ASEAN Journal of Community and Special Needs Education

Journal homepage: https://ejournal.bumipublikasinusantara.id/index.php/ajcsne

Bibliometric Analysis for Understanding "Science Education" for "Student with Special Needs" using VOSviewer

*Sofi Septiani Julaeha Nursaniah, Asep Bayu Dani Nandiyanto**

Universitas Pendidikan Indonesia, Bandung, Indonesia

*Correspondence: E-mail: nandiyanto@upi.edu

ABSTRACT

Science education for students with special needs requires a student-centered approach. For students with exceptional needs, science education is being implemented various paradigms of learning exist, including "Science, Technology, Engineering, and Mathematics" (STEM), scientific learning, etc. With the aid of data mapping (VOSviewer software) and a bibliometric evaluation strategy, this study seeks to examine the breadth of research on science education for students with special needs. Material research data was collected from the application reference manager database from 2013-2022. The search is directed by the study material's title, keywords, and abstract. A study employing the number of publications collected up to 1000 linked articles was done for the 2013–2022 timeframe. Based on the number of publications related to science education, it has decreased. However, 2020 publications related to science education experienced an increase in number but it continued to decline for the next year. This study highlights the value of bibliometric analysis in providing information about how phenomena occur. This study is intended to assist and become a reference for researchers in conducting and deciding research topics.

ARTICLE INFO

Article History:
Submitted/Received 24 Nov 2022
First Revised 18 Dec 2022
Accepted 23 Feb 2023
First Available online 25 Feb 2023
Publication Date 01 Mar 2023

Keyword:
Bibliometric,
Science,
Science education,
Special needs,
Studen,t
VOSviewer.

1. INTRODUCTION

Science education involves teaching pupils about nature and how to systematically investigate it. Learning science is strongly tied to information gained by scientific method-based observation, proof, discovery, and experimentation. Three main categories make up the essence of scientific study or science, namely processes, products, and attitudes. The scientific or science learning process method should be more student-orientated (student-centric) and less teacher-centered (Yasmin *et al*., 2015). A scientific learning methodology has been applied to science education in Indonesia (Asyhari, 2015). Through research, direct experience, and the development of critical thinking skills, science learning is intended to help students make connections between different concepts or theories (Surasmi, 2013).

Only when the offered material is relevant to students can meaningful learning be attained. As a result, science instruction for children with special needs must be made readily available to them, particularly through the use of user-friendly media and teaching aids. Differentiation in science instruction is also necessary due to the wide range of characteristics among students with special needs (Scruggs & Mastropieri, 2007; Brigham *et al*., 2011). The guided inquiry model is one educational strategy that can be used to actively engage students in the development of science process skills, knowledge, and experiences. Each student has unique traits, thus they cannot all be treated equally, so the teacher accommodates them following their needs. (Florian & Linklater, 2010). Differentiated learning is not the same as individualized learning. Learning differentiation is directed at the teacher's ability to engineer learning to suit the needs of students (Baum *et al*., 2001). In science education, this differentiation can include modification of learning objectives, materials, content, or learning media.

Science education for students with special needs is developing alongside science itself, and research on this subject is expanding year after year. Learning techniques, methods, new learning mediums, and other studies are all examples of existing studies. However, there hasn't been a lot of bibliometric analysis research done on the subject of science education for students with special needs.

Therefore, we chose to examine bibliometric analysis with the keyword "science education for students with special needs". This study aims to conduct bibliometric science education research by combining mapping results using VOSviewer software. This research is expected to be a reference for researchers in conducting and determining research topics to be taken, especially those related to science education for students with special needs.

2. METHODS

This study uses article data that has been published in journals indexed by Google Scholar. These data are collected and processed using the Publish or Perish application as the database source. This reference management application is used to collect research data that has been published related to the topic of science education. Research data from published articles were collected and filtered from 2013-2022. The keywords used to compile the articles are "science education" and "special needs education" to get 1000 articles related to this topic. Keyword frequency is set as desired when generating the bibliometric map, and irrelevant or less relevant terms are omitted.

The collected data were analyzed and mapped based on the required categories. There are three forms of data mapping: network, density, and overlay visualization. Furthermore, this data mapping is visualized using the data mapping application, VOSviewer. The VOSviewer application is an open-source application that can be used to create bibliometric maps to

DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309

visualize and analyze trends. Data mapping is made based on database sources that have been prepared (Nandiyanto & Al Husaeni, 2021; Al Husaeni & Nandiyanto, 2022; Al Husaeni & Nandiyanto, 2023).

3. RESULTS AND DISCUSSION

3.1. Research Development in the Field of Science Education for Students with Special Needs

The development of research related to the study of science education for students with special needs within a period of 10 years (2013-2022) is shown in **Figure 1**, showing that the number of publications related to science education for students with special needs has decreased every year. A significant increase in the number of publications on this topic occurred in 2020. The number of publications in 2013 was 225 articles. Then there was a decrease in 2014 so the number of articles became 177 articles. This decline continued until 2019. In 2015 there were only 145 articles, in 2016 there were only 129 articles, in 2017 there were only 106 articles, in 2018 there were only 79 articles, and in 2019 there were only 37 articles. Even though the trend of articles discussing science education for students with special needs has decreased in the last 6 years, in 2020 it has increased again from 2019, namely, there were 74 published articles. However, in 2021-2022 it has again experienced a drastic decline to 19 articles in 2021 and 5 articles in 2022. Berdasarkan Gambar 1, trend paling tinggi terjadi pada tahun 2013 dikarenakan pada tahun ini pendekatan pembelajaran berbasis STEM (Science, Technology, Engineering, and Mathematics) banyak dipelajari dan diimplementasikan di dunia pendidikan (Li *et al.*, 2020). Di Indonesia sendiri pendekatan pembelajaran seperti ini diintegrasikan pada kurikulum pendidikan nasional (Falentina, 2018; Sartika, 2019).

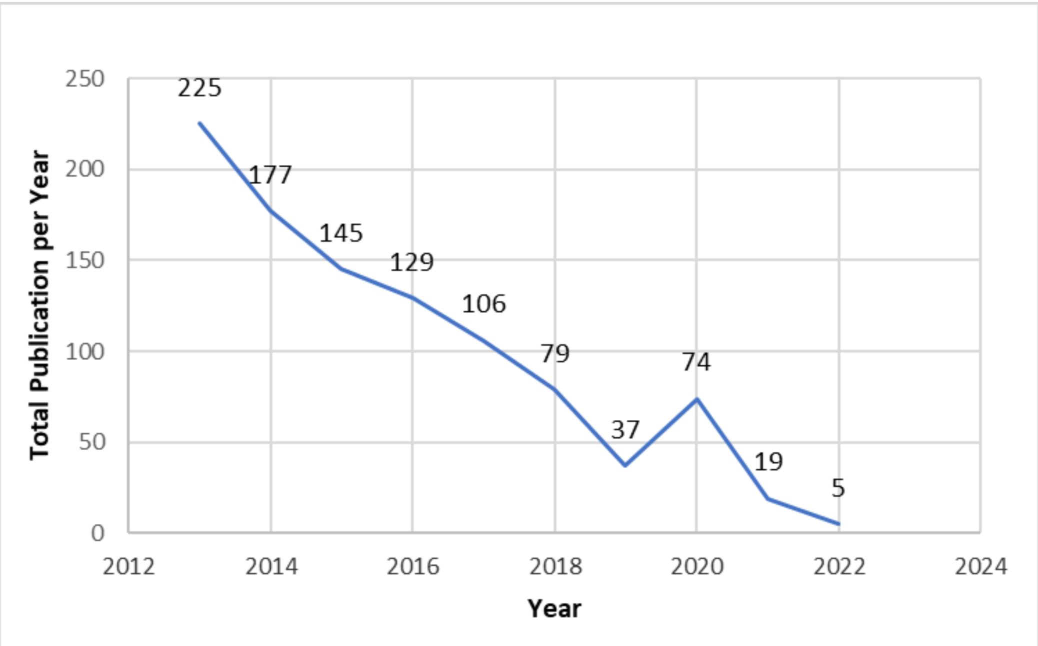

Figure 1. Developmental level of research on science education for students with special needs.

Based on a total of 1000 published articles on science education for students with special needs, there are 20 articles with the highest number of citations based on search results through the Google Scholar database. In detail, this data is sorted from the highest to the smallest citation shown in **Table 1**.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309

Table 1. List articles with the most citations.

No.	Authors	Title	Year	Source	Citation
1.	H Wickham, M Averick, J Bryan, W Chang…	Welcome to the Tidyverse	2019	The Journal of Open Source Software	7683
2.	AH Schoenfeld	Learning to think mathematically: Problem-solving, metacognition, and sense making in mathematics (Reprint)	2016	Journal of Education	7137
3.	M Raissi, P Perdikaris, GE Karniadakis	Physics-informed neural networks: A deep learning framework for solving forward and inverse problems involving nonlinear partial differential equations	2019	Journal of Computational Physics	5172
4.	B Pfefferbaum, CS North	Mental health and the Covid-19 pandemic	2020	New England Journal of Medicine	4402
5.	P McCrory, WH Meeuwisse, M Aubry…	Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport, Zurich, November 2012	2013	Journal of Athletic Training	3928
6.	FC Bull, SS Al-Ansari, S Biddle, K Borodulin…	World Health Organization 2020 guidelines on physical activity and sedentary behaviour	2020	British Journal of Sport Medicine	3877
7.	M Maguire, B Delahunt	Doing a thematic analysis: A practical, step-by-step guide for learning and teaching scholars.	2017	All Ireland Journal of Higher Education	3764
8.	P McCrory, W Meeuwisse, J Dvorak, M Aubry…	Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016	2017	British Journal of Sport Medicine	3593
9.	AL Catapano, I Graham, G De Backer…	2016 ESC/EAS guidelines for the management of dyslipidaemias	2016	European Heart Journal	3227
10.	BL Zhong, W Luo, HM Li, QQ Zhang…	Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey	2020	International Journal of Biological Sciences	3196
11.	VN Anney	Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria	2014	Journal of Emerging Trends in Educational Research and Policy Studies	3048
12.	A Joshi, S Kale, S Chandel, DK Pal	Likert scale: Explored and explained	2015	Journal of Applied Science and Technology	2988
13.	MG Bellemare, Y Naddaf, J Veness…	The arcade learning environment: An evaluation platform for general agents	2013	Journal of Artificial Intelligence Research	2908

DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309

Table 1 (continue). List articles with the most citations.

No.	Authors	Title	Year	Source	Citation
14.	A Moser, I Korstjens	Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis	2018	European Journal of General Practice	2547
15.	V Lyubashevsky, C Peikert, O Regev	On ideal lattices and learning with errors over rings	2013	Journal of the ACM (JACM)	2471
16.	C Son, S Hegde, A Smith, X Wang…	Effects of COVID-19 on college students' mental health in the United States: Interview survey study	2020	Journal of Medical Internet Research	2392
17.	D Roy, S Tripathy, SK Kar, N Sharma, SK Verma…	Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic	2020	Asian Journal of Agriculture	2355
18.	J Crawford, K Butler-Henderson…	COVID-19: 20 countries' higher education intra-period digital pedagogy responses	2020	Journal of Applied Learning and Teaching	2332
19.	AG Baydin, BA Pearlmutter, AA Radul…	Automatic differentiation in machine learning: a survey	2018	Journal of Machine Learning Research	2278
20.	HK Mohajan	Qualitative research methodology in social sciences and related subjects	2018	Journal of Economic Development, Environment and People	2271

3.2. Clusters Resulting from the VOSviewers Mapping with Keyword of Science Education for Student with Special Needs

Determining the minimum number of relationships between terms on VOSviewer is determined by two terms (Nandiyanto & Al Husaeni, 2021). In this study, the terms used are "science education" and "special needs". The number of clusters obtained from the VOSviewer mapping with the keywords Science education and special needs is 4 clusters. Each cluster differs from the others in terms of its size, composition, and color. The size of the circle varies from one component of the circular cluster to the next. The frequency of the circle's appearance determines its size. (Mulyawati & Ramadhan, 2021). The keyword is used more frequently when the circle is larger, and less frequently when the circle is smaller.

Following are the four clusters identified by the VOSviewer mapping results using the keyword science education and special needs:

(i) Cluster 1 which is marked in red has 16 items (see **Figure 2**), there are classroom, educational research, effectiveness, engineering, interest, journal, mathematics, meta-analysis, motivation, online learning, perception, science learning, science teaching, stem, systematic literature review, and theory.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309

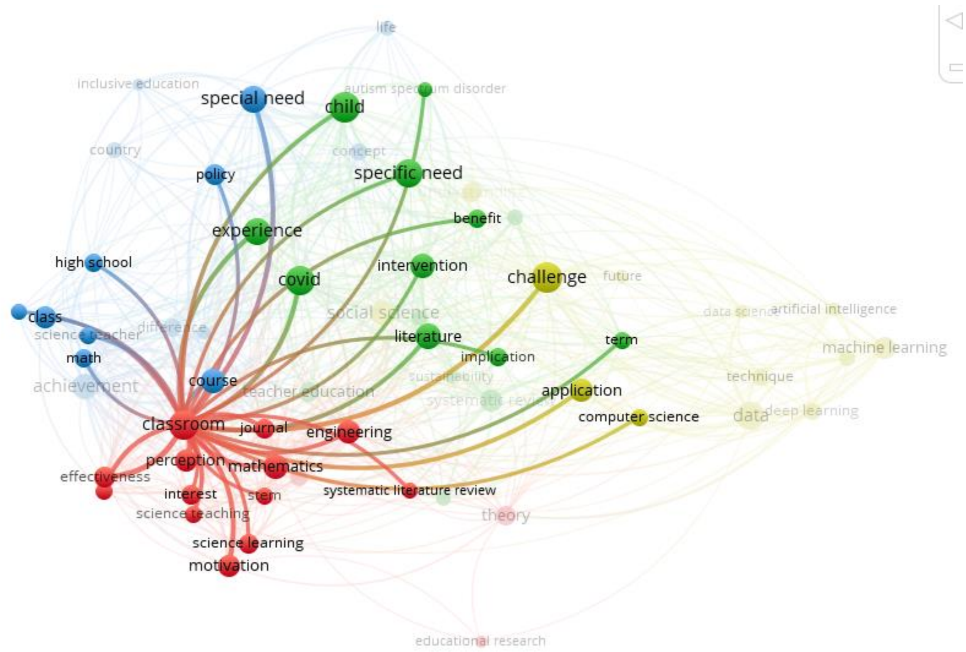

Figure 2. Network visualization of student term in cluster 1.

(ii) Cluster 2 which is marked in green has 16 items (see **Figure 3**), there are autism spectrum disorder, benefit, child, covid, experience, implication, individual, intervention, literature, specific need, sustainability, systematic review, teacher education, term, value, and web.

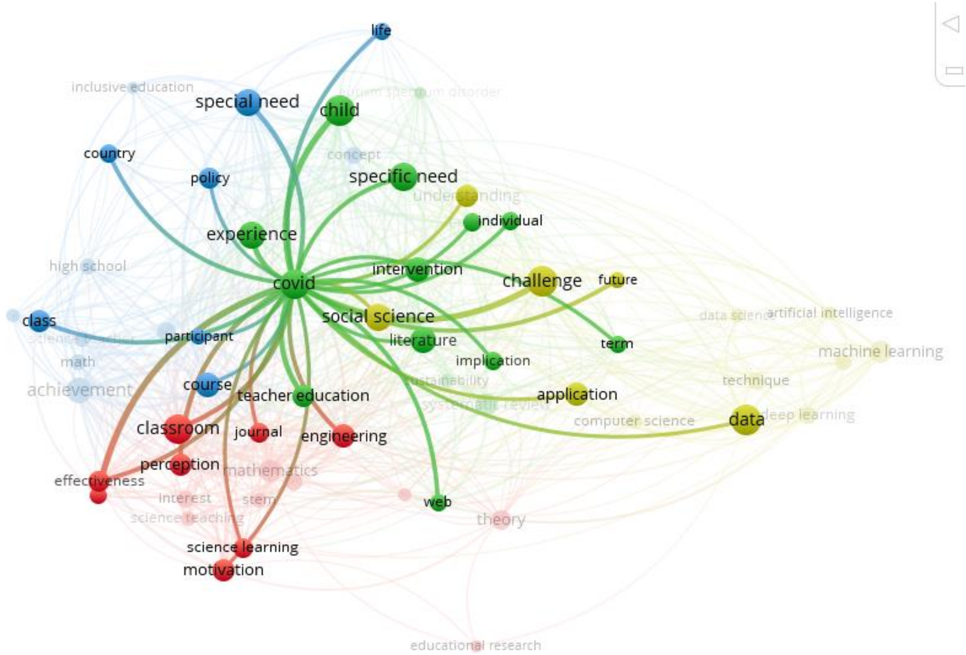

Figure 3. Network visualization of student term in cluster 2.

(iii) Cluster 3 which is marked in blue has 15 items (see **Figure 4**), there are achievement, class, concept, country, course, difference, high school, inclusive education, influence, life, math, participant, policy, science teacher, and special need.

DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309

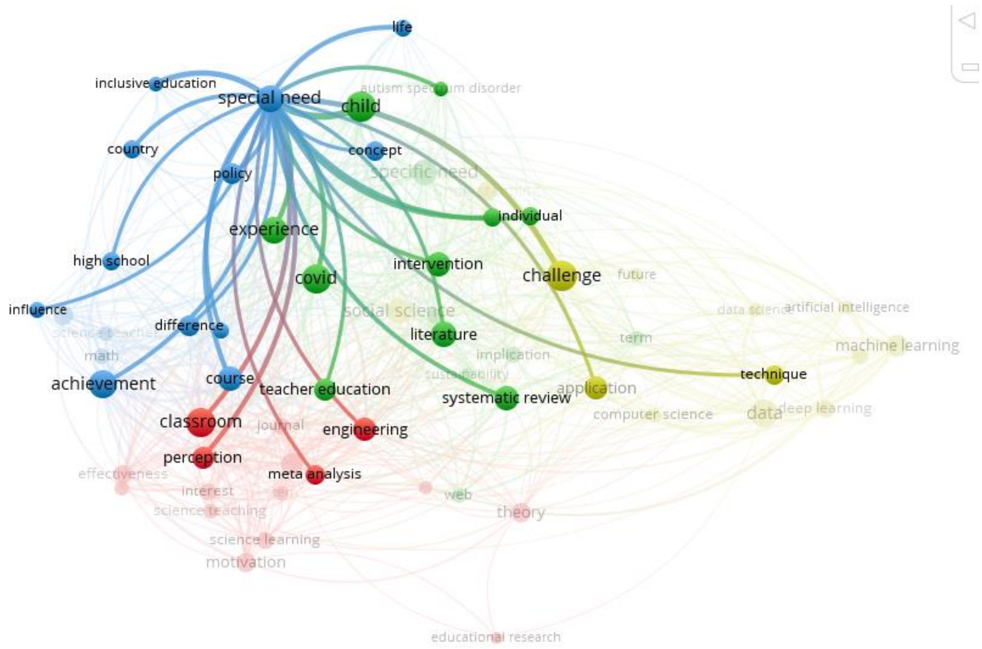

Figure 4. Network visualization of student term in cluster 3.

(iv) Cluster 4 which is marked in yellow has 13 items (see **Figure 5**), there are application, artificial intelligence, challenge, computer science, deep learning, future, machine, machine learning, social science, technique, and understanding.

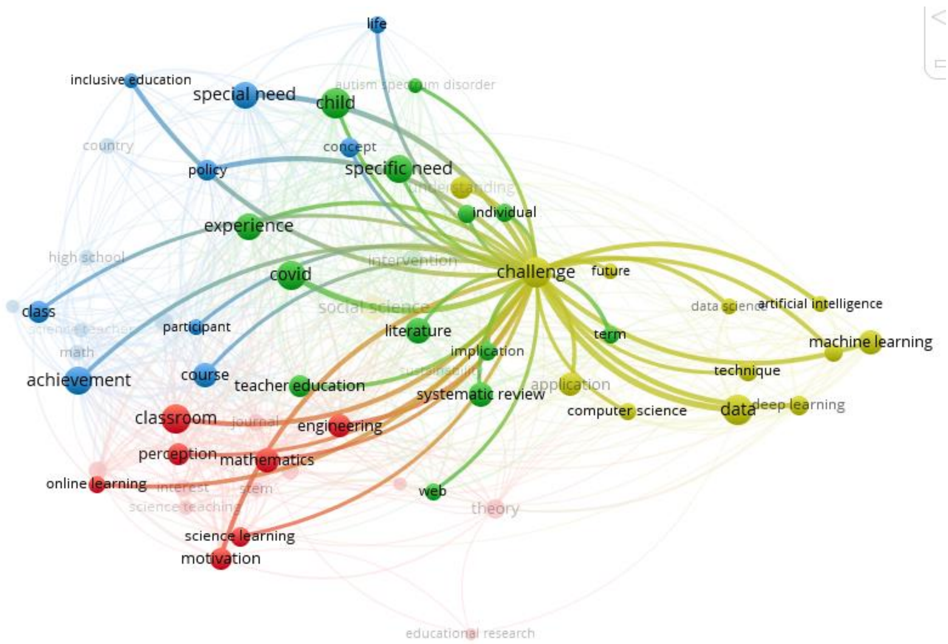

Figure 5. Network visualization of student term in cluster 4.

3.3. Visualization Science Education Topic Area Using VOSviewer

The three visualization types that VOSviewer may present are network visualization (see **Figure 6**), overlay visualization (see **Figure 7**), and density visualization (see **Figure 8**). In network visualization, the relationships between terms are shown as networks or lines that connect one term to another.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309

Figure 6 shows the clusters in the science education research topic area. Based on **Figure 6**, science education has links with 4 clusters, 60 items, 598 links, and 1034 link strengths.

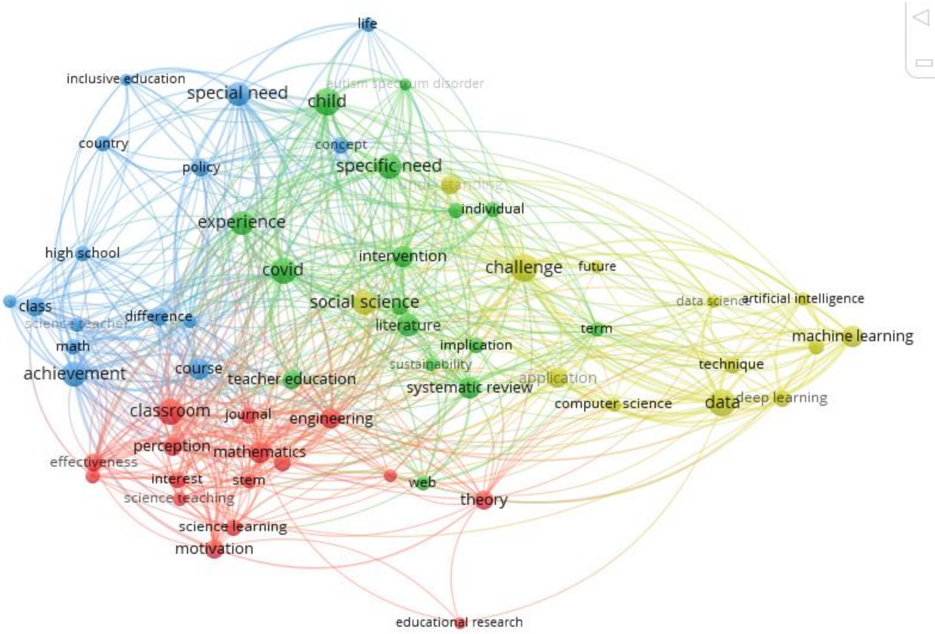

Figure 6. Network visualization on science education topic.

Figure 7 shows the shape of the overlay visualization. In this overlay visualization, we can see the year in which research is often done on the keyword we are looking for (Ragadhita & Nandiyanto; 2022; Al Husaeni & Nandiyanto, 2023). In **Figure 7** it can be seen that the keywords "science education" and "special needs" were widely researched in early 2015 - early 2017.

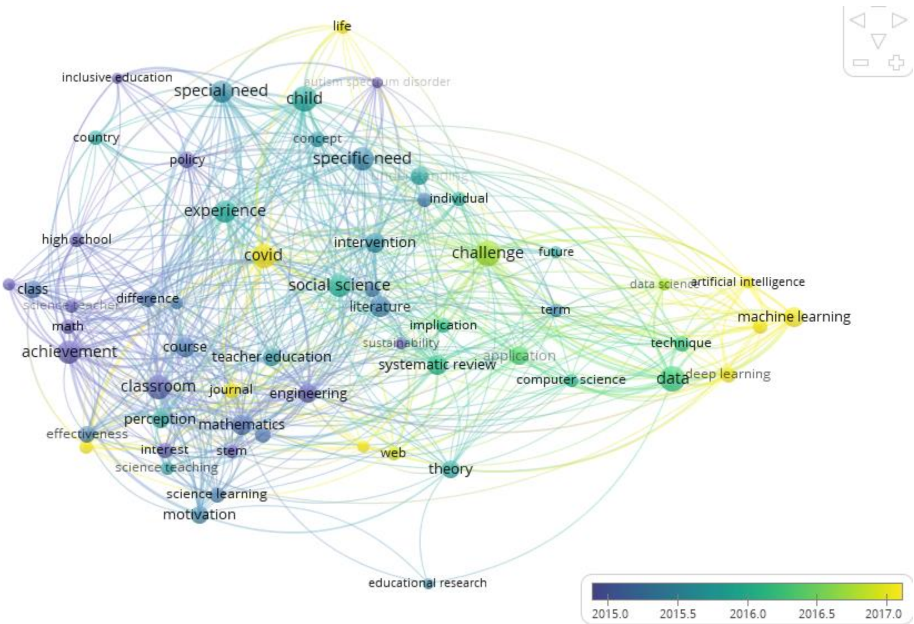

Figure 7. Overlay visualization of science education topic.

Figure 8 shows the shape of the density visualization. In this density visualization, we can see how often or rarely keywords are searched (Ragadhita & Nandiyanto, 2022; Al Husaeni & Nandiyanto, 2023). **Figure 8** shows a density visualization of the research topic with the

DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309

keywords "science education" and "special needs". The indicator that determines how often a keyword is researched is the color that the term contains. The darker or lighter the color, the more frequently the term is studied and the dimmer the color, the less frequently the term is studied.

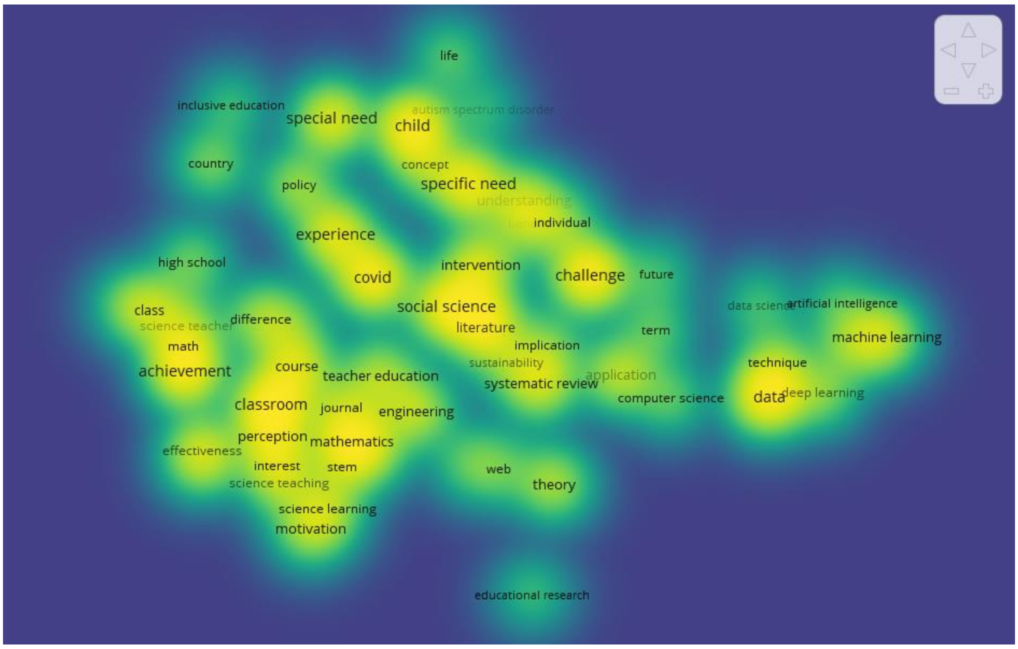

Figure 8. Density visualization of science education topic.

4. CONCLUSION

This research is a bibliometric analysis by integrating mapping analysis with VOSviewer software in research issues with the topic of science education for students with special needs. Data collection and management using publish or perish reference management tools. The information collected was filtered using the keywords "science education" and "special needs". Topic, title, keywords, and abstract are some of the bibliographical data used in this study. Found 1000 articles published from 2013 to 2022 relating to the keywords "science education" and "special needs". The results of this study are that the number of articles published from 2013-2022 on science education for students with special needs has decreased every year. The most articles on this topic are in 2013 and the fewest in 2022. Some of the articles obtained have been cited with more than 7000 citations. A search with the keyword science education produces 4 clusters, each cluster having a different number of items. Each classification is indicated by a circle with a different color.

5. 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.

6. REFERENCES

Al Husaeni, D. F., and Nandiyanto, A. B. D. (2022). 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. *ASEAN Journal of Science and Engineering*, *2*(1), 19-46.

Al Husaeni, D. F., and Nandiyanto, A. B. D. (2023). Mapping visualization analysis of computer science research data in 2017-2021 on the google scholar database with vosviewer. *International Journal of Informatics Information System and Computer Engineering*, *3*(1), 1-18.

Asyhari, A. (2015). Profil peningkatan kemampuan literasi sains siswa melalui pembelajaran saintifik. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *4*(2), 179-191.

Baum, S. M., Cooper, C. R., and Neu, T. W. (2001). Dual differentiation: An approach for meeting the curricular needs of gifted students with learning disabilities. *Psychology in the Schools*, *38*(5), 477-490.

Brigham, F. J., Scruggs, T. E., and Mastropieri, M. A. (2011). Science education and students with learning disabilities. *Learning Disabilities Research and Practice*, *26*(4), 223-232.

Falentina, C. T. (2018). Mobil bertenaga angin: Media berbasis stem untuk siswa kelas IV sekolah dasar. *PEDADIDAKTIKA: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *5*(3), 152-162.

Florian, L., and Linklater, H. (2010). Preparing teachers for inclusive education: Using inclusive pedagogy to enhance teaching and learning for all. *Cambridge Journal of Education*, *40*(4), 369-386.

Husaeni, D. N. A., and Nandiyanto, A. B. D. (2023). Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar. *Indonesian Journal of Educational Research and Technology*, *3*(1), 1-12.

Li, Y., Wang, K., Xiao, Y., and Froyd, J. E. (2020). Research and trends in STEM education: A systematic review of journal publications. *International Journal of STEM Education*, *7*(1), 1-16.

Mulyawati, I. B., and Ramadhan, D. F. (2021). Bibliometric and visualized analysis of scientific publications on geotechnics fields. *ASEAN Journal of Science and Engineering Education*, *1*(1), 37-46.

Nandiyanto, A. B. D., and Al Husaeni, D. F. (2021). A bibliometric analysis of materials research in Indonesian journal using VOSviewer. *Journal of Engineering Research*, *9*(ASSEEE Special Issue), 1-16.

Sartika, D. (2019). Pentingnya pendidikan berbasis STEM dalam kurikulum 2013. *JISIP (Jurnal Ilmu Sosial dan Pendidikan)*, *3*(3), 89-93.

Scruggs, T. E., and Mastropieri, M. A. (2007). Science learning in special education: The case for constructed versus instructed learning. *Exceptionality*, *15*(2), 57-74.

Surasmi, W. A. (2013). Penerapan pendekatan saintifik dalam proses pembelajaran kurikulum 2013. *Gospodarka Materiałowa i Logistyka*, *26*(4), 185-197.

Yasmin, N., Ramdani, A., and Azizah, A. (2015). Pengaruh metode inkuiri terbimbing terhadap keterampilan proses sains dan hasil belajar biologi siswa kelas VIII di SMPN 3 Gunungsari tahun ajaran 2013/2014. *Jurnal pijar MIPA*, *10*(2), 69-75.

DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2828-3236 e- ISSN 2828-3309