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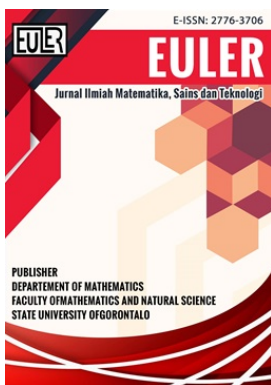
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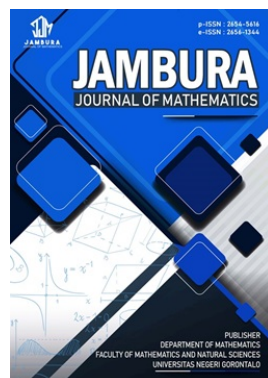


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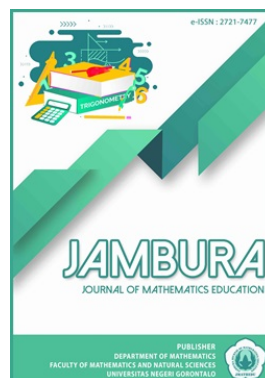
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# Global Trend of Numeracy Research: A Bibliometric Analysis Using Scopus Database

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**ABSTRACT.** *The study of numeracy has grown rapidly in the last decade, especially after the implementation of the Minimum Competency Assessment (MCA) in Indonesia since 2021. This research aims to map the development of numeracy research globally through bibliometric analysis, with a computational mapping approach using Bibliometrix in RStudio and VOSviewer. Article data was taken from the Scopus database published from 2014 to 2023. Article titles, keywords and abstracts guided the search process with reference to the keyword 'numeracy'. A total of 811 documents were identified, of which 699 were cited. The analysis showed an increasing publication trend, with a predominance of contributions from specific countries and institutions, and a thematic focus on academic achievement, cognitive ability and early literacy. Keyword visualisations also reveal interrelationships between topics and show that the integration of technology in numeracy learning is still relatively limited. The findings provide a comprehensive overview of the structure and direction of numeracy research and open up opportunities for further exploration in digital and interdisciplinary learning contexts.*



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution-NonCommercial 4.0 International License. *Editorial of EULER:* Department of Mathematics, Universitas Negeri Gorontalo, Jln. Prof. Dr. Ing. B. J. Habibie, Bone Bolango 96554, Indonesia.

## 1. Introduction

Mathematics education plays an important role in equipping students with the ability to think logically, analytically, and quantitatively. School learning is designed to help students understand basic concepts such as mathematical facts, principles, and relationships, and be able to apply them in problem solving efficiently and relevantly [1]. One of the main focuses is the mastery of number elements that not only support numeracy but also serve as a foundation in interpreting number-based information in various life contexts. In the national curriculum, this learning outcome is represented through numeracy competence, which has been part of the national assessment since the implementation of the Minimum Competency Assessment (MCA) in 2021.

Numeracy in an educational context refers to the ability to use mathematical knowledge functionally to understand, interpret, and respond to number-based information. Numeracy includes number recognition, numerical operations, problem solving, as well as diagram reading and data processing skills [2, 3]. Other studies emphasise the importance of applying numeracy in everyday life, not only as a mastery of mathematical concepts, but also as a basis for rational and evidence-based decision-making [4–6]. With this scope, numeracy is considered a competency that supports the development of critical thinking and active participation in a digital society.

In the last two decades, scientific publications related to numeracy have increased, reflecting the increasing complexity of the issues studied, ranging from early literacy to financial literacy and digital numeracy [7–10]. Research is no longer lim-

ited to basic arithmetic skills, but has expanded to more applied domains, such as data analysis and contextual problem solving. Several educational policies in various countries also encourage a more holistic and context-based approach to numeracy learning. In these developments, bibliometric mapping is needed to identify trends, dominant topics, important actors, as well as the direction of numeracy research development globally. This article aims to conduct such an analysis using Bibliometrix and VOSviewer based on Scopus data for the period 2014–2023.

During the global growth of numeracy studies, a comprehensive mapping is needed to determine the direction and pattern of research in this field. Bibliometric analysis is one of the effective approaches to identify trends, measure scientific contributions, and visualise the network of relationships between various elements in scientific publications [11]. Therefore, this article aims to conduct a bibliometric analysis of numerical publications using R-Studio's Bibliometrix Package and VOSviewer. The main focus of this research is: (i) identifying trends in numeracy research; (ii) analysing the impact of publications by author, country, and affiliation; and (iii) mapping and visualising the relationship between keywords and emerging topics in the global numeracy literature.

## 2. Methods

The method used in this research is bibliometric analysis, which is a quantitative approach to assess and map scientific literature in the field of numeracy. This method was chosen because it can identify trends, collaboration patterns, dominant keywords, and contributions of individuals and institutions in a

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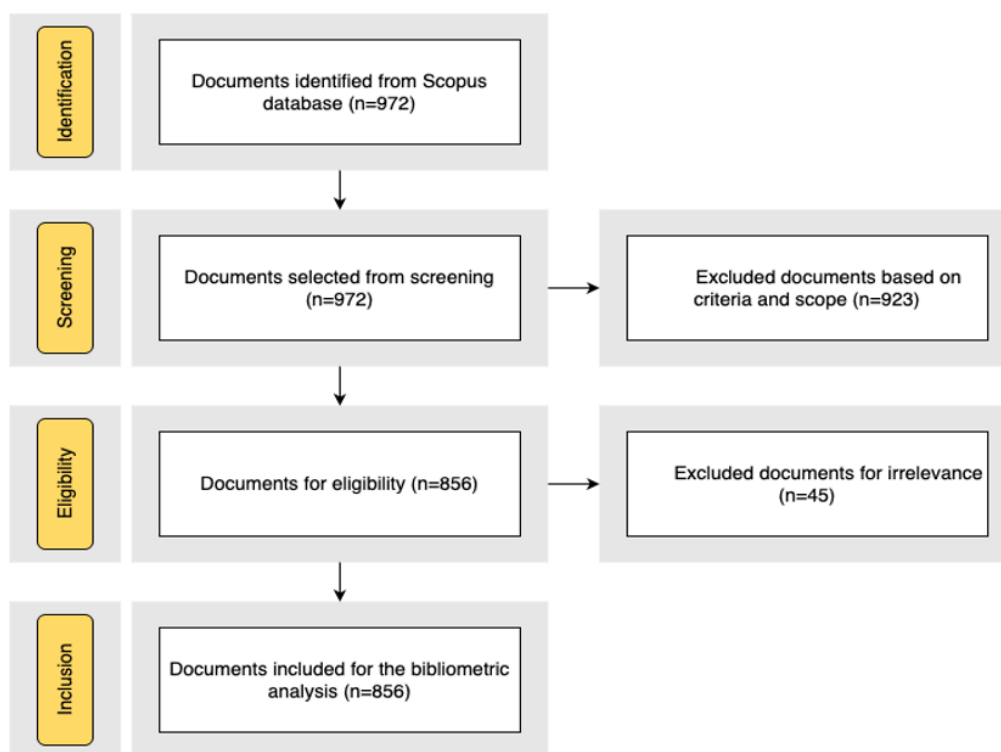


Figure 1. The PRISMA method was used in the document

scientific discipline [12]. The purpose of applying this method is to produce descriptive and visual data and findings regarding the development of numeracy studies over the past ten years. This research is expected to not only provide a comprehensive picture of the structure and dynamics of numeracy research but also offer a strong scientific foundation for formulating the direction of educational policy development and research strategies in the future.

The data search covered scholarly publications in multiple languages, allowing for a thorough examination of academic literature from different countries and language contexts. In this study, a clear time limit was set to maintain consistency of data coverage. Only articles published up to 31 December 2023 were included in the analysis. Articles that appeared after this period were systematically excluded from the database to avoid bias due to the mismatch of publication time with the analytical framework. This research is expected to not only provide a comprehensive picture of the structure and dynamics of numeracy research but also offer a strong scientific foundation for formulating the direction of educational policy development and research strategies in the future.

The first stage in the research process was data collection from the Scopus database, which is recognised as one of the most reputable international journal citation indices. The inclusion criteria included research articles published between 2014-2023 and containing the main keyword 'numeracy' in the title, abstract, or keyword list. Figure 1 presents the document selection flow using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method that illustrates the stages of identification, screening, eligibility selection, and final inclusion of articles analysed in this study. All articles that met the criteria were exported in two file formats, Comma Separated Values

(.csv) for data exploration in RStudio and Research Information Systems (.ris) for visualisation using VOSviewer.

The next step was bibliometric analysis. The analysis was conducted using the Bibliometrix Package on the RStudio platform [13]. This package allows researchers to extract metrics such as the number of publications per year, number of citations, analysis of the most productive authors, analysis of journals and institutions, and collaboration patterns between countries and between authors. The results of these analyses are presented in the form of graphs, tables, and other bibliometric indicators.

Visualisation of the results was enhanced by using VOSviewer software, which is designed to build and visualise bibliometric networks [14]. VOSviewer was used specifically to construct keyword co-occurrence maps, co-authorship networks, and co-citation networks. These visualisations helped identify dominant research themes, relationships between researchers, and thematic clusters formed in the numerical literature. Each emerging cluster was then analysed to reveal key dimensions of numeracy research, as well as potential future research directions.

### 3. Results and Discussion

From 2014 to 2023, 811 numeracy papers were published, 699 of which were cited. Of all published articles, there were a total of 392 sources (journals, books, etc.). Table 1 shows that the annual growth rate is 15.47%, the average document year since publication is 4.32, the average number of citations per document is 12.71, and the number of Keywords Plus (ID), Author's Keywords (DE), Authors, and Co-Authors per Document are 1201, 2339, 2291, and 3.29 respectively.

The increase in the number of publications on numeracy in the last decade shows a consistent and significant trend. Based

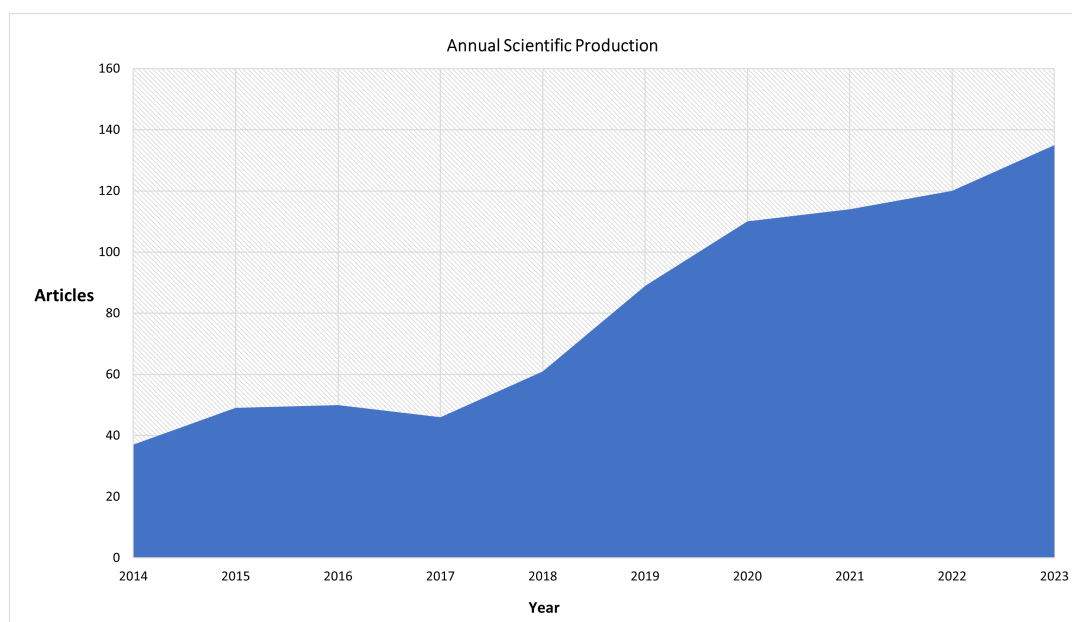


Figure 2. Number of scientific publications on numeracy per year in the period 2014-2023 based on Scopus data

Table 1. Main information about the data of all numeracy-related articles

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2014:2023
Sources (Journals, Books, etc) Documents	392
Annual Growth Rate %	15,47
Document Average Age	4,32
Average citations per doc	12,71
References	0
DOCUMENT CONTENTS	
Keywords Plus (ID)	1201
Author's Keywords (DE)	2339
AUTHORS	
Authors	2291
Authors of single-authored docs	137
AUTHORS COLLABORATION	
Single-authored docs	152
Co-Authors per Doc	3,29
International co-authorships %	24,66
DOCUMENT TYPES	
article	811

on data from Scopus, articles on numeracy increased year on year, with a slight decline in 2017, but a sharp spike from 2019 to 2023. As shown in Figure 2, this trend reflects the increasing attention to the importance of numeracy in addressing global education challenges and the needs of an increasingly data-driven society. This context also reinforces the urgency of research that emphasises numeracy mastery as part of 21st-century literacy.

In Indonesia, the increased attention to numeracy is in line with the implementation of the Minimum Competency Assessment (MCA), which replaced the National Examination in 2021 [15]. MCA places numeracy as one of the main indicators of student learning outcomes, focusing on the ability to reason us-

ing mathematical concepts and procedures in solving contextual problems. This policy encourages teachers, researchers, and policymakers to pay more attention to how mathematics learning can build numeracy ability that can be used flexibly in everyday life. In this context, the increasing number of publications also reflects a shift in learning approaches from procedural to more functional and reflective approaches.

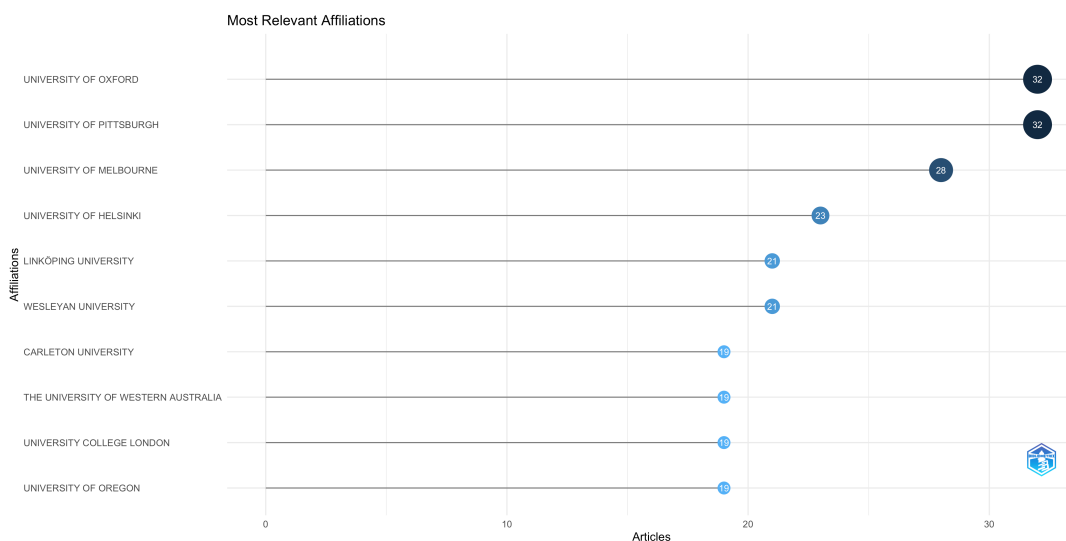
Globally, literature trends also show a new orientation in defining numeracy, not only as numeracy ability, but as a form of critical literacy towards quantitative information in social life. Several studies voice the importance of data understanding, number-based decision-making, and statistical literacy as part of the modern numeracy framework [6, 16, 17]. In this context, the increase in numeracy publications is not only seen as an indicator of scientific growth but also as a response to new challenges facing the digital society, including the need for data literacy, information transparency, and adaptive skills in dealing with the complexity of quantitative information.

In addition to the number of publications, the influence of a scientific work can also be traced through its citation rate. Table 2 presents the ten most cited articles in numeracy over the period 2014-2023. The article by Kahan tops the list with 392 citations, signalling an important contribution to numeracy discourse, especially about data-based decision-making and quantitative literacy in political contexts. It is noteworthy that this paper was published in the journal Q1 (SJR = 1.53). The rest of the articles come from diverse institutions and cover themes such as cognitive reflection, financial literacy, and early childhood education, illustrating the breadth and relevance of numeracy in various fields.

Institutional contributions to numeracy studies can also be observed through the visualisation of affiliation networks. As shown in Figure 3, the University of Oxford and the University of Pittsburgh stand out with the highest number of articles, at 32 each. The University of Melbourne follows with 28 articles, showing that they are also key players in the same academic

**Table 2.** Most influential papers

No	Published Year	First Author	Title	Affiliation	Country	Citation
1	2017	Kahan [18]	Motivated numeracy and enlightened self-government	Yale University	United States	392
2	2017	Nguyen [19]	The state of the science of health literacy measurement	Boston University	United States	20
3	2016	Primi [20]	The Development and Testing of a New Version of the Cognitive Reflection Test Applying Item Response Theory (IRT)	University of Florence	Italy	195
4	2015	Heath [21]	Manufacturing growth and the lives of Bangladeshi women	University of Washington	United States	149
5	2022	Skagerlund [22]	Decision-making competence and cognitive abilities: Which abilities matter?	Linköping University	United States	21
6	2021	Roberts [23]	Follow the leader: Child-led inquiries to develop science learning of young children	Edith Cowan University	Australia	3
7	2015	Grohmann [24]	Childhood roots of financial literacy	German Institute for Economic Research (DIW Berlin)	Germany	123
8	2015	Williams [25]	Evaluating a rugby sport intervention programme for young offenders	University of Hertfordshire	United Kingdom	24
9	2014	Schneeweis [26]	Does Education Improve Cognitive Performance Four Decades After School Completion?	Johannes Kepler University Linz	Austria	109
10	2018	Bialek [27]	The cognitive reflection test is robust to multiple exposures	Kozminski University	Poland	101

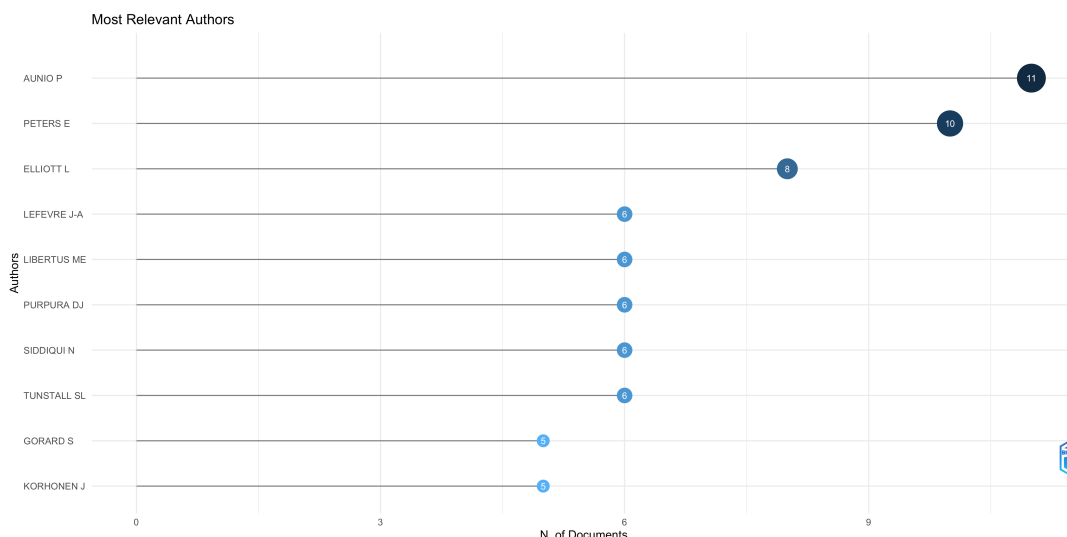


**Figure 3.** Ten institutions with the highest number of publications in numeracy (2014-2023) based on Scopus data

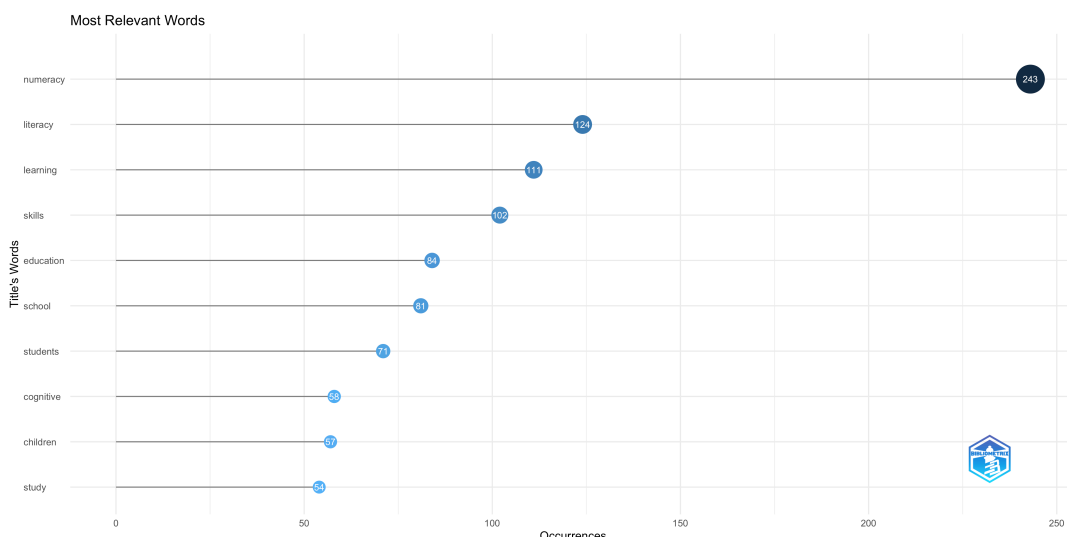
field. Meanwhile, the University of Helsinki and Linköping University have 23 and 21 articles, respectively, showing strong but slightly lower participation compared to the top three universities. On the other hand, Wesleyan University, Carleton University, the University of Western Australia, University College London, and the University of Oregon have 9 articles each, indicating that they have a lower level of engagement in this research compared to the other institutions on the list. This visualisation not only shows the productivity of the institutions, but also shows the collaboration clusters that form in the global publication network. This is an indicator that numeracy studies have involved

strong international collaborations, and reinforces the position of some universities as influential centres of numeracy research.

Besides institutions, the contribution of individual authors is also an important indicator in the numeracy research map. As shown in Figure 4, Aunio P. and Peters E. are the two most prolific authors in the last decade, with 11 and 10 papers, respectively. Other authors also come from different institutional backgrounds and countries, signalling that numeracy has become a cross-cutting issue of interest to the global scientific community. The position of these authors is important not only as an indicator of productivity but also as nodes in a scholarly network that



**Figure 4.** Visualisation of the top ten most prolific authors in numerical publications based on the number of documents published during 2014-2023



**Figure 5.** The most relevant keywords in numeracy publications based on their frequency of occurrence

strengthens the numeracy knowledge base.

To understand the direction and trend of the developing themes, keyword analysis is an important step. In **Figure 5**, the word ‘numeracy’ appears as the most dominant term in the publications, followed by ‘literacy’, ‘early numeracy’, and ‘education’. These terms illustrate that numeracy studies are mostly associated with primary education, assessment, and strengthening basic mathematical skills. The emergence of keywords such as ‘assessment’ and ‘quantitative literacy’ also indicates a shift in research focus from content mastery to critical thinking skills and data interpretation capabilities.

Furthermore, the keyword co-occurrence analysis visualised in **Figure 6** reveals the conceptual structure in the numeracy literature. It appears that terms such as ‘achievement’, ‘maths achievement’, ‘cognitive ability’, and ‘financial literacy’ form interrelated clusters, reflecting approaches that link numeracy to cognitive performance and real-life decision-making. However, topics related to technology integration, such as ‘e-learning’ or ‘digital literacy’, do not yet occupy a central position in the net-

work, indicating that the utilisation of technology in numeracy enhancement is still a relatively open research opportunity.

Analysing keyword co-occurrence in scientific publications makes an important contribution to understanding the direction and focus of emerging research [28]. The visualisation shown in **Figure 6** shows a complex network structure, illustrating the interconnectedness of various concepts in education, skills, and attainment. The network is divided into coloured clusters, which reflect the interconnections between concepts in the context of numeracy education. The mapping shows that numeracy is related not only to mathematics learning outcomes but also to decision-making and evaluative aspects of the education system. While this visualisation reveals the extensive connections between topics, there are still gaps in terms of the integration of technology into numeracy learning and assessment mechanisms. Some important aspects, such as the utilisation of digital technology and the development of contextual numeracy, have not been empirically explored.

Furthermore, these findings were reinforced by a biblio-

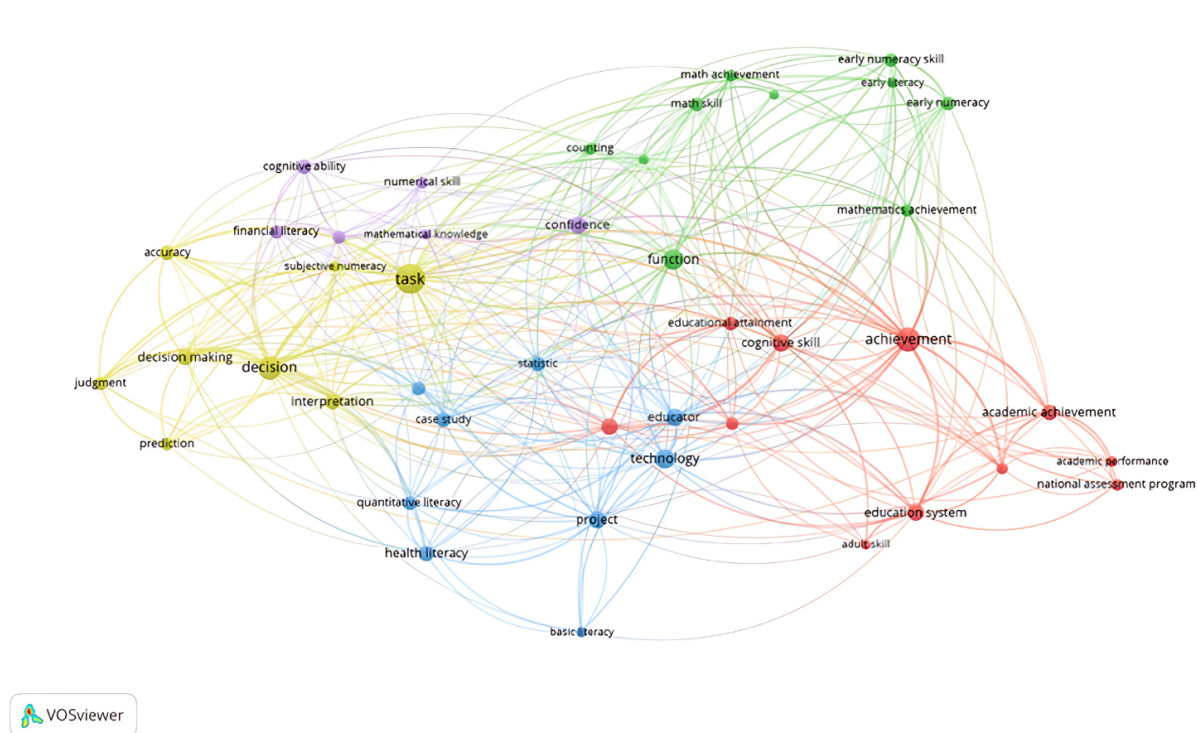


Figure 6. Keyword co-occurrence maps in global numeracy publications

metric study that mapped the relationship between numeracy literacy, digital literacy, and character strengthening through keyword network analysis using VOSviewer [29]. The study identified the emergence of keywords such as e-learning, digital literacy, and project-based learning as indicators of a growing research focus towards technology integration in education. However, they also noted that the implementation of technology in numeracy learning practices is still relatively limited. This is in line with the research findings [30], who pointed out that research related to Technological Pedagogical and Content Knowledge (TPACK) at the basic education level has increased, but most of it is still at the conceptual level. Concrete practices that integrate technology directly into numeracy learning have not been widely documented. Therefore, the keyword network analysis not only maps the trends that have occurred, but also opens up interdisciplinary research opportunities between the fields of numeracy, educational technology, and learning evaluation that still require further exploration.

#### 4. Conclusion

The results of this bibliometric analysis provide a comprehensive overview of the development of numeracy research in the last decade. The consistent increase in the number of publications indicates that numeracy has become an important focus in global education. This finding confirms that numeracy is no longer seen simply as part of basic mathematics mastery, but rather as a cross-cutting competency related to decision-making, financial literacy, and data understanding.

The review also identifies institutions and authors that play a key role in the development of numeracy literature, and reveals the dominance of themes such as academic achievement, cognitive ability, and early literacy. However, the keyword network

mapping shows that the integration of technology in numeracy learning has not been a major focus, thus opening up space for the development of more innovative digital and interdisciplinary approaches.

The implications of these findings are important for educators, researchers, and policymakers. For educational practitioners, the results emphasise the need to design numeracy learning that not only focuses on counting, but also encourages students to reason reflectively in real-world contexts. Meanwhile, for researchers, there are ample opportunities to explore the role of technology, socio-cultural contexts, and data-based assessments in strengthening numeracy competencies across educational levels.

In the future, numeracy research needs to be directed at developing learning models that are responsive to digital challenges, strengthening data-based numeracy, and expanding the context of numeracy into contemporary issues such as artificial intelligence, digital economy, and social inequality. Thus, numeracy can be developed not only as an individual skill but also as part of citizenship literacy in the 21st century.

**Author Contributions.** Veni Saputri: Conceptualization, methodology, formal analysis, and writing—original draft preparation. Yaya S. Kusumah: Validation, supervision, writing—review and editing. T. Turmudi: Data curation, writing—review and editing. Al Jupri: Supervision, writing—review and editing. All authors have read and approved the final version of the article.

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**Conflict of interest.** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Data availability.** All data used in this study come from the Scopus database and comprise publication metadata that is openly available to registered users. The exported and analysed data, including files in .csv and .ris formats, can be made available upon request to the correspondence author for academic and non-commercial purposes. Due to access licence limitations of the Scopus database, the raw data cannot be openly published in a public repository.

## References

- [1] BSKAP Kemendikbudristek, "Keputusan Kepala BSKAP Kemendikbudristek No. 008/H/Kr/2022 Tentang Capaian Pembelajaran Pada Pendidikan Anak Usia Dini, Jenjang Pendidikan Dasar, dan Jenjang Pendidikan Menengah Pada Kurikulum Merdeka," Jakarta: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi, 2022.
- [2] E. Indefenso and A. Yazon, "Numeracy Level, Mathematics Problem Skills, and Financial Literacy," *Universal Journal of Educational Research*, 2020.
- [3] R. M. Zaenal, S. F. Nasrullah, and E. F. W. Puadi, "Development of E-Learning of Mathematics Numeracy to Improve Students' Numeracy Ability," *AKSIOMA J. Program Studi Pendidik. Mat.*, vol. 13, no. 3, p. 838, Sep. 2024. doi: [10.24127/ajpm.v13i3.8832](https://doi.org/10.24127/ajpm.v13i3.8832).
- [4] P. Jain and M. Rogers, "Numeracy as critical thinking," *Adults Learn. Math. Int. J.*, vol. 14, pp. 23–33, 2019.
- [5] R. G. Retamero, A. Sobkow, D. Petrova, and J. Traczyk, "Numeracy and risk literacy: What have we learned so far?," *Span. J. Psychol.*, vol. 22, no. e10, 2019. doi: [10.1017/sjp.2019.16](https://doi.org/10.1017/sjp.2019.16).
- [6] OECD, *The Assessment Frameworks for Cycle 2 of the Programme for the International Assessment of Adult Competencies*, OECD Skills Studies, Paris: OECD Publishing, 2021. [Online]. Available: [10.1787/4bc2342d-en](https://doi.org/10.1787/4bc2342d-en).
- [7] M. Chiu, "Effects of early numeracy activities on mathematics achievement and affect: Parental value and child gender conditions and socioeconomic status mediation," *EURASIA J. Math. Sci. Technol. Educ.*, vol. 14, no. 12, pp. 1634–1634, 2018. doi: [10.29333/ejmste/97191](https://doi.org/10.29333/ejmste/97191).
- [8] S. Hwang, "Examining the effect of students' early numeracy activities at home on later mathematics achievement via early numeracy competencies and self-efficacy beliefs," *Int. Electron. J. Elem. Educ.*, vol. 13, no. 1, pp. 47–56, 2020. doi: [10.26822/iejee.2020.172](https://doi.org/10.26822/iejee.2020.172).
- [9] M. Levels, J. Dronkers, and C. Jencks, "Contextual explanations for numeracy and literacy skill disparities between native and foreign-born adults in western countries," *PLoS ONE*, vol. 12, no. 3, pp. 1–25, 2017. doi: [10.1371/journal.pone.0172087](https://doi.org/10.1371/journal.pone.0172087).
- [10] D. S. Nusantara, "Designing PISA-like mathematics problem in covid-19 pandemic (PISAComat)," *J. Phys. Conf. Ser.*, vol. 1657, no. 1, 2020. doi: [10.1088/1742-6596/1657/1/012057](https://doi.org/10.1088/1742-6596/1657/1/012057).
- [11] M. Tekdal, "Trends and development in research on computational thinking," *Educ. Inf. Technol.*, vol. 26, no. 5, pp. 6499–6529, Sep. 2021. doi: [10.1007/s10639-021-10617-w](https://doi.org/10.1007/s10639-021-10617-w).
- [12] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *J. Bus. Res.*, vol. 133, pp. 285–296, Sep. 2021. doi: [10.1016/j.jbusres.2021.04.070](https://doi.org/10.1016/j.jbusres.2021.04.070).
- [13] M. Aria and C. Cuccurullo, "bibliometrix: An R-tool for comprehensive science mapping analysis," *J. Informetr.*, vol. 11, no. 4, pp. 959–975, Nov. 2017. doi: [10.1016/j.joi.2017.08.007](https://doi.org/10.1016/j.joi.2017.08.007).
- [14] D. F. Husaeni and A. B. D. Nandiyanto, "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 J. Sci. Eng.*, vol. 2, no. 1, pp. 19–46, Jun. 2021. doi: [10.17509/ajse.v2i1.37368](https://doi.org/10.17509/ajse.v2i1.37368).
- [15] Y. Rokhmat et al., *Panduan Penguatan Literasi dan Numerasi di Sekolah*, Kemdikbud, 2021.
- [16] L. Ginsburg, M. Manly, and M. J. Schmitt, "The Components of Numeracy," *NCSALL Occasional Paper*, 2006.
- [17] M. Ibrahim et al., "STEM Learning for Students Mathematical Numeracy Ability," *Eur. J. STEM Educ.*, vol. 9, no. 1, p. 20, Dec. 2024. doi: [10.20897/ejsteme/15750](https://doi.org/10.20897/ejsteme/15750).
- [18] D. M. Kahan, E. Peters, E. C. Dawson, and P. Slovic, "Motivated Numeracy and Enlightened Self-Government," *Behav. Public Policy*, 2017.
- [19] T. H. Nguyen, M. K. Paasche-Orlow, and L. A. McCormack, "The state of the science of health literacy measurement," *Inf. Serv. Use*, vol. 37, no. 2, pp. 189–203, 2017. doi: [10.3233/ISU-170827](https://doi.org/10.3233/ISU-170827).
- [20] C. Primi, K. Morsanyi, F. Chiesi, M. A. Donati, and J. Hamilton, "The Development and Testing of a New Version of the Cognitive Reflection Test Applying Item Response Theory (IRT)," *J. Behav. Decis. Mak.*, vol. 29, no. 5, pp. 453–469, 2016. doi: [10.1002/bdm.1883](https://doi.org/10.1002/bdm.1883).
- [21] R. Heath and A. M. Mobarak, "Manufacturing growth and the lives of Bangladeshi women," *J. Dev. Econ.*, vol. 115, pp. 1–15, Jul. 2015. doi: [10.1016/j.jdeveco.2015.01.006](https://doi.org/10.1016/j.jdeveco.2015.01.006).
- [22] K. Skagerlund, M. Forsblad, G. Tinghög, and D. Västfjäll, "Decision-making competence and cognitive abilities: Which abilities matter?," *J. Behav. Decis. Mak.*, vol. 35, no. 1, 2022. doi: [10.1002/bdm.2242](https://doi.org/10.1002/bdm.2242).
- [23] P. Roberts, "Follow the leader: Child-led inquiries to develop science learning of young children," *J. Child. Educ. Soc.*, vol. 2, no. 3, pp. 303–313, 2021. doi: [10.37291/2717638X.202123120](https://doi.org/10.37291/2717638X.202123120).
- [24] A. Grohmann, R. Kouwenberg, and L. Menkhoff, "Childhood roots of financial literacy," *J. Econ. Psychol.*, vol. 51, pp. 114–133, Dec. 2015. doi: [10.1016/j.joep.2015.09.002](https://doi.org/10.1016/j.joep.2015.09.002).
- [25] D. Williams, L. Collingwood, J. Coles, and S. Schmeer, "Evaluating a rugby sport intervention programme for young offenders," *J. Crim. Psychol.*, vol. 5, no. 1, pp. 51–64, Feb. 2015. doi: [10.1108/JCP-05-2014-0008](https://doi.org/10.1108/JCP-05-2014-0008).
- [26] N. Schneeweis, V. Skirbekk, and R. Winter-Ebmer, "Does Education Improve Cognitive Performance Four Decades After School Completion?," *Demography*, vol. 51, no. 2, pp. 619–643, Apr. 2014. doi: [10.1007/s13524-014-0281-1](https://doi.org/10.1007/s13524-014-0281-1).
- [27] M. Bialek and G. Pennycook, "The cognitive reflection test is robust to multiple exposures," *Behav. Res. Methods*, vol. 50, no. 5, pp. 1953–1959, 2018. doi: [10.3758/s13428-017-0963-x](https://doi.org/10.3758/s13428-017-0963-x).
- [28] H. N. Su and P. C. Lee, "Mapping knowledge structure by keyword co-occurrence: a first look at journal papers in Technology Foresight," *Scientometrics*, vol. 85, no. 1, pp. 65–79, Oct. 2010. doi: [10.1007/s11192-010-0259-8](https://doi.org/10.1007/s11192-010-0259-8).
- [29] L. Yulindaria, Y. Ruyadi, E. S. Nurdin, and A. Dahliyana, "Integrative Learning Models For Numeracy Literacy And Character Development: Insights From A Bibliometric Analysis," *J. of Educational Research and Evaluation*, vol. 6, no. 3, pp. 931–945, 2025.
- [30] Q. Shabira, Baharudin, and Y. Yanti, "Mapping the Literature of Technological Pedagogical and Content Knowledge (TPACK) in Elementary Education: A Bibliometric Review," *J. Penelit. Pendidik. IPA*, vol. 10, no. 9, pp. 631–643, 2024. doi: [10.29303/jppipa.v10i9.8731](https://doi.org/10.29303/jppipa.v10i9.8731).