



Bibliometric Mapping of the Mathematics Role in Daily Life

Ahmad Iswanto¹, Asma Ul Husna², Kiki Amalia³, Kristianti⁴, Nur Kurniyasih⁵, Muntazhimah^{6*}

^{1,2,3,4,5,6} Mathematics Education, University of Muhammadiyah Prof. Dr. Hamka. Indonesia

Correspondence: ✉ muntazhimah@uhamka.ac.id

Article Info

Article History

Received: 23-05-2022

Revised: 17-06-2022

Accepted: 17-06-2022

Keywords:

Bibliometric;
Google Scholar;
Mathematics Role;
Publish or Perish;
VOS Viewer

Abstract

This study aims to analyze the bibliometric mapping the mathematics' role in everyday life. This study uses a qualitative method by comparing the information obtained from a Google Scholar search. This method is entirely based on the hunt for journal articles developed through bibliometric analysis. Data was collected using Publish or Perish (PoP) and visualized using a VOS viewer. In this study, researchers obtained metadata from as many as 995 articles of applied mathematics in everyday life published on April 15, 2022, using a database of 1000 articles from 1926 to 2022. The results and discussion of the bibliometric analysis that has been carried out show that this research topic is still possible. Other researchers for the next period because the data that has been analyzed is still categorized as feasible, and there are still few studies related to bibliometric mapping of the role of mathematics in everyday life. Then suggestions for further research if researchers are interested in choosing a research topic on bibliometric mapping of the role of mathematics in everyday life, namely by connecting various other activities in society and combining it with the progress that developed during the research period so that the data obtained is always up-to-date to evaluate the effectiveness of mathematics in daily life.

INTRODUCTION

The 21st century is a period of global development of science and technology, which changes people's habits toward something new, especially in the field of knowledge. Knowledge always related to everyday life is not far from mathematics[1]–[4]. Mathematics is a habit used as a fundamental concept in solving problems in activities to make a decision or conclusion with a logical and rational pattern of thinking. Habits that people always carry out in living their daily lives in mathematics are identical trades in calculating the weight of goods, trade profits, and others. Mathematics has many functions, including comparing pocket money, calculating the weight of objects, and various other disputes [5].

In addition, mathematics is also related to the world of education, where changes that occur in everyday life, both in the development of science and technology and other fields are basically from the world of education. Education can change and create HR (Human Resources), which will later be guided to have an ability that plays a vital role in social life, namely the ability to reason mathematically, behavior patterns, and resilience. Mathematical reasoning is an ability possessed by each individual in carrying out the thinking process related to deciding on the form of a

conclusion[6]–[10]. Indicators of mathematical reasoning ability are: (1) Submitting conjectures, (2) Performing mathematical manipulations, (3) Compiling evidence and providing reasons for solutions, (4) Checking the validity of arguments, and (5) Drawing conclusions from statements[11]–[14].

Resilience is a form of individual effort to adapt efficiently related to conditions that lead to an emphasis on a good direction to be able to overcome various difficulties.[15]. In the development of the concept of resilience, resilience is influenced not only by individual and genetic factors but many other things that form the basis for the influence of one's characteristics, especially for students at school, including results from culture, environment, and others. There is a theory from an expert in the field of the concept of resilience, namely Reivich and Shatte, whose theory states that resilience is a skill in overcoming and being able to adapt to an event that occurs in one's life. Then Thomsen's theory says that every individual has an origin of resilience.[16].

The mathematical resilience in this study was adapted from the indicators of mathematical strength in Sumarmo's theory [17], [18], namely: (1) Showing perseverance, self-confidence, and others in dealing with various levels of problems related to failure and not actual, (2) There is a sense of desire to socialize related to discussions with peers, (3) Generating new ideas by seeking creative solutions, (4) Use the concept of experience to build motivation, (5) Have a high curiosity for images related to research from various sources, (6) Have expertise in regulating personality levels in a conscious situation based on their feelings.

Based on previous research by Jenning & Dunne, "most students have difficulty in applying mathematics in everyday life because, in learning mathematics, the real world is only used as a place to apply concepts, not as tools and resources in learning mathematical knowledge. According to Jenning & Dunne, this is the initial cause of students' difficulty learning mathematics. Namely, mathematics is felt to be less meaningful.[19], [20]. However, along with the development of science and technology, research has been carried out by Haris Kurniawan, where it was found that there are several benefits from studying mathematics in everyday life, namely: (1) Solving problems; (2) commercial activities; (3) Critical and systematic thinking patterns; (4) The development of ways of thinking; (5) Counting skills; (6) Skills to make deductive conclusions; (7) Accurate attitude[21].

But so far, there has been no study of bibliometric mapping on the role of mathematics in everyday life. Therefore, from the results of the exposure of several studies that previous researchers have carried out, the current research takes the topic of the role of mathematics in everyday life. Then this study also aims to analyze Bibliometrics on the part of mathematics in everyday life.

METHOD

In the research method applied in this study, the researchers obtained a population of 995 articles about the mathematics involved in daily life published on April 15, 2022, using a database of 1000 articles from 1926 to 2022. The study used qualitative methods to compare the information obtained from google scholar searches. This method is based on searching for journal articles developed through bibliometric analysis. Data was collected using Publish or Perish (PoP) and visualized using VOSviewer [22].

RESULTS AND DISCUSSION

Results

Based on the results of a search for articles on Google Scholar about the bibliometric mapping of the role of mathematics in everyday life until 2022, the data comes from a Publish or Perish (PoP) search and is then stored in CSV type, which is analyzed through Microsoft Excel, as many as 1000 article metadata have been obtained, but extracted from the metadata are only 995 articles. The graphs related to the cycle of 1000 article metadata brought are as follows:

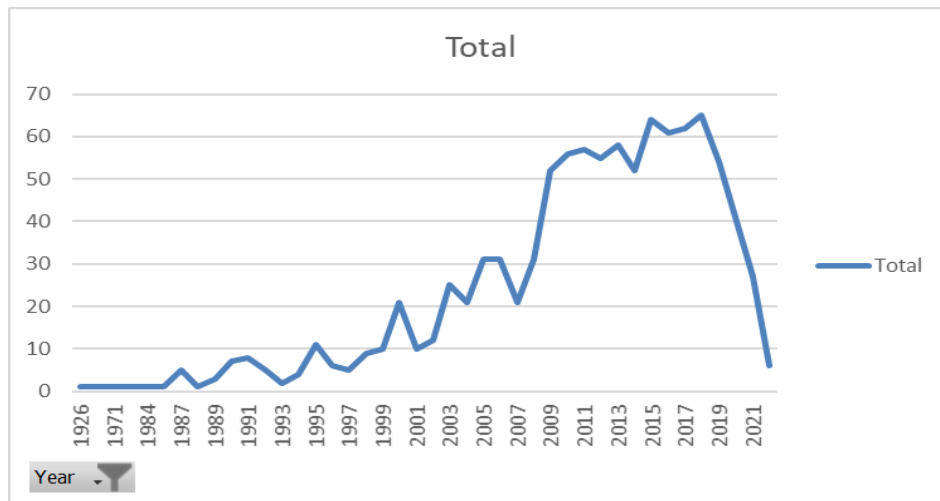


Figure 1. Increment Cycle of Article Metadata

Several publishers publish articles on bibliometric mapping of the role of mathematics in everyday life, which on average come from search.proquest.com publishers as many as 83 different titles, but here only five search.proquest.com article titles are taken. It has the most citations.

Table 1. Search.Proquest.com Articles

No	Cites	Authors	Title	Year
1	91	RM Ellington, R	Black high-achieving undergraduate mathematics majors discuss success and persistence in mathematics	2010
2	82	WF Drew, J Christie, JE Johnson	A value-added strategy for meeting early learning standards	2008
3	67	KL Sun	There's no limit: Mathematics teaching for a growth mindset	2015
4	61	RM Ellington	Having their say: Eight high-achieving African-American undergraduate mathematics majors discuss their success and persistence in mathematics	2006
5	57	S Sigurdsson	Hermann Weyl, mathematics and physics, 1900-1927	1991

Then from the metadata of the articles found about bibliometric mapping to the role of mathematics in everyday life, it has 220 publishers, of which five publishers have been published with various article titles, namely from search.proquest.com, Springer, Taylor & Francis, Elsevier, ERIC. The graphs from several publishers with the number of titles achieved.

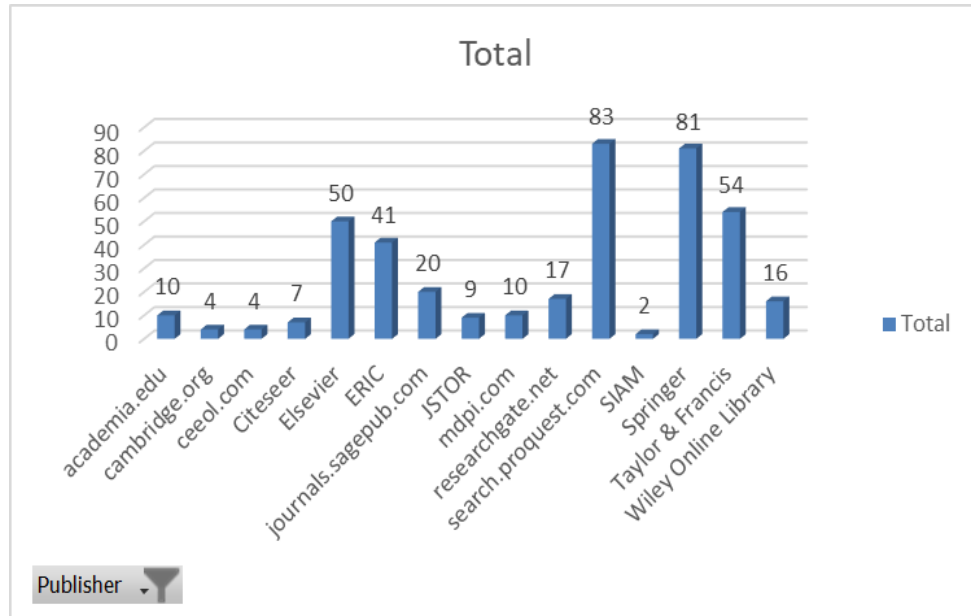


Figure 2. Publisher with The Most Articles

Then the metadata of the five publishers with the highest number of articles from 220 can be focused on the results of the five publishers with the most titles, among others, as follows.

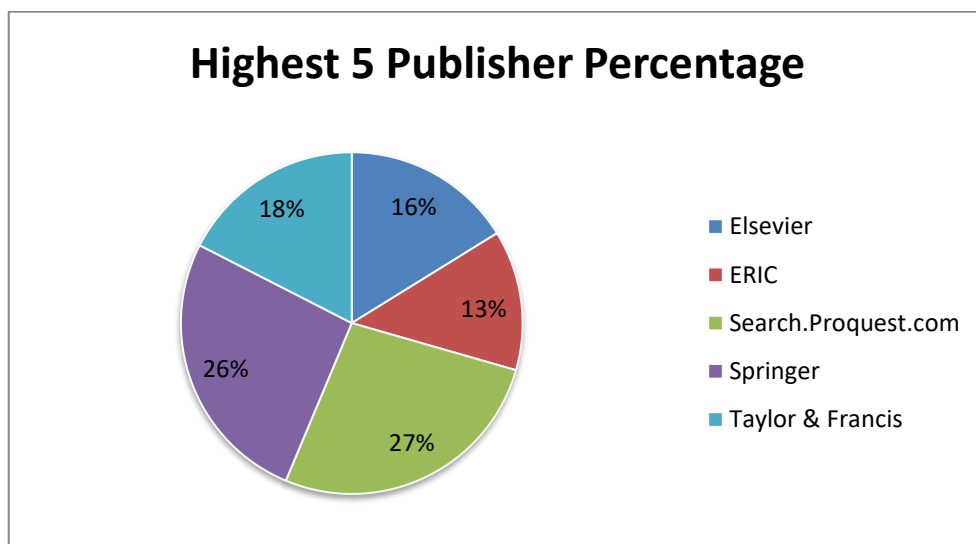


Figure 3. Publisher with The Most Articles

Then for the number of citations from the metadata search results for articles about bibliometric mapping on the role of mathematics in everyday life from the earliest year, which fell from 1926 to 2022, there were four articles with the most citations, but there was one article with more than 20000 citations, including as follows:

Table 2. Most Citations

No	Cites	Authors	Title	Year	Source	Publisher
1	22409	MEJ Newman	The structure and function of complex networks	2003	SIAM review	SIAM
2	8920	BJ Zimmerman	Attaining self-regulation: A social cognitive perspective	2000	Handbook of self-regulation	Elsevier
3	4252	JD Mayer, P Salovey, DR Caruso, RJ Sternberg	Models of emotional intelligence	2000	JD Mayer	Books.google.com
4	4001	JR Savery	Overview of problem-based learning: Definitions and distinctions	2015	Essential readings in problem-based learning	Books.google.com

From these data, it can be seen that several authors have the highest number of published titles, of which there are five authors, including M. Hilton, DB Reeves, L Darling-Hammond, A Kuzle, C Fine with the following table :

Table 3. Authors Based on Most Titles

No	Author	Jumlah
1	M. Hilton	10
2	DB Reeves	6
3	L Darling-Hammond	3
4	A Kuzle	2
5	C Fine	2

Furthermore, for the last five years with the most citations from article metadata search results in 2018 to 2022 which have the latest problems related to bibliometric mapping of the role of mathematics in everyday life as recommendations for future research, including the following:

Table 4. Articles of The Last 5 Years

No	Cites	Authors	Title	Year	Source	Publisher
1	655	GZ Yang, J Bellingham, PE Dupont, P Fischer	The grand challenges of Science Robotics	2018	Science robotics	science.org
2	252	P Cantor, D Osher, J Berg, L Steyer	Malleability, plasticity, and individuality: How children	2019	Applied Developmental	Taylor & Francis

No	Cites	Authors	Title	Year	Source	Publisher
			learn and develop in context1			
3	964	R DeKeyser	Skill acquisition theory	2020	Theories in second language acquisition	taylorfrancis.com
4	71	C Barroso, CM Ganley, AL McGraw, EA Geer	A meta-analysis of the relation between math anxiety and math achievement.	2021	Psychological	psycnet.apa.org
5	4	Y Huang, L Huang, Q Zhu	Reinforcement learning for feedback-enabled cyber resilience	2022	Annual Reviews in Control	Elsevier

In addition to analyzing bibliometric mapping of the role of mathematics in everyday life through Microsoft Excel, it can also be done through VOSViewer, where the article metadata from PoP is stored in RIS type using binary counting calculations with a minimum number of occurrences of 10. It turns out that from 5,010 terms there are, 131 were selected to meet the criteria. After verification, the existing terms were re-selected to only 79 terms. However, for eight terms that were not by the bibliometric mapping of the role of mathematics in everyday life, only 71 terms were selected. Then in the VOS viewer display, there are three visualizations to analyze the verified terms: network visualization, overlay visualization, and density visualization. The form of the show is as follows:

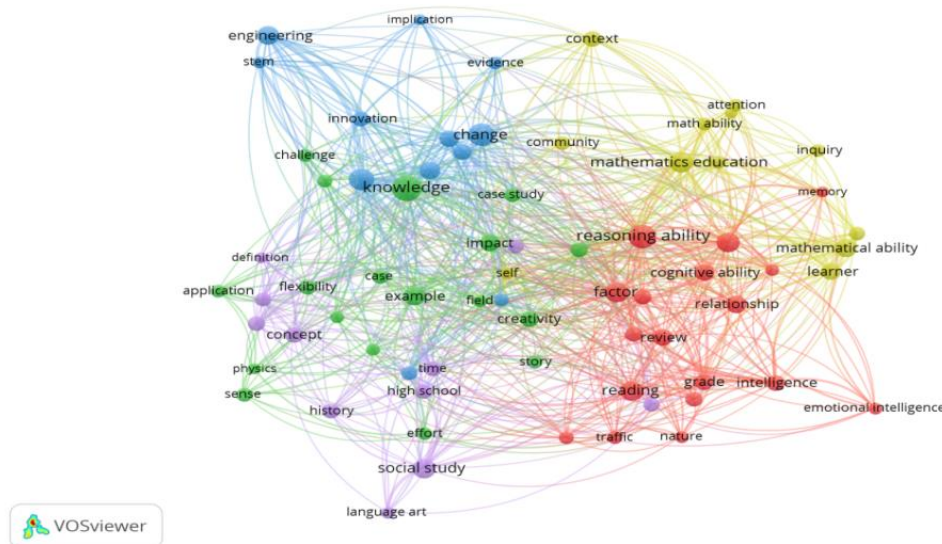


Figure 4. Network Visualization

The appearance of the Network Visualization can be grouped into five closely related clusters from the eight existing terms. The tables and percentages that state the cluster division are as follows:

Table 5. Clusters and Items

Cluster	Color	Items
1	Red	Cognitive ability, communication, emotional intelligence, factor, grade, influence, intelligence, logical reasoning, memory, nature, need, performance, reading, reasoning ability, relationship, review, risk, traffic
2	Green	Application, case, case study, challenge, creativity, effort, example, field, flexibility, future, impact, knowledge, mathematical problem, mathematization, mind, physics, sense, story
3	Blue	Age, change, engineering, evidence, face, higher education, implication, innovation, reasoning skill, resilient, stem, technology
4	Yellow	Attention, community, confidence, context, inquiry, interest, learner, math ability, mathematical ability, mathematics education, quantitative reasoning, self
5	Purple	Concept, decision, definition, high school, history, information, language art, social science, social study, subject, time

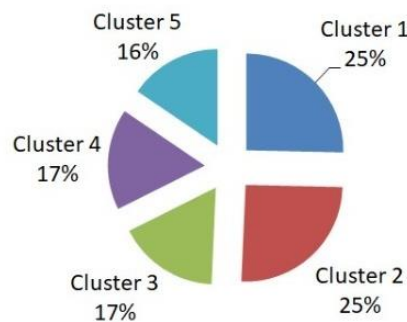


Figure 5. Percentage Cluster Network Visualization

The appearance of the Overlay Visualization is stage 2 in doing VOSViewer. To make it more clear, this is how it looks:

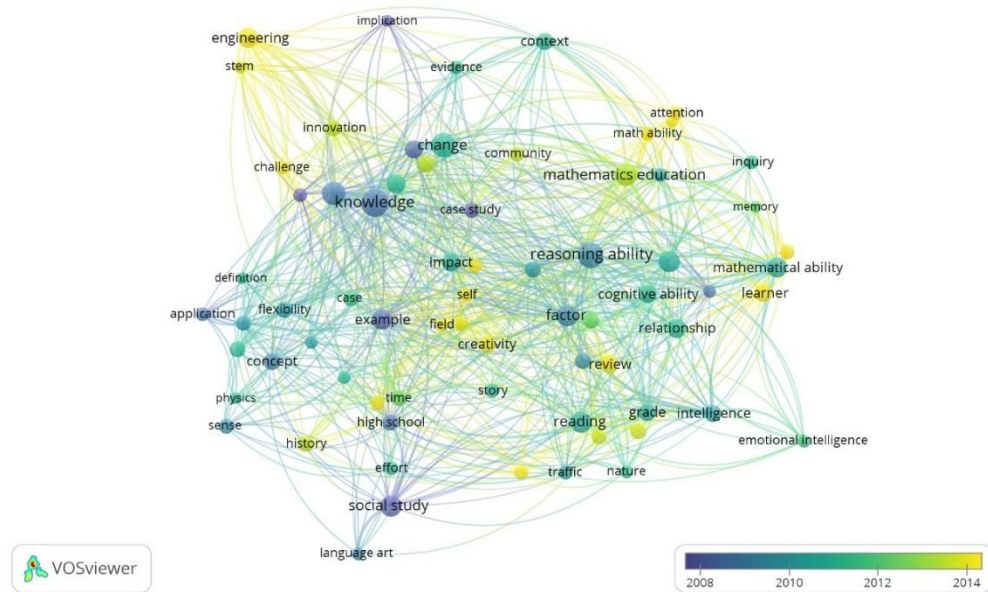


Figure 6. Overlay Visualization

The tables and percentages that state the distribution of clusters by year are as follows:

Table 6. Clusters by Year

Year	Color	Items
2008-2010	Purple	Implication, knowledge, application, example, concept, social study, case study, factor
2010-2012	Dark green	Context, evidence, change, education, inquiry, mathematical ability, cognitive ability, relationship, grade intelligence, nature, traffic, reading, story, language art, high school, impact, physics, sense, flexibility, definition, emotional intelligence
2012-2014	Light green	Innovation, mathematics education, community, memory, time, history
2014- now	Yellow	Engineering, stem, challenge, creativity, field, self, math ability, learner, attention

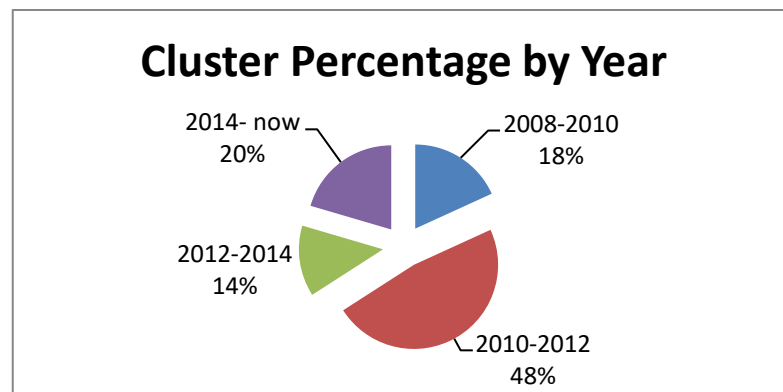


Figure 7. Cluster Percentage by Year

The display of Density Visualization is stage 3 in doing VOSViewer so that it is more apparent, and the following looks like this:

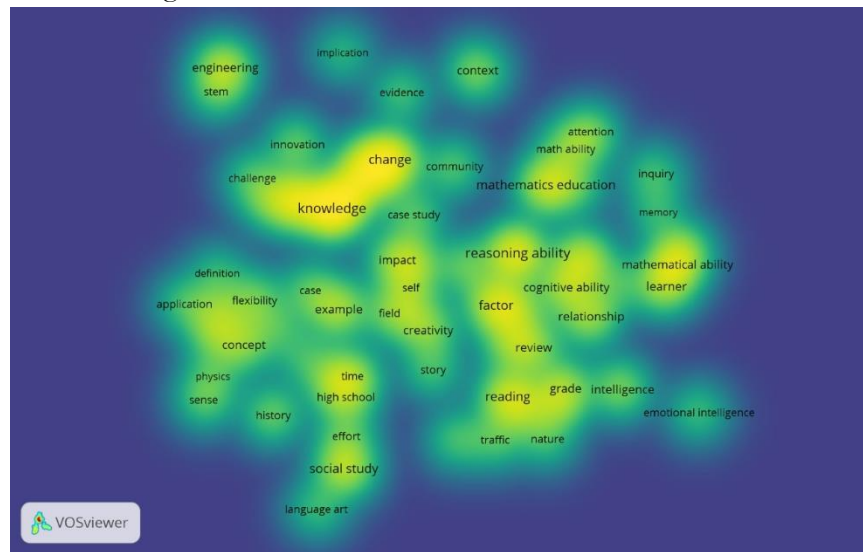


Figure 8. Density Visualization

The tables and cycles that state the division of clusters are based on the bright color combination, which is symbolized as a term that researchers have used, where researchers have often used the lighter the color, the period, while if the paint is less bright, then the time is still rarely used by researchers. in more detail, among others, as follows:

Table 7. Clusters Based on Level of Color Description

Color Caption Level	Items
Very Bright	Knowledge, change
Bright	Time, high school, reading, grade, factor, review, reasoning ability, cognitive ability, mathematical ability, learner, mathematics education ability, attention, social study, concept, example, impact, self, flexibility, engineering, field
Bright Enough	Stem, definition, application, physics, sense, history, traffic, nature, relationship, intelligence, case, case study, context, innovation
Not Bright	Implication, evidence, community, inquiry, memory, emotional intelligence, language art, story

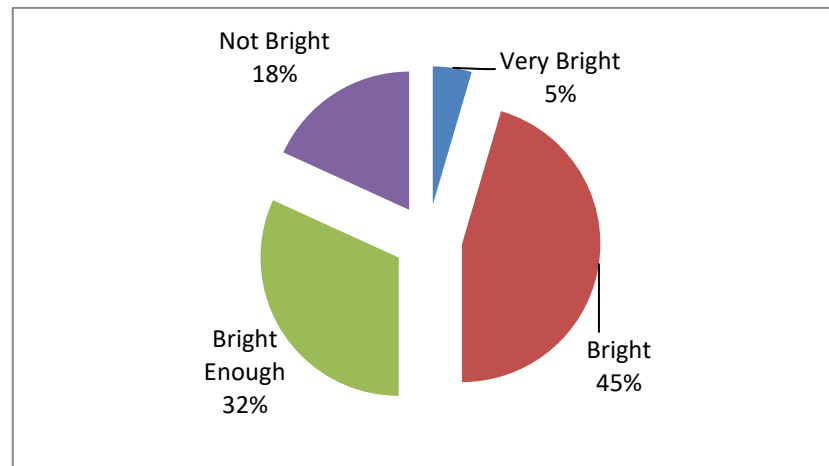


Figure 9. Cluster Cycle Based on Level of Color Description

Discussion

The results of the data obtained through the images and tables displayed are related to Bibliometric, which states that the results of data analysis through PoP stored in CSV format with the operation of Microsoft Excel can be shown in Figure 1, where it can be seen that the topics discussed are related to bibliometric mapping of the role of mathematics in everyday life. -days experienced an increase from 2007 to 2009, but from 2019 until now, it has decreased drastically. This can happen because of the interest of the reader in a problem raised by the researcher about the role of mathematics in everyday life, where when the graph goes up, it is possible that the issue presented is more interesting, but when the chart goes down, the concern raised may be less interesting for the reader.

Then for the percentage of publishers shown in Figure 3, which is the most widely published study on bibliometric mapping of the role of mathematics in everyday life, Search.Proquest.com is 27%, equivalent to 83 publications. Furthermore, Springer has 26% or equivalent to 81 publications, in the second position. The third position is Taylor & Francis, with 18% or equivalent to 54 journals. In the fourth position, Elsevier is 16% or equal to 50 publications. Finally, in the fifth position, the ERIC was 13% or equivalent to 41 journals. Next to the most prolific author, who has written ten articles related to bibliometric mapping of the role of mathematics in everyday life.

Table 2 shows the most citations that have been published in various studies, where there is 1 article that has several sources reaching 22409, namely in 2003 with the title The structure and function of complex networks written by Mej Newman, where the contents of the article explain the vital role from mathematics in graph theory material to operate technology in the internet network system, as well as being applied as a social and biological network. [23].

Then for the last five years, shown in table 4, which is still the latest regarding the topic of problems that occur regarding the bibliometric mapping of the role of mathematics in everyday life with the most citations which have published various studies related to the subject of this research, which every year from 2018 to 2022 there are representatives with the highest number of citations, namely in the first position located in 2018 with a total of 655 sources entitled The grand challenges of Science Robotics written by GZ Yang, J Bellingham, PE Dupont, P Fischer. Next in the second

position is in 2019, with a total of 252 citations entitled Malleability, plasticity, and individuality: How children learn and develop in context¹ written by P Cantor, D Osher, J Berg, L Steyer. The third position is in 2020 with 964 citations entitled Skill acquisition theory written by R DeKeyser. The fourth position is in 2021, with 71 sources entitled A meta-analysis of the relation between math anxiety and math achievement, written by C Barroso, CM Ganley, AL McGraw, and EA Geer. And the fifth and last position is in 2022, with four citations entitled Reinforcement learning for feedback-enabled cyber resilience written by Y Huang, L Huang, and Q Zhu.

The analysis results using VOSViewer with a metadata collection from PoP stored as many as 1000 articles in the RIS type. The data that has been collected can be seen based on the relationship of several pieces with various kinds of visualization, such as network visualization, overlay visualization, and density visualization. In this study, 71 verified terms were grouped into five different clusters based on the relationship between several items related to bibliometric mapping to the role of mathematics in everyday life, such as Cluster 1 by 25% and Cluster 2 by 25%, Cluster 3 by 17. % and Cluster 4 is 17%, Cluster 5 is 16%. A cluster is a relationship of verified terms seen from the network, overlay, and density visualization. The system used in the VOSViewer display is that the closer the term network is to other words in the visualization, the closer the relationship will be, and the bigger the term, the more researched these terms will be. Furthermore, if the item terms are in one cluster, of course, the relationship between the two items is powerful in studies that previous studies have carried out.

Then, the information can be obtained through visualization overlays to determine the research trends from each year. The more comprehensive study research will look darker in color in this visualization. This can be seen in 2008. It means that a light color like yellow indicates that the research study is a study that is included in the current research trend, which is located in 2014 until now, regarding mapping bibliometrics on the role of mathematics in everyday life. Percentage related to the research trend of the overlay visualization display in 2008-2010 was 18%, in 2010-2012 was 48%, in 2012-2014 was 14%, and then for 2014-current was 20%.

Furthermore, to show the saturation of the research topic can be seen from the Density visualization. In this visualization research study, the larger the terms on the existing items and the yellower the color, it can be stated that the research has done a lot of research. On the other hand, if it is green and slightly faded, the research is still very possible to be studied so that it can be seen in table 7, where the bibliometric mapping item on the role of mathematics in everyday life, many have learned the term so that the color is self-explanatory and less straightforward. Then words that are green in colors, such as implication, evidence, community, inquiry, memory, emotional intelligence, language art, and stories, are still few who study these terms.

CONCLUSIONS AND SUGGESTIONS

Based on the Bibliometric analysis that has been carried out, it was found that this research topic is still possible for other researchers to carry out for the next period because the data that has been analyzed is still categorized as feasible. There are still few studies related to bibliometric mapping of the role of mathematics in everyday life. Then suggestions for further research if researchers are interested in choosing a research topic about bibliometric mapping on the mathematics role in everyday life, namely by connecting various other activities in the community

and combining them with the progress that developed in the research period so that the data obtained can constantly be updated to evaluate the effectiveness of mathematics in everyday life.

REFERENCES

- [1] S. R. Janah, H. Suyitno, and I. Rosyida, "Pentingnya Literasi Matematika dan Berpikir Kritis Matematis dalam Menghadapi Abad ke-21," *PRISMA, Prosiding Seminar Nasional Matematika*, vol. 2, pp. 905–910, 2019.
- [2] S. Maskar, "Alternatif Penyusunan Materi Ekspresi Aljabar Untuk Siswa Smp/Mts Dengan Pendekatan Pendidikan," *Prisma*, vol. VII, no. 1, pp. 53–69, 2018.
- [3] I. Maula, A. Setyaning Pambudi, and Z. Rohmah, "Perkembangan Matematika dalam Sejarah Peradaban Islam," *Prosiding Konferensi Integrasi Interkoneksi Islam dan Sains*, vol. 1, no. September, pp. 115–119, 2018.
- [4] S. Mulyani, "Analisa Kesulitan Pembaca Masalah pada Materi Perbandingan Berdasarkan Ranah Kognitif Revisi Taksonomi Bloom," *Trabalho de conclusão de curso*, vol. 1, no. 9, pp. 1–10, 2020.
- [5] J. Tampubolon, N. Atiqah, and U. I. Panjaitan, "Kehidupan Sehari-Hari Dalam Masyarakat," 2019.
- [6] U. Rosyidah, A. Setyawati, and S. Qomariyah, "Analisis Kemampuan Penalaran dan Kemampuan Pemahaman Konsep Matematis Mahasiswa Pendidikan Matematika Pada Mata Kuliah Aljabar Dasar," *SJME (Supremum Journal of Mathematics Education)*, vol. 5, no. 1, pp. 63–71, 2021, doi: 10.35706/sjme.v5i1.4488.
- [7] S. K. N. Mik Salmina, "Kemampuan Penalaran Matematis Siswa Berdasarkan Gender Pada Materi Geometri," *The New Oxford Shakespeare: Modern Critical Edition*, vol. 5, no. April 2018, pp. 487–500, 2018, doi: 10.1093/oseo/instance.00168128.
- [8] L. Q. 'Aini, "Analisis Kemampuan Penalaran Matematis Siswa Ditinjau Dari Self-Efficacy Siswa Smp Kelas Vii," *JURNAL e-DuMath*, vol. 6, no. 1, pp. 30–39, 2020, doi: 10.52657/je.v6i1.1162.
- [9] Zumratus, "ANALISIS Kemampuan Masalah Ditinjau Dari Kemampuan Penalaran Siswa Kelas V SD/MI Pada Pembelajaran Matematika," *Fashluna*, vol. 1 No. 01, 2020, doi: <https://doi.org/10.47625/fashluna.v1i01.216>.
- [10] M. S. Raharjo, E. Azhar, and A. Faradillah, "Pengaruh Model Pembelajaran Realistic Mathematics Education (Rme) Terhadap Kemampuan Penalaran Matematis Siswa," *Seminar Nasional Pendidikan Matematika 2018*, vol. 01, pp. 19–29, 2018.
- [11] N. V. Shafiyah, A. P. Abadi, and A. Info, "Jurnal Didactical Mathematics Analisis Kemampuan Pemahaman Matematis Siswa SMP dengan," vol. 4, no. April, pp. 65–73, 2022.
- [12] U. M. Sofyana and A. B. Kusuma, "Siswa Menggunakan Pembelajaran Generative Pada," no. 2, pp. 11–23, 2018.
- [13] S. Marwiyah, H. Pujiastuti, and S. Sukirwan, "Profil Kemampuan Penalaran Matematis Siswa Ditinjau Dari Gaya Belajar V-a-K Pada Materi Bangun Ruang Sisi Datar," *Teorema: Teori dan Riset Matematika*, vol. 5, no. 2, p. 295, 2020, doi: 10.25157/teorema.v5i2.3738.

- [14] P. E. Santoso, T. Y. Hendrowati, and R. Cahyadi, “Analisis Penalaran Matematis Pada Operasi Baris Elementer Untuk Menyelesaikan Persamaan Linier,” *Jurnal e-DuMath*, vol. 7, no. 1, pp. 11–17, 2021, doi: 10.52657/je.v7i1.1341.
- [15] A. I. Yanuar Fauzuddin, Mochamad Syaiful Arif, Dwi Sasono, Hendrik Rizqiawan, “Eksplorasi Resiliensi Budaya Organisasi : Studi Kasus Pada PT . Jasa Raharja (Persero) Cabang Bali,” vol. 5, pp. 193–208, 2022.
- [16] yuni wulandari, “Mengenal Resiliensi dalam Ilmu Psikologi,” *binus*. 2020.
- [17] R. Rahmatiya and A. Miatun, “Analisis Kemampuan Pemecahan Masalah Matematis Ditinjau Dari Resiliensi Matematis Siswa Smp,” *Teorema: Teori dan Riset Matematika*, vol. 5, no. 2, p. 187, 2020, doi: 10.25157/teorema.v5i2.3619.
- [18] P. S. Mardhatillah, K. M. S. A. Fauzi, and S. Saragih, “Pengembangan Media Pembelajaran Berbasis Adobe Flash Menggunakan Model Thinking Aloud Pair Problem Solving untuk Meningkatkan Kemampuan Spasial dan Resiliensi Matematis,” vol. 06, no. 01, pp. 1166–1183, 2022.
- [19] J. A. Dahlan and . N., “Integrasi Budaya Masyarakat Dalam Pembelajaran Matematika: Contoh Dalam Pembelajaran Sistem Persamaan Linear Dua Variabel,” *Jurnal Penelitian Dan Karya Ilmiah*, vol. 18, no. 1, pp. 15–31, 2018, doi: 10.33592/pelita.v18i1.25.
- [20] A. P. Reza Delviana, “Systematic Literature Review: Eksplorasi Etnomatematika Pada Ornamen,” *Leibniz: Jurnal Matematika*, vol. 1, no. 1, pp. 21–35, 2022.
- [21] Marliani, “Matematika Dalam Aksiologi Mathematics In Axiology,” *Jurnal Pendidikan Guru Sekolah Dasar*, vol. 7, no. 1, pp. 26–31, 2021.
- [22] I. Eryanti and J. Soebagyo, “Bibliometric Analysis of Blended Learning Mathematics in Scientific Publications Indexed by Scopus,” *Numerical: Jurnal Matematika dan Pendidikan Matematika*, vol. 1, no. 1, pp. 1–11, 2021.
- [23] M. E. J. Newman, “The Structure and Function of Complex Networks,” *SLAM Review*, vol. 45, no. 2, pp. 167–256, 2003, doi: 10.1137/S003614450342480.