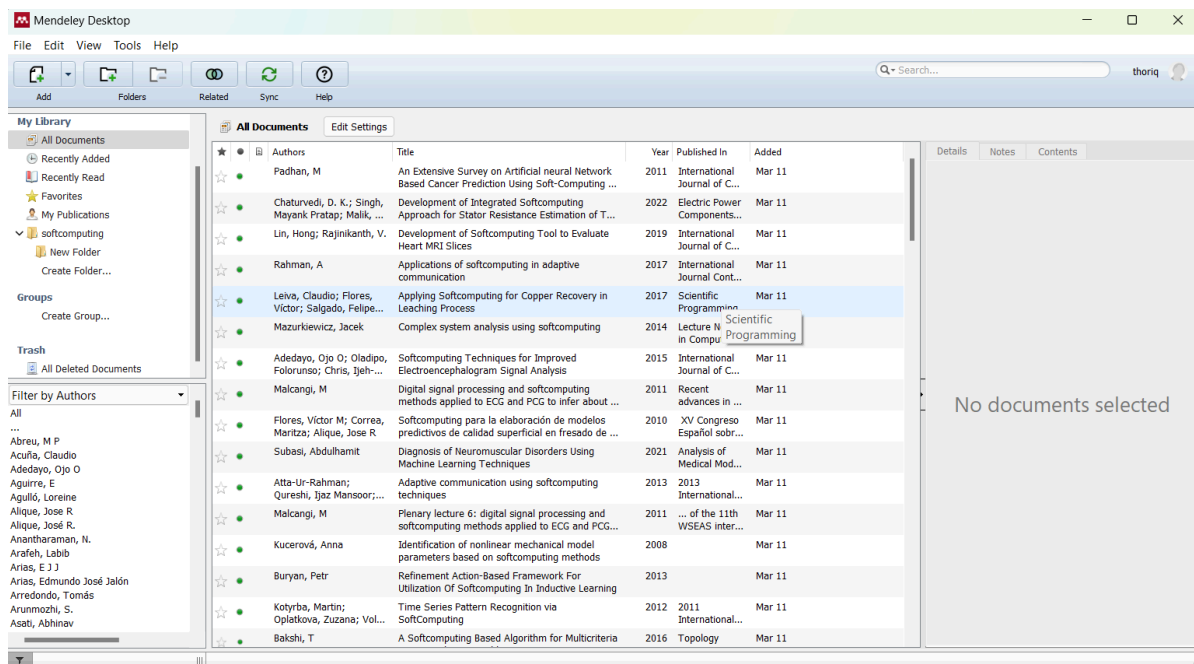

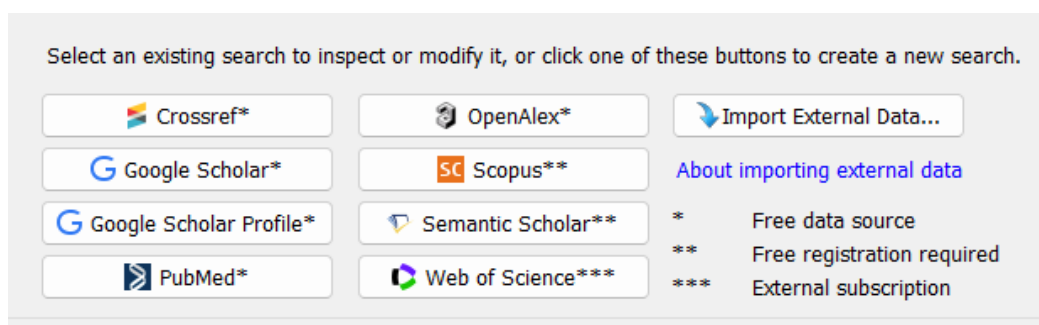**Gambar 2.** Aplikasi Publish or Perish

Figure 3. Aplikasi Mendeley

2.2. Pengambilan data

Data yang digunakan dalam penelitian ini adalah data publikasi jurnal media Soft computing pada bidang natural language processing yang diperoleh dengan menggunakan aplikasi pengelola referensi. Aplikasi pengelola referensi yang digunakan dalam penelitian ini adalah Publish or Perish. Publish or Perish digunakan untuk melakukan tinjauan literatur terhadap tema yang dipilih. Dengan demikian, sehingga diperoleh database tema penelitian yang sejenis.

Publish or Perish digunakan untuk mengetahui penulis mana yang paling banyak dikutip, tahun tertua dan terbaru suatu artikel dan kita akan mendapatkan catatan bibliometrik dari setiap penelitian yang akan digunakan. Publish or Perish menyediakan beberapa pilihan sumber data penelitian yang akan digunakan seperti dari Crossref, Google Scholar, Google Scholar Profile, PubMed, Microsoft Academic, Scopus, dan Web of Science seperti terlihat pada **Gambar 4**. Dalam penelitian ini menggunakan data dari Google Scholar.

2.3. Pemetaan Data Penelitian

Pemetaan data pada penelitian ini menggunakan aplikasi pemetaan digital yaitu VOSviewer. Data yang sudah didapat diolah sedemikian rupa agar sesuai dengan kata kunci yang diinginkan. Setelah itu data diinput ke dalam aplikasi VOSviewer yang selanjutnya akan mengubah data tersebut menjadi peta data yang saling berhubungan.

Gambar 4. Pilihan sumber data pada Publish or Perish.

3. HASIL DAN PEMBAHASAN

Pada bagian ini dibahas bagaimana menganalisis hasil pemetaan data menggunakan VOSviewer dengan data perkembangan jumlah publikasi jurnal bertemakan utama media pembelajaran digital pada database Google Scholar dari tahun 2017-2021.

3.1. Data yang Digunakan

Sebagai contoh penelitian ini, datanya akan diambil melalui Google Scholar. Artinya setiap data artikel yang terdapat di Google Scholar dan sesuai dengan tema pencarian yang dibutuhkan dalam penelitian ini akan dibackup menjadi sebuah file yang akan digunakan dalam menggunakan VOSviewer. Langkah-langkah untuk mendapatkan datanya adalah sebagai berikut.

a. Buka Aplikasi Publish or Perish

Langkah pertama untuk mendapatkan data melalui publish or perish adalah dengan membuka aplikasi seperti pada **gambar 5**. Setelah publish or perish terbuka maka kita akan melihat jendela awal aplikasi seperti pada **gambar 6**.
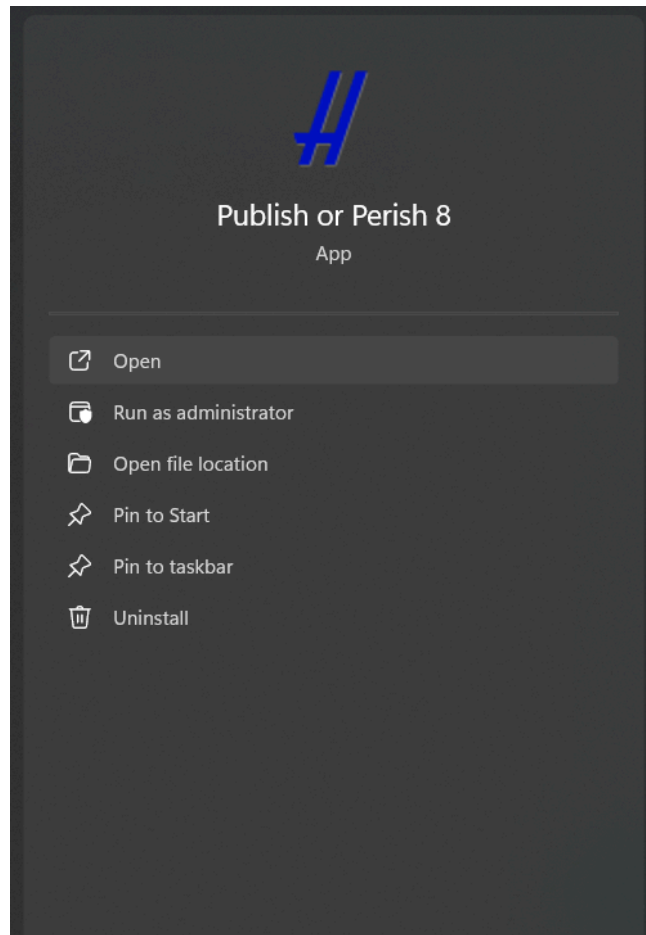
Gambar 5. Buka Aplikasi Publish or Perish
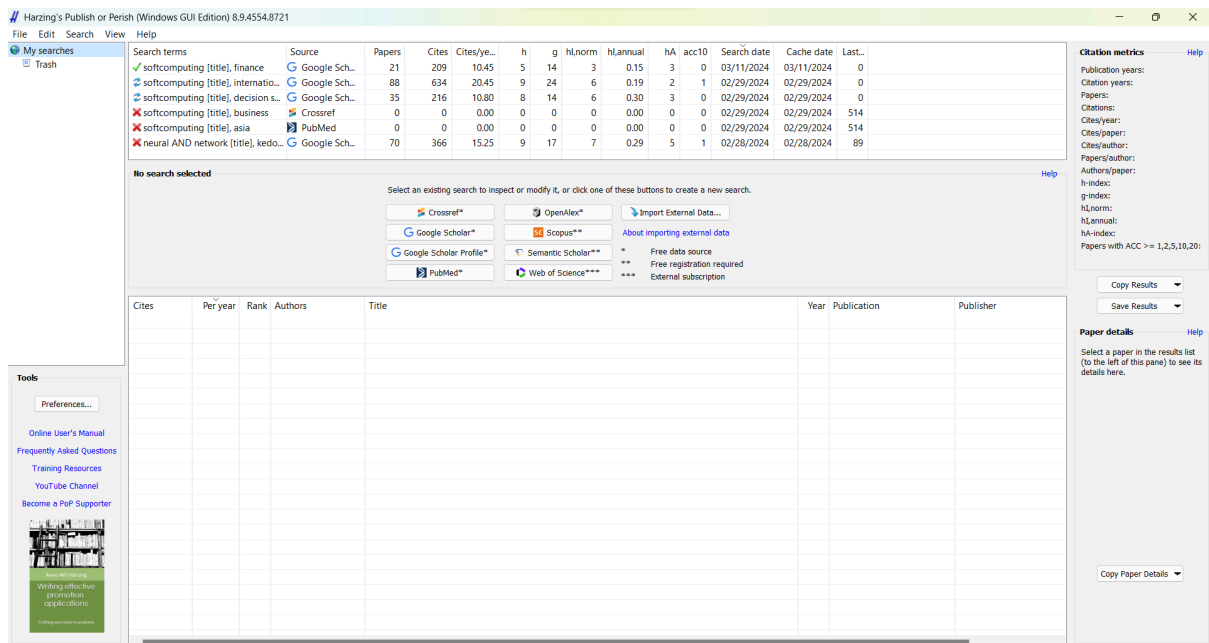
Gambar 6. Tampilan Awal Publish and Perish.

a. Klik tombol Google Scholar

   Gambar 7 menunjukkan letak tombol Google Scholar pada Publish atau Perish. Langkah yang harus dilakukan pada tahap ini adalah dengan menekan tombol.
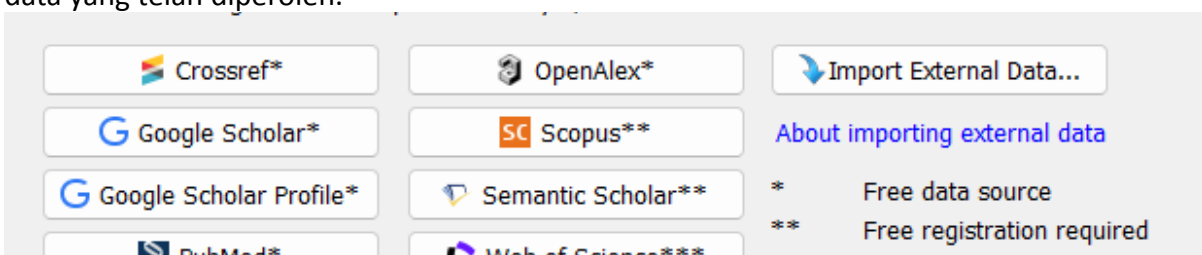
b. Isi Pencarian Google Scholar

   Seperti terlihat pada **Gambar 8**, terdapat beberapa bagian dalam Pencarian Google Scholar, antara lain penulis, nama publikasi, kata judul, dan kata kunci. Dalam penelitian ini tema yang dicari adalah Soft computing pada bidang. Isi kolom title dengan soft computing dan isi kolom keywords dengan natural language processing

   Jika kolom-kolom yang dibutuhkan pada form pencarian Google Scholar sudah terisi, klik tombol cari di pojok kanan atas seperti pada **Gambar 8**. Setelah muncul tampilan Publish or Perish seperti pada **Gambar 9**, kita tinggal menunggu pencariannya. proses untuk diselesaikan.

c. Hasil Pencarian

   Gambar 10 menunjukkan hasil pencarian dari Publish or Perish. Jika kita lihat pada bagian hasil yang ada pada sisi kiri layar, **Gambar 10** menunjukkan beberapa informasi data dari data yang telah diperoleh.

Gambar 7. Lokasi tombol Google Scholar.

Gambar 8. Bagian Pencarian Google Scholar.

Gambar 9. Proses pencarian artikel di Publish or Perish.

Gambar 10. Hasil pencarian berdasarkan Publish atau Perish

d. Simpan Data dari Publish or Perish

Langkah selanjutnya untuk setiap hasil yang disimpan adalah dengan mengklik tombol Simpan Hasil. Setelah itu simpan hasilnya dalam bentuk RIS **(Gambar 11)**. Karena filenya berbentuk RIS yang bisa dibaca oleh VOSviewer.
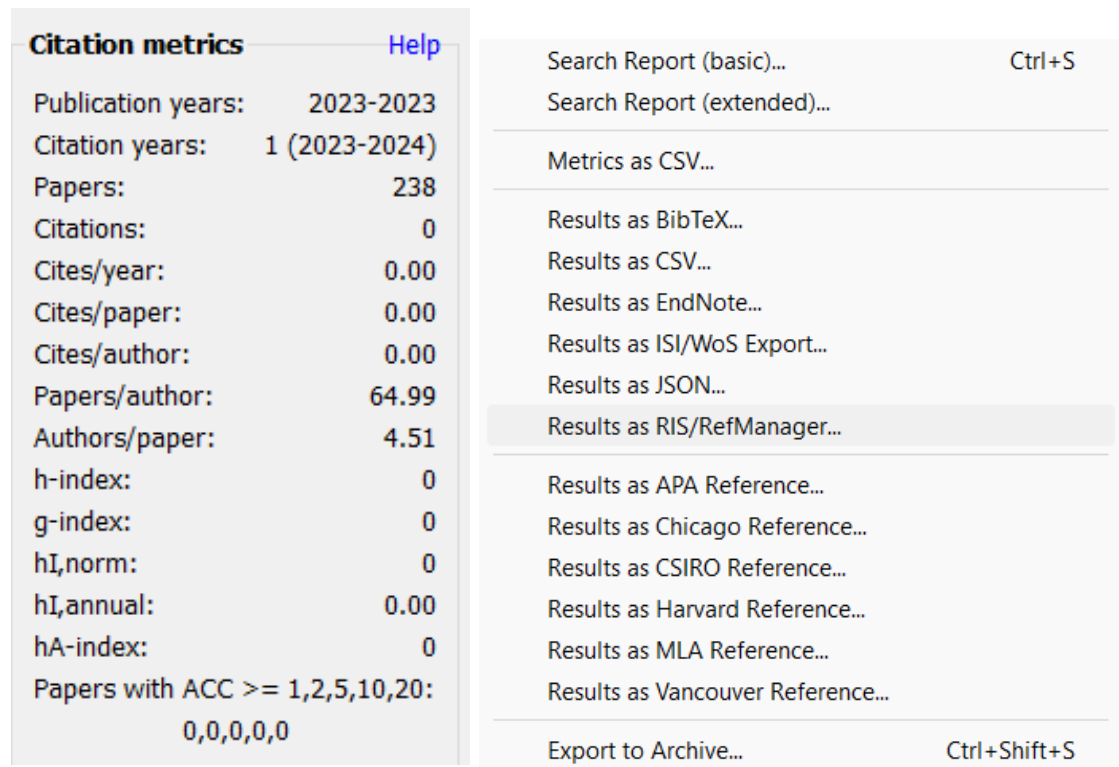
Gambar 11. Cara menyimpan data pencarian Publish or Perish.

Artikel yang ditemukan di Publish or Perish dipetakan menggunakan VOSviewer. Data yang ditampilkan di Publish or Perish berupa metadata bukan full text yaitu nama penulis, judul, tahun, jurnal yang menerbitkannya, dan juga penerbit artikel yang ditemukan.

Tabel 1 menunjukkan data pencarian dari terbitkan atau musnah yang digunakan dalam analisis VOSviewer penelitian ini. Didapatkan 88 artikel, jumlah sitasi 495, jumlah sitasi per tahun 123,75, jumlah sitasi per artikel 5,63, penulis tiap artikel 2,35, h-index 9, g-index adalah 21, h1, tahunan 2,00, indeks h 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	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	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	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	2020	3	1.00	0.04	0.00

Table 1 (Continue). Digital learning research data.

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 Iqbal	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	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	2021	2	0.00	0.00	0.00

Table 1 (Continue). Digital learning research data.

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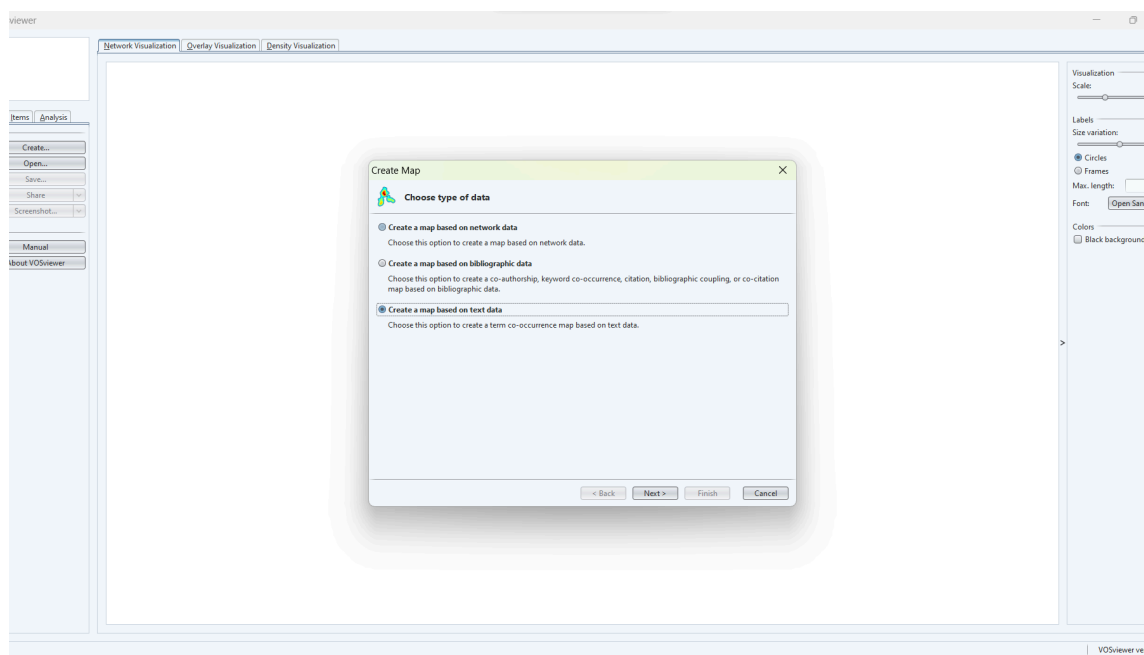
Table 2. The development of research on digital learning media.

Years of Publication	Number of Publication
2023	238
Total	**238**
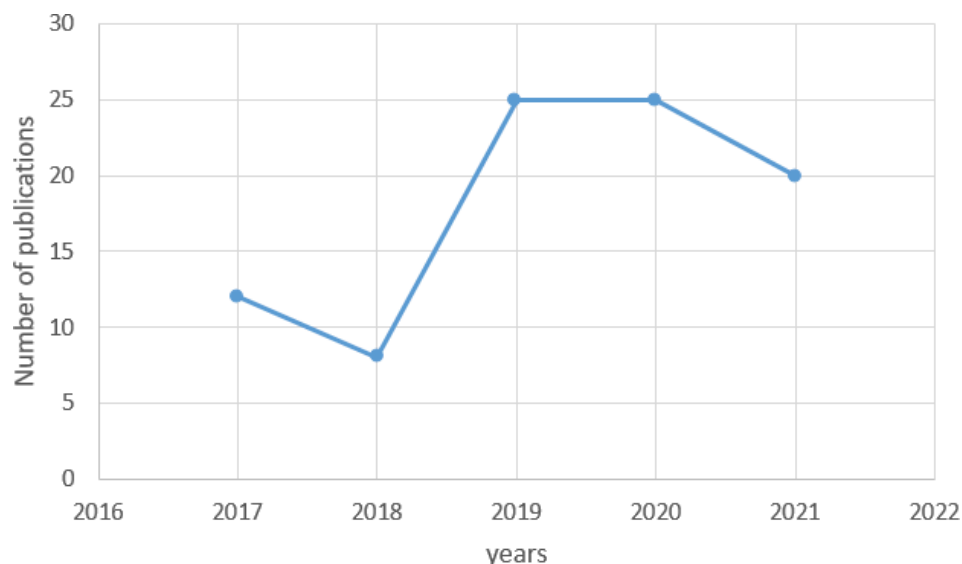
Figure 12. Graph of the level of research development on digital learning media.

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.
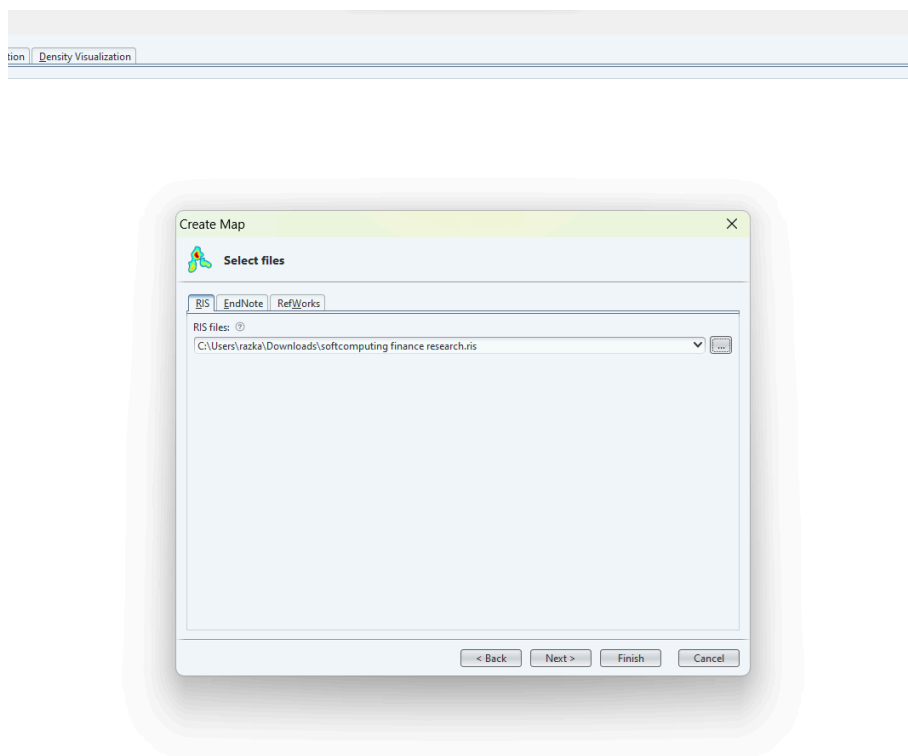
e. Choose counting method

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.
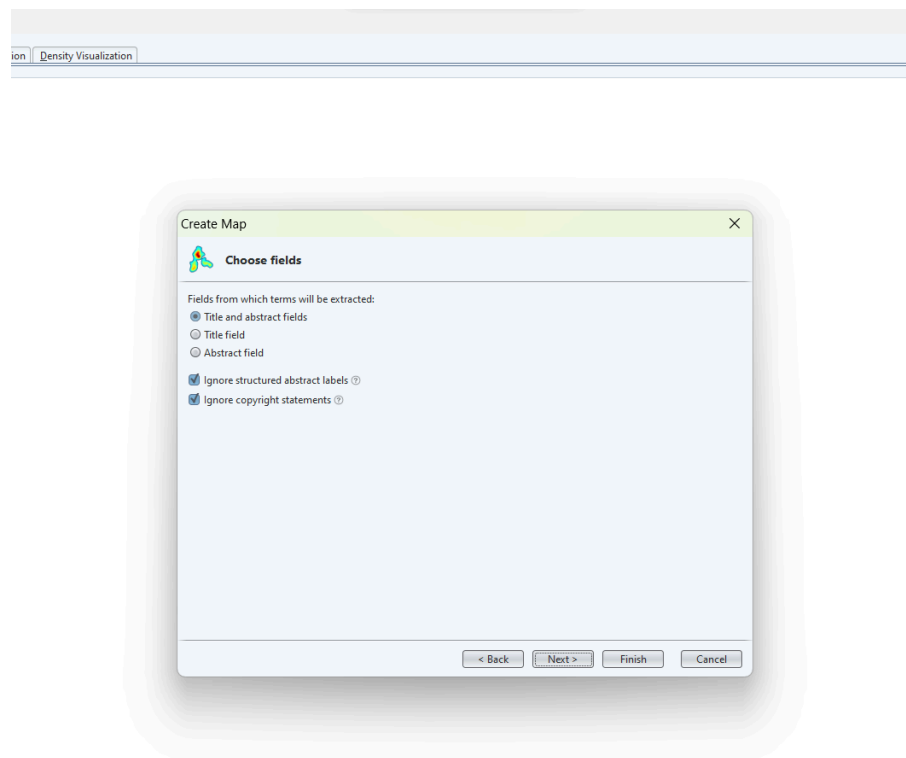
f. Choose Threshold

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.
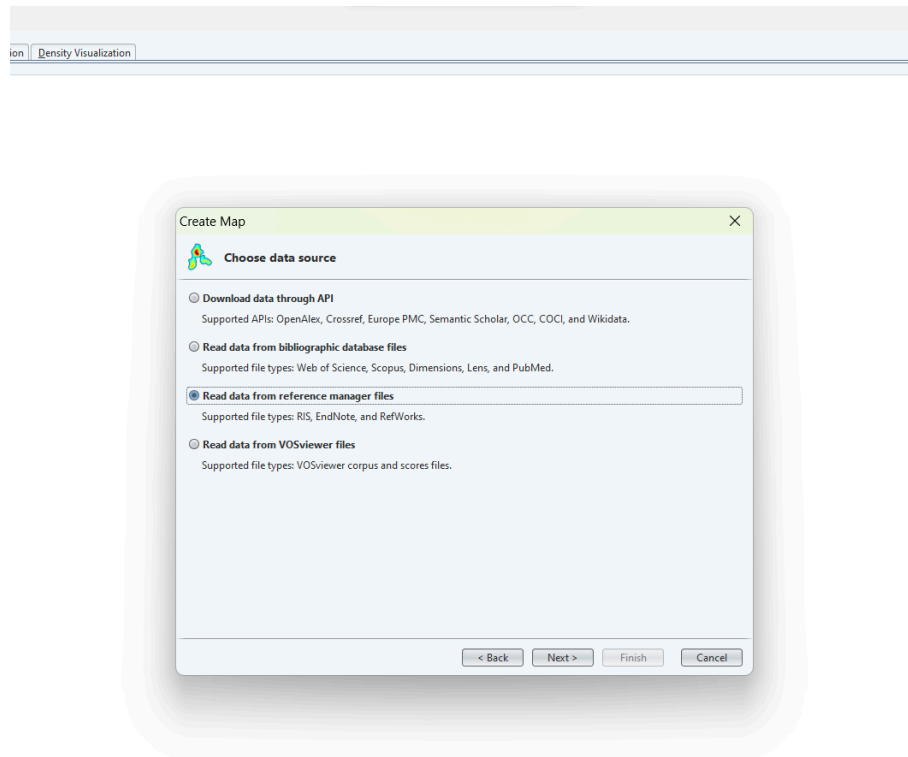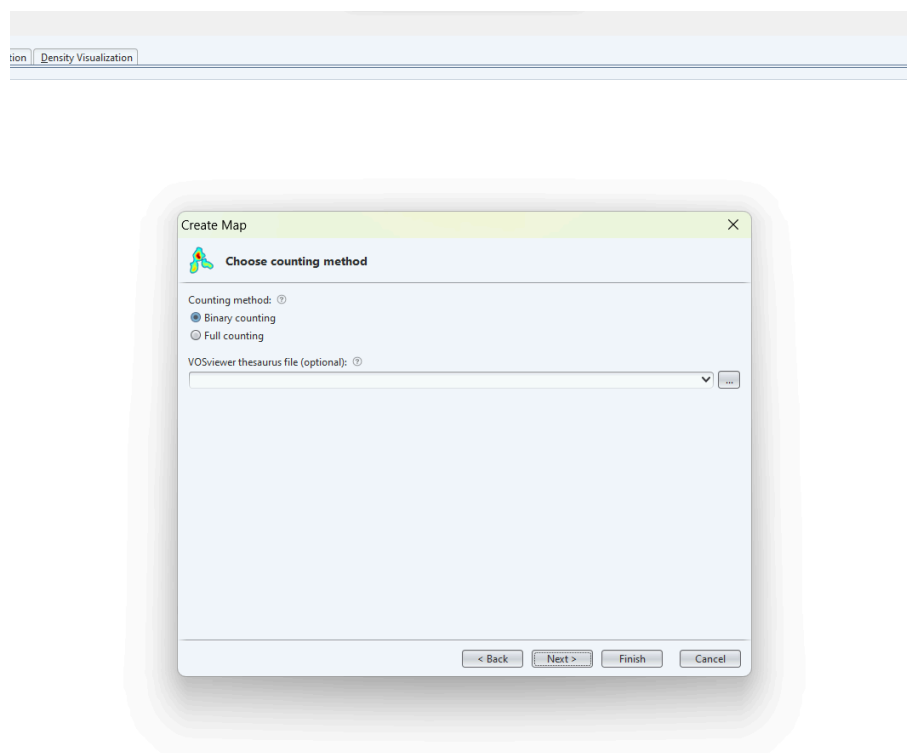
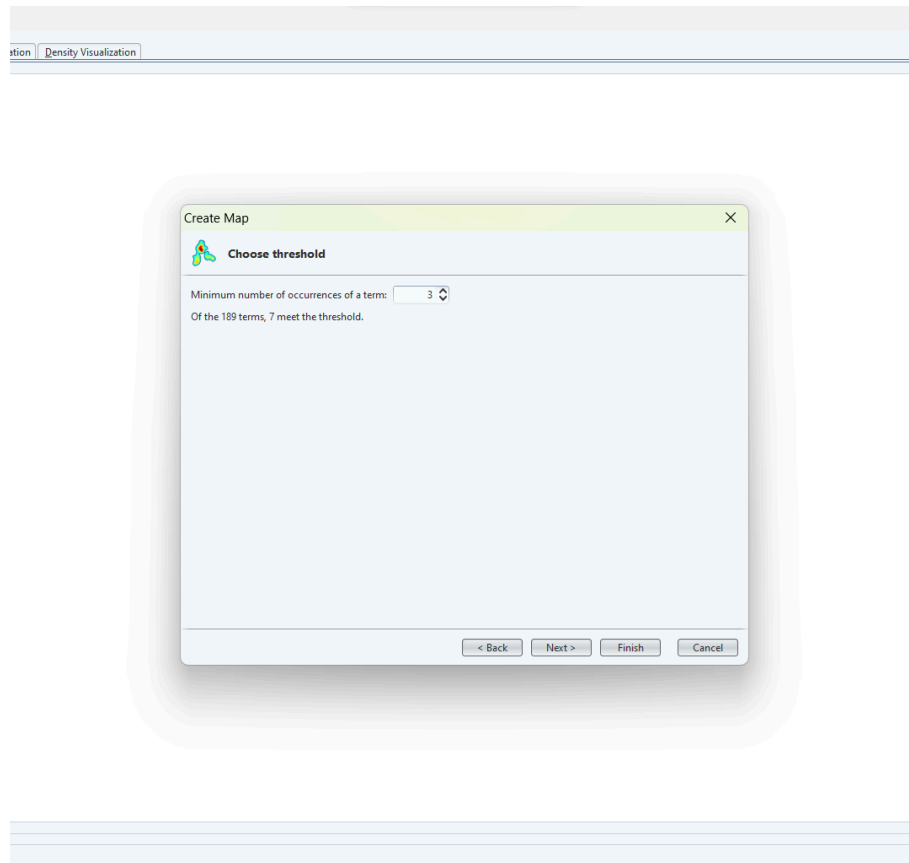**Figure 14.** Selection of data sources on VOSviewer.

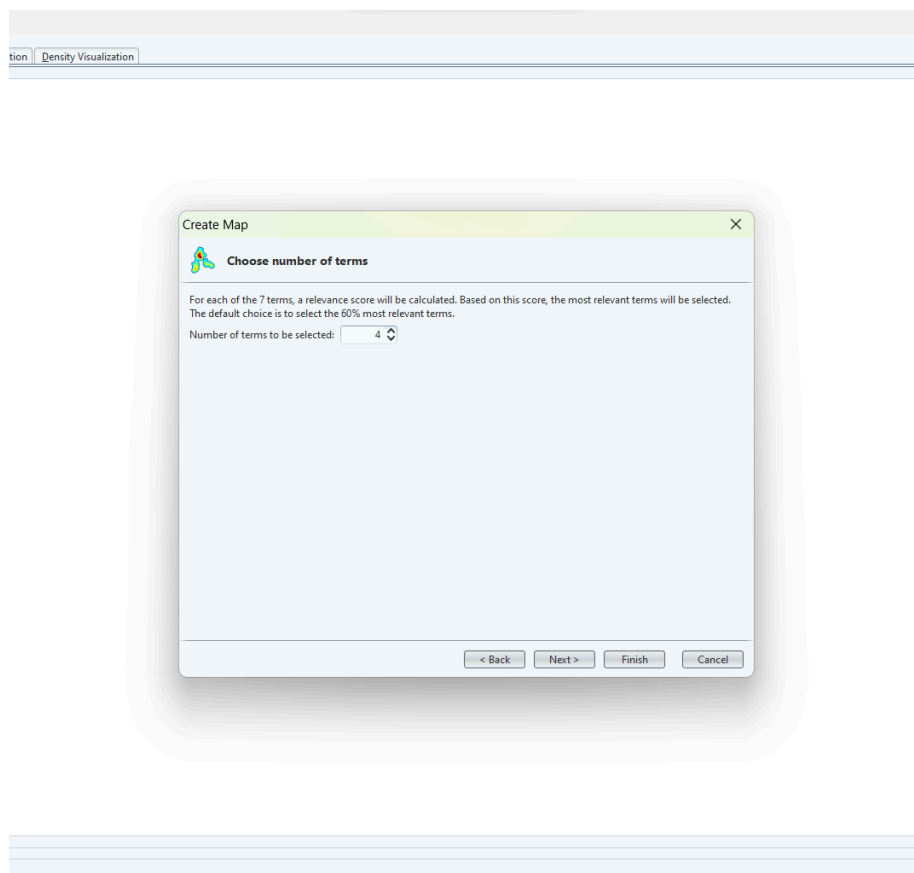**Figure 15.** Selection of the file to be used as the source of mapping data in VOSviewer.

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**.
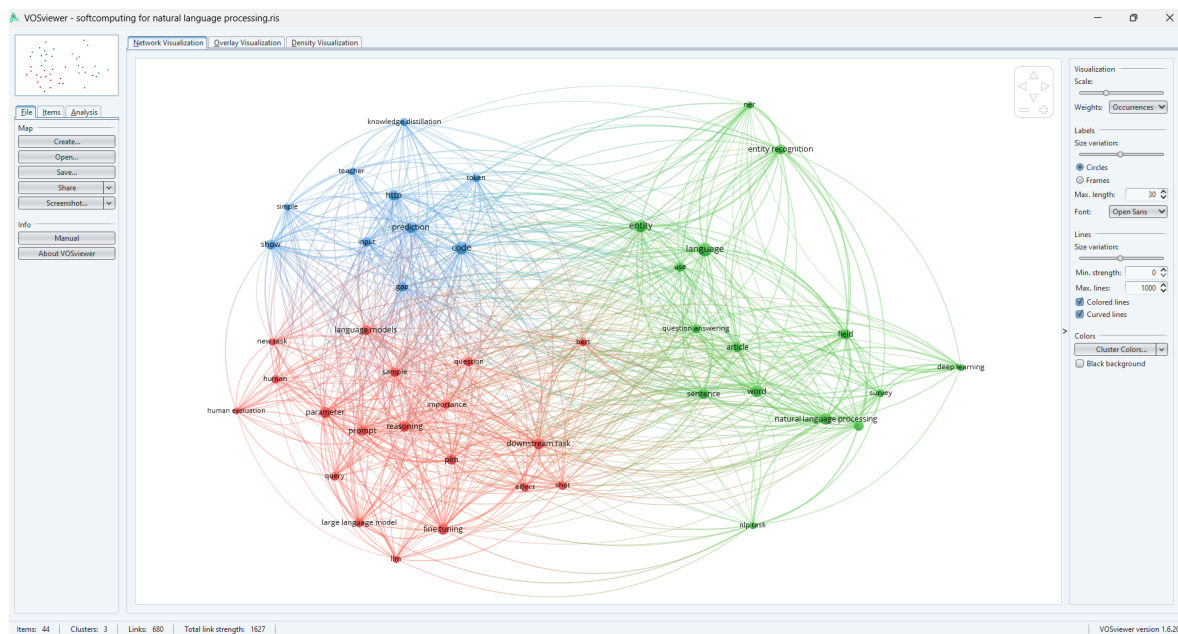

Figure 20. Verification of word selection on VOSviewer.

Figure 21. The results of the mapping of the research on VOSviewer.
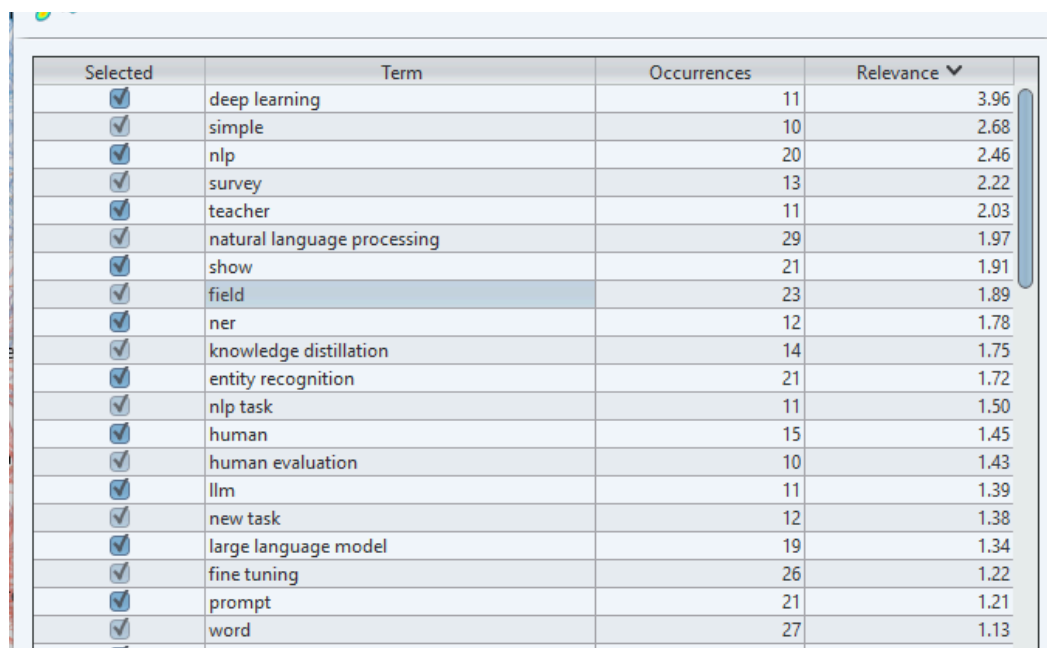
3.2.1. Co-Word Map network visualization

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.
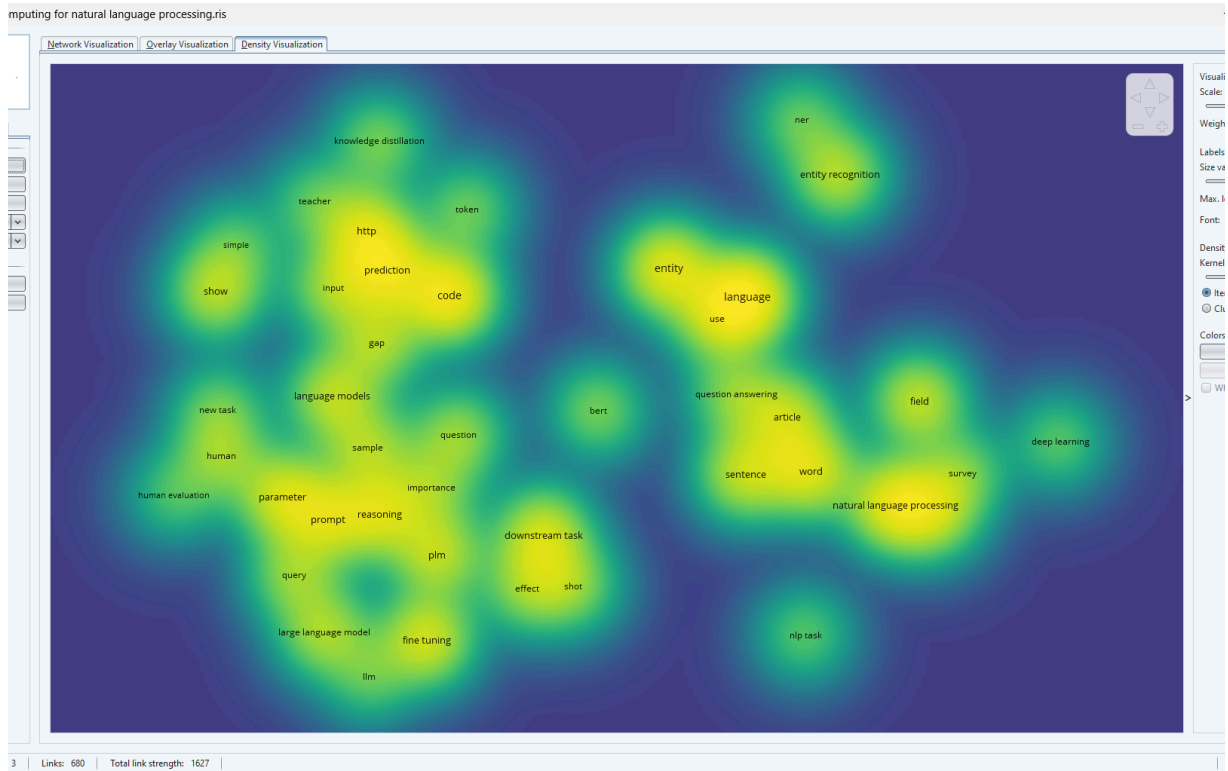
3.2.2. Co-Word map density visualization

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).

Selected	Term	Occurrences	Relevance ⌄
✓	deep learning	11	3.96
✓	simple	10	2.68
✓	nlp	20	2.46
✓	survey	13	2.22
✓	teacher	11	2.03
✓	natural language processing	29	1.97
✓	show	21	1.91
✓	field	23	1.89
✓	ner	12	1.78
✓	knowledge distillation	14	1.75
✓	entity recognition	21	1.72
✓	nlp task	11	1.50
✓	human	15	1.45
✓	human evaluation	10	1.43
✓	llm	11	1.39
✓	new task	12	1.38
✓	large language model	19	1.34
✓	fine tuning	26	1.22
✓	prompt	21	1.21
✓	word	27	1.13

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.

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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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