

## Research of mathematics teachers in the Scopus database between 2012 and 2022: A bibliometric analysis

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### Abstract

Mathematics teachers are vital in helping students understand math better. This crucial aspect of the responsibility of mathematics teachers is gaining recognition all across the world. So, we use bibliometric analysis to assist academics and researchers in comprehending the relevant research on mathematics teachers. The purpose of this bibliometric study was to investigate and depict the evolution of 1,145 Scopus-registered mathematics teacher articles published in various international journals between 2012 and 2022. Obtained results were exported to Microsoft Excel, and Harzing's Publish or Perish to analyze frequency and measure citation metrics. To visualize and analyze the collaboration patterns, VOSviewer was used. The publication was then interpreted according to growth rate, prolific journals, productive countries, main institutions, top ten cited papers, keywords analysis and topic of interest. Our results show a rising pace of growth of literature on the research of mathematics teachers from 2012 until 2022. The United States was the top contributor on research of mathematics teachers. This evolution research of mathematics teachers reflects a rising emphasis on Science, Technology, Engineering and Mathematics (STEM) education incorporated into the 21st-century curriculum to prepare the desired workforce.

**Keywords:** Bibliometric analysis, Mathematics teachers, Mathematic education

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## Introduction

Mathematics education in general is vital for the development of critical thinking abilities, which will substantially benefit progress toward modernisation (Bass & Ball, 2016; Julius et al., 2021). Teachers face numerous decisions and challenges when teaching mathematics, all of which impact the students' learning opportunities (Superfine, 2022). They need to be aware of what needs to be done, how it should be done and why it should be done (Bereiter & Scardamalia, 2014). Alterations in the roles that teachers play are an inevitable consequence of the various reforms and regulations that have been implemented in mathematics education programmes. Teachers are now required to not only plan activities, but they must also engage students in class participation (Ozkaya, 2018). Some extremely intriguing reviews have recently been published on the *Journal of Mathematics Teacher Education (JMTE)* by Springer, which focus on research in mathematics education. However, these reviews only focus on the current stage of progress as well as the programmes, challenges and potential studies (Superfine, 2022).

Various efforts have been undertaken to improve mathematics education in this scenario, but not from the perspective of a mathematics teacher. To the best of the researcher's knowledge, there has been little bibliometric analysis research on the topic on mathematics teacher (RMT). Comprehensive study is required to help other researchers take strategies to improve mathematics teachers. In contrast, to systematic review papers bibliometric research involves analysing meta data from published articles to find patterns in certain fields all around the world. By analysing data from citation indices, this bibliometric study may now measure the reputation and influence of specific papers, authors, and research publications.

In recent years, bibliometric analysis has experienced a significant growth in popularity in mathematics education research in recent years. However, just a few studies have used bibliometric analysis to map the overall trend of research on mathematics teachers worldwide. Indeed, the bibliometrics methodology has been utilised in various areas of mathematics education research, such as in information and communications technology (ICT) in mathematics (Tigrero-tigrero & Choez-jalca, 2020), artificial intelligence (AI) in mathematics (Hwang & Tu, 2021), realistic mathematics education (RME) in mathematics (Phan et al., 2021) and GeoGebra (Gobbi et al., 2020).

On the other side, bibliometric research in the field of mathematics education has been discovered. Ozkaya (2019) examined 9,841 mathematics education texts published between 1980 and 2018. In this analysis, only articles from the Web of Science citations database were considered. Data was collected and analysed based on the publishing year, type of publication, language of publication, title, author name, and country of residence. The United States was determined to be the most productive country by the study's findings. Furthermore, the most regularly used phrases in this survey were "elementary mathematics classroom", "teacher education", and "the achievement gap". As mentioned, this study presented a suggestion to examine the collaboration among the authors.

Latest publication, European researchers, Julius et al., (2021) published a bibliometric evaluation of mathematics education research using the Scopus database. This study provides scientific data on the distribution pattern of mathematics education journals, prolific authors, countries, institutions, research topics, international collaboration, and direction of research from 12,670 articles. However, both bibliometric analyses are only limited to mathematics education. In

today's world, bibliometrics has developed into an instrument that is indispensable for evaluating and scrutinising the output of researchers (Moral-muñoz et al., 2020). Scholars use bibliometrics for a variety of purposes, including uncovering emerging patterns in article and journal performance, collaborative trends, research constituents, and the intellectual structure of a certain topic as portrayed in the existing corpus of published literature are all being investigated (Donthu et al., 2021).

As a result, well-conducted bibliometric studies would provide good foundations for bringing that discipline forward in unique and significant ways. Furthermore, analysing the trend of recent mathematics education research will lead researchers and educators in scientific discussions and questions (Ozkaya, 2018). Thus, our study focuses on gathering publications and synthesising meta data about research on mathematic teachers. Three specific research questions would be investigated:

1. What is the trend of publication in 2012–2022 on research on mathematics teachers?
2. Which journal, country, institutions, and cited papers most published about research on mathematics teacher in 2012–2022?
3. What's the most frequently used keywords in published studies on mathematics teachers?

So to conclude, the goal of this research is to explore global research on mathematics teachers based on all metadata produced from research questions. These results will aid in recognising and understanding mathematics teacher research's core, underlying patterns, and development. Furthermore, the data represents academic networks, communication, and developments for potential worldwide research collaborations.

### **1. Methods and Materials:**

New and more effective methods for finding and analysing research in the literature have been developed in the last few years (Drijvers et al., 2020). Bibliometrics is the most popular and rigorous statistical evaluation and trend analysis (Donthu et al., 2021) using keyword co-occurrence (Zhang et al., 2020) for statistical evaluation and trend analysis of publications. Using bibliometric methodologies, this study identified the global research tendencies of mathematic teachers in mathematics education. Using this method, a researcher can determine the piece's impact by analysing citations in other publications (Maditati et al., 2018).

The Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) statements and reporting checklists were adopted as a guideline to meet this objective (Ahmi & Mohamad, 2019). PRISMA, invented by Page et al., (2021), attempts to provide comprehensive reporting that allows readers to examine the appropriateness of the methodology and therefore the credibility of the conclusions. Furthermore, providing and summarising characteristics of studies contributing to a synthesis allows policymakers to assess the relevance of the finding to their context.

Considering the aforementioned rationale, relevant publications were extracted from the Scopus database until March 2022. For the purposes of searching and extracting documents, the Scopus database was selected as the repository for the data. Scopus is one of the most important tools for a wide range of activities, including the selection of journals and literature (Pranckuté, 2021). The literature search was conducted with the keyword "TITLE-ABS-KEY (("teacher\*" OR

“scholar\*” OR “educator\*”) AND (“math\* edu\*” OR “mathematic\*educat\*”)” using the Scopus search engine. Using the query string to specify the title, abstract, or keywords (TITLE-ABS-KEY). It will help the search engine capture articles related to the main theme (Julius et al., 2021). The search scope was also limited to any published journals and articles from 2012 to 2022. This enables the search engine to retrieve the most recent research published in the literature within the last ten years. In addition, this review also had a limited reach in terms of document and source categories, with only papers and journals being included. As a result of the search carried out in Scopus, 1,145 scientific research were found. To ensure that the search for material that has been made only covers the scope of the study, the researcher added phrases in the search field to focus on relevant articles in the field of mathematics. In this context, 1,145 articles were selected for further analysis. Figure 1 illustrates the search strategy's flow diagram.

The data were analysed in some ways to generate the information needed to answer the research questions. Some results were collected straight from Scopus by utilising the analyse search results tool. Besides, some data was exported or manually inserted into a new Excel file. The data was exported in Research Information Systems (RIS) and Comma-Separated Values (CSV) formats as part of the data sets. All the collected data was evaluated in form of percentages and cumulative percentages. In computing, the citation metric and some other frequencies, we utilised Harzing’s Publish or Perish Software. Additionally, the VOSviewer was also used to visualize the bibliometric networks (Ahmi & Mohd Nasir, 2019).

### PRISMA flow diagram

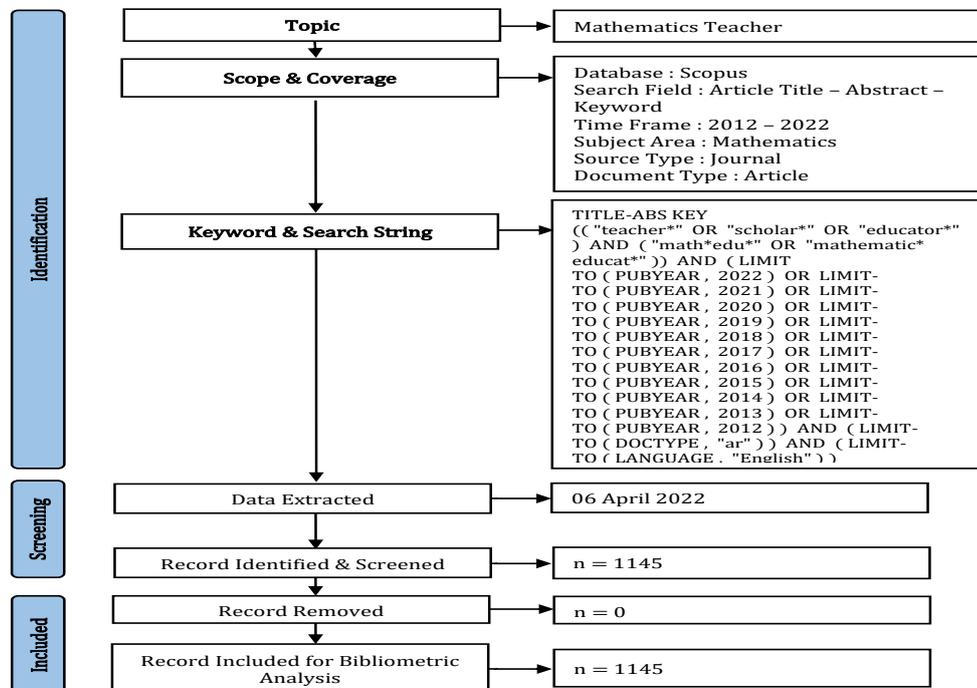
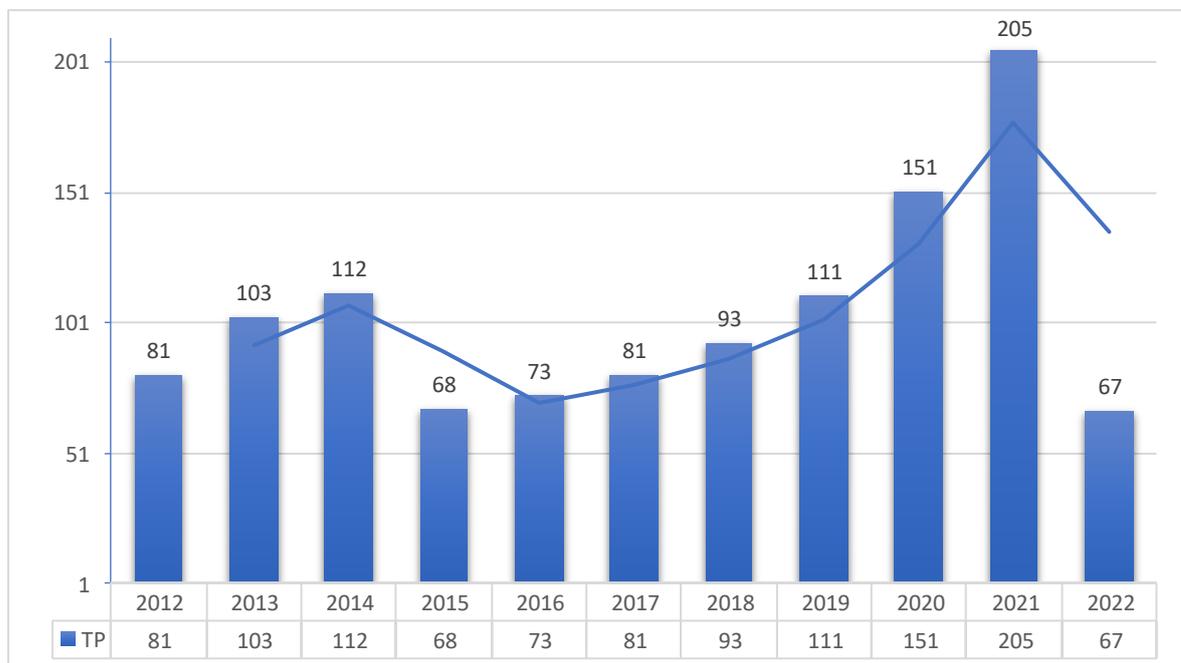


Figure 1: Flow diagram of the search

## 2. Results /Findings

This section will focus on the findings of the bibliometric analysis based on the research questions. The results of the research are presented as (1) growth rate, (2) top ten prolific journals, (3) top ten most productive countries, (4) top ten main institutions involved in RMT, (5) top ten cited papers on RMT, (6) keywords analysis and (7) topic of interest. Most findings are reported in the form of frequency and percentage. Some of the findings were extended and presented in the following sub-section such as the total publications (TP), number cited publications (NCP), total citations (TC), citations per paper(C/P), citations per cited paper(C/CP), *h-index* and *g-index*.

### 3.1 Growth rate



Note. TP represents the total publication

Figure 2: Publication Trend per Year

Figure 2 shows an updated draught on publications articles concerning RMT published over 10 years, starting from 2012 to 2022 from Scopus Database. From 2015 to 2021, the number of publications about mathematics teachers published increased gradually. The largest significant increase was noted on the Scopus website in 2021, with 205 publications. Before this surge, data showed a significant fall in 2015, with 68 articles compared to 112 articles in 2014. Even though there was a slight drop, the increase in publications published in this field demonstrates that its importance in the study is still being evaluated. To conclude the growth rate on RMT, 2021 shows the most number of publications with 205 articles, while the lowest number of publications was in 2022 (67 articles).

Only papers published through April 2022 were included in this bibliometric research, as the data mining procedure began in April 2022. To get the best analyses, all data after April 2022 was not considered to avoid the danger of using data that may be unstable (Monroy & Diaz, 2018). Besides, total publications for this year is inaccessible. As seen in Table 1, the year with the most cited articles was 2020 (111 citations per publication), while the year with the lowest citations was 2022 (6 citations), followed by 2015 (59 citations). Based on the trend, the total number articles on RMT is likely to rise even more. Productively, 2012 and 2014 shows the highest *h-index* of 18 for authors. The *h-index* measures the importance, significance and breadth of a scientist's contributions to science (Braun et al., 2006).

Table 1: Year of publication

Year	TP	NCP	TC	C/P	C/CP	h
2012	81	77	996	12.30	12.94	18
2013	103	95	957	9.29	10.07	16
2014	112	101	1150	10.27	11.39	18
2015	68	59	671	9.87	11.37	14
2016	73	64	697	9.55	10.89	14
2017	81	74	607	7.49	8.20	13
2018	93	80	594	6.39	7.43	12
2019	111	89	377	3.40	4.24	10
2020	151	111	784	5.19	7.06	10
2021	205	100	207	1.01	2.07	5
2022	67	6	10	0.15	1.67	2
Total	1,145					

Note. TP represents the total publication, NCP is the number cited per publication, TC denotes total citation, C/P is cited paper, C/CP is the citations per cited paper while h is h-index.

Table 2: Language

Language	Total Publications	%
English	1,000	86.51
Portuguese	80	6.92
Spanish	41	3.55
Turkish	17	1.47
Arabic	10	0.87
Italian	3	0.26
Russian	3	0.26
French	1	0.09
Polish	1	0.09

Note. % represents the percentage

The data obtained also analysed the frequency of language used in publication trends according to the year of publication, as compared on Table 2. The English language is the most widely used in publications, with around 86.51% of 1,145 published articles. Portuguese is the second highest language with 6.92%. The other articles were written using seven different languages, which are

Spanish, German, Turkish, Italian, Russian, French, and Polish. However, these languages are only 3.55% and below. The massive total publications using English language as English language became the official language of some 56 countries worldwide and the unofficial lingua franca of dozens more. (Cogo & Pitzl, 2013).

### 3.2 Top Ten prolific journals

The top ten prolific journals are ranked in Table 3 based on their number publications. Based on the total publications, the top three journals included The ZDM Mathematics Education Journal, The Bolema Mathematics Education Bulletin and The Mathematics Education Research Journal. The ZDM Mathematics Education journals were the most prominent with 132 publications. ZDM, the journal that came in the first place, is recognised as the most prestigious publication in mathematics education (Nivens & Otten, 2017). This rank demonstrates that ZDM Mathematics Education journals have achieved the prestigious status of being one of the first academic journals in mathematics.

Bolema Mathematics Education Bulletin ranks second with 99 publications, followed by Mathematics Education Research Journal with 94 publications. Other prominent RMT in mathematics journals includes Educational Studies in Mathematics (85 publications), International Journal of Mathematical Education in Science and Technology (77 publications), International Journal of Science and Mathematics Education (71 publications), Eurasia Journal of Mathematics, Science and Technology Education (61 publications), Journal of Mathematics Teacher Education (61 publications), Mathematics Enthusiast (47 publications) and Journal of Mathematical Behaviour (34 publications). ZDM had the highest TC with 1,294 citations, while Mathematics Enthusiast had the lowest total citation with 127 citations and a cite score of 1 which is greater (0.3) than the lowest cite score of 0.7, which is Bolema Mathematics Education Bulletin. Five of the top 10 most productive journals were owned by Springer Nature, 2 by Modestum Ltd. and 1 each by Bolema Department of Mathematics, University of Montana – ScholarWorks and Elsevier.

Table 3: Top 10 most prolific journals

Ranked	Source Title	TP	TC	Publisher	Cite score
1st	ZDM Mathematics Education	132	1,294	Springer Nature	3.6
2nd	Bolema Mathematics Education Bulletin	99	142	Bolema Departamento de Matematica	0.7
3rd	Mathematics Education Research Journal	94	757	Springer Nature	2.4
4th	Educational Studies in Mathematics	85	837	Springer Nature	3.4
5th	International Journal of Mathematical Education In Science and Technology	77	242	Modestum Ltd.	4.0

6th	International Journal of Science and Mathematics Education	71	537	Springer Nature	4.0
7th	Eurasia Journal of Mathematics Science and Technology Education	61	722	Modestum Ltd.	4.0
8th	Journal of Mathematics Teacher Education (JMTE)	61	559	Springer Nature	3.3
9th	Mathematics Enthusiast	47	127	University of Montana - ScholarWorks	1.0
10th	Journal of Mathematical Behaviour	34	309	Elsevier	2.2

Note. TP represents the total publication, while TC denotes the total citation

### 3.3 Top ten most productive countries

Figure 3 and table 4 presents the data on top 10 most productive countries based on total publications paper. As shown in figure 3, the country with the darkest colour was the most productive, in contrast to the nations with the lighter colours. So, the US is the most productive nation, having produced 333 publications, followed by Brazil, which has produced 107 publications, and Australia, which has produced 84 publications, coming in as the third most productive nation. The table reveals that the article originating from the continent of North America has amassed the most number of total citations, accumulating 2,136 citations compare to the others. One could say that readers from these continents chose their work more frequently to cite than readers from any other continent. Other European countries, such as the United Kingdom (UK), Spain, Germany and Turkey are also listed as having the most total citations, with total citation tallies of 668, 617, 553 and 389. Considering the evidence, we can conclude that the most cited papers in mathematics came from Europe.

TC denotes total citation, C/P is cited paper, and C/CP is the citations per cited paper.

Country	TP	NCP	TC	C/P	C/CP	Continent
United States	333	260	2,316	6.95	8.91	North America
Brazil	107	57	349	3.26	6.12	South America
Australia	84	75	668	7.95	8.91	Oceania
Turkey	69	51	389	5.64	7.63	Europe
United Kingdom	65	56	617	9.49	11.02	Europe
Spain	64	44	553	8.64	12.57	Europe
Germany	61	51	566	9.28	11.10	Europe
South Africa	60	43	473	7.88	11.00	Africa
Canada	44	36	395	8.98	10.97	North America
Indonesia	33	26	385	11.67	14.81	Asia

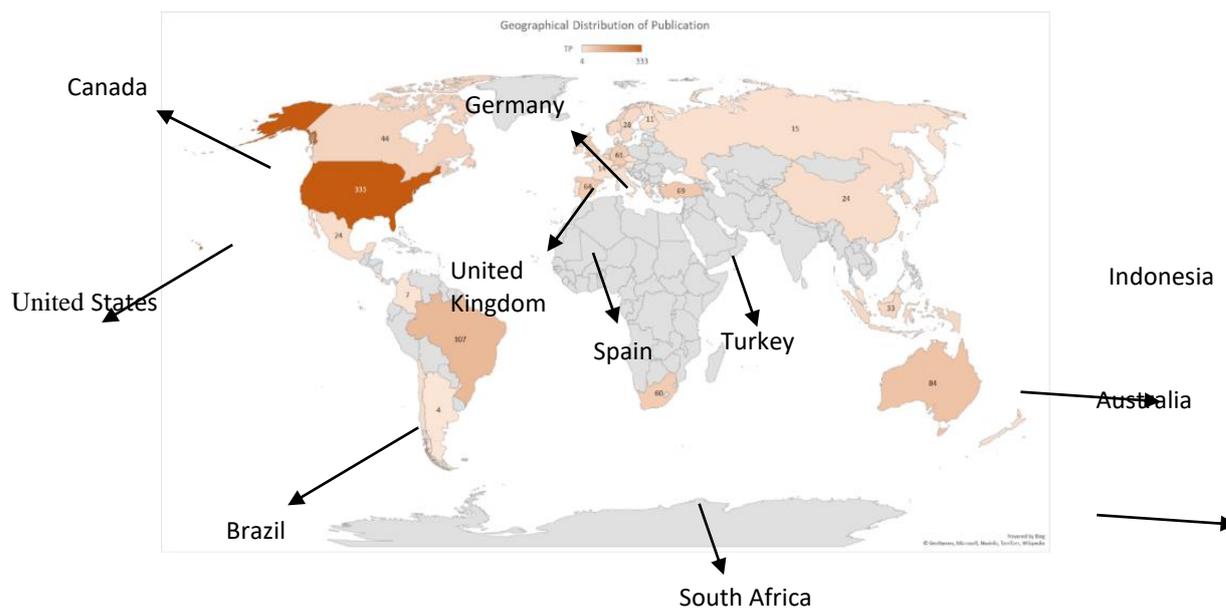


Table 4: List of the 10 most productive countries

Note. TP represents the total publication, NCP is the number cited per publication,

### 3.4 Top 10 main institutions involved in RMT

Table 5 presents the top 10 most influential institutions concerning RMT. The Sao Paulo State University was the institution that contributed the most to the 1,145 documents compiled, as part of the research on mathematics teachers with 25 publications, followed by Utrecht University and Australian Catholic University (19 publications), University of Granada, University of Limerick and University of Hamburg (16 publications each). On the other hand, Freudenthal Institute and the University of the Witwatersrand, Johannesburg, recorded 13 TP. Only Australian Catholic University publications were all cited with 134 total citations, pursuing Sao Paulo State University (181 citations) and Michigan State University (135 total citations). These differences demonstrate that each university has its own publications for fulfilling the global needs for mathematics education.

One of the institutions of a Commonwealth nation was identified as having the highest h index. There is strong evidence that the articles produced by this institution has a greater influence than those produced by other institutions, as shown by their cumulative h-index impact score of 7. On the other hand, Utrecht University, University of Hamburg, and Michigan State University all have an h-index impact score of 6. Meanwhile, an improved version of Hirsh's h-index, called the g-index, is created to measure an article's worldwide citation impact. Half of the world's best colleges are ranked. These articles highlight the extensive research conducted at this institution on the impact of mathematics instruction on student success.

Table 5: Top 10 main institutions

Institution	Country	TP	NCP	TC	C/P	C/CP	h	g
São Paulo State University	Brazil	25	13	181	7.24	13.92	5	13
Utrecht University	Netherlands	19	16	84	4.42	5.25	6	8
Australian Catholic University	Australia	19	19	134	7.05	7.05	7	10
University of Limerick	Ireland	16	15	79	4.94	5.27	5	8
University of Granada	Spain	16	8	34	2.13	4.25	3	5
University of Hamburg	Germany	16	16	127	7.94	7.94	6	11
State University of Campinas	Brazil	15	10	25	1.67	2.50	3	4
Michigan State University	United States	15	12	135	9.00	11.25	6	11
Freudenthal Institute	Brazil	13	10	52	4.00	5.20	4	6
University of the Witwatersrand, Johannesburg	South Africa	13	10	123	9.46	12.30	5	10

Note. TP represents the total publication, NCP is the number cited per publication, TC denotes total citation, C/P is cited paper, C/CP is the citations per cited paper, h is h-index, while g referred as g-index.

### 3.5 Top 10 cited papers on RMT

Based on the analyses, the top ten most cited papers on RMT list on table 6. Articles by Mailizar [26] have the greatest number of citations. This Eurasian journal's article has been referenced 147 times. In second place, the article titled as "Effect of COVID-19 on the performance of grade 12 students : Implications for STEM Education" [27] published in the same year and same publisher also received more than 100 citations for a total of 129. Moreover, 6 articles were reportedly cited between 100 and 60 times. The remainder were cited 53 and 52 times, respectively. According to the table, the most cited articles on mathematics teachers were published in 2012, with 3 articles published, followed by 2020 and 2016, while 2015, 2018 and 2014 had 1 citation each. According to our findings, a large number of authors have also decided to submit their original work to the esteemed journal, ZDM Mathematics Education, for publication.

Table 6: Top 10 cited papers on RMT

No	Year	Author (s)	Article title	Number of citations	Journal name
1	2020	Mailizar et al.	Secondary school mathematics teachers view on e-learning implementation barriers during the COVID-19 pandemic: The case of Indonesia	147	Eurasia Journal of Mathematics, Science and Technology Education
2	2020	Sintema	Effect of COVID-19 on the performance of grade 12 students	129	Eurasia Journal of Mathematics, Science and

					Technology Education
3	2014	Remillard, Heck,	Conceptualising the curriculum enactment process in mathematics education	95	ZDM Mathematics Education
4	2016	Borba et al.	Blended learning, e-learning and mobile learning in Mathematics Education	89	ZDM Mathematics Education
5	2016	Stahnke et al.	Teachers' perception, interpretation, and decision-making: a systematic review of empirical mathematics education research	83	ZDM Mathematics Education
6	2012	Hand	Seeing culture and power in mathematical learning: Towards a model of equitable instruction	70	Educational studies in Mathematics
7	2013	Planinic et al.	Comparison of student understanding of line graph slope in physics and mathematics	66	International Journal of Science and Mathematics Education
8	2018	Laurens et al.	How does RME improve students' mathematics cognitive achievement?	61	Eurasia Journal of Mathematics, Science and Technology Education
9	2012	Turner et al.	Promoting equity in mathematics teacher preparation	53	Journal of Mathematics Teacher Education
10	2015	Bruce & Hawes	The role of 2D and 3D mental rotation in mathematics for young children	51	ZDM Mathematics Education

### 3.6 Keywords

To address research questions 3, we focused on identifying the keywords which were most frequently used amongst scholars on RMT. Most scholars use 'mathematics education' as a keyword, according to the keywords list from the 1,145 article. This term appears in the keywords list of 305 (26.64%) publications. As this study focuses on mathematics teachers in mathematics education, the researcher's primary keywords are 'mathematics education'. Other keywords included in the researcher's list of keywords usage are 'teacher education' and 'mathematics'. 'Teacher's education' was repeated 69 times, while 'mathematics' was repeated 57 times. 'Professional development', 'problem-solving', 'mathematics teacher education', 'teaching', 'teacher knowledge' and 'equity' were also reported as keywords listed in the RMT articles. Table 7 shows that this list of keywords appears in 20 publications. The findings show that studies on mathematics teachers in improving professional development in mathematics education are still relevant, based on the results. Further studies like this must be continued to enhance students' mathematical achievement in light of the current educational changes.

Table 7: Keywords analysis

Keywords	TP	%
Mathematics education	305	26.64
Teacher education	69	6.03
Mathematics	57	4.98
Professional development	44	3.84
Problem-solving	32	2.79
Mathematics teacher education	27	2.36
Teaching	26	2.27
Teacher knowledge	25	2.18
Equity	24	2.10

Note. TP represents the total publication, % is the percentage

### 3.7 Topic of Interest

Within this part, we bring attention to the examination of keyword occurrences in mathematics research to establish the research priority pertaining to mathematics educators. From the analysis, 2,971 authors' keywords reported from 1,145 articles with 46 keywords meet the threshold of 10 minimum number of keyword occurrences. This number was reduced to 34 keywords after relabelling keywords with slight differences using the thesaurus. Figure 4 shows the bibliometric map of the keywords using VOS viewer overlay visualisation mode to illustrate the effect. All keywords from the analysis were separated into eight clusters represented by different colours, as shown in Figure 4.

Teacher education in mathematics education is a synonymous combination with creating a versatile mathematics teacher. The VOSviewer visualisation shows that 'mathematics education' has become the most frequently encountered (379 occurrence and 321 links). Other terms related to mathematics education include 'teacher education' (69 occurrence, 73 links), 'professional developments' (55 occurrence, 57 links), 'teacher beliefs' (53 occurrence, 57 links), 'pre-services' (51 occurrence, 46 links) and 'problem posing' (36 occurrence, 43 links). The list shows us that research on mathematics teacher professionalism developments also became a hot topic other than teacher education.



The United States and Brazil dominated the top chart as the most contributing countries to research on mathematics teachers through total publications, and Sao Paulo State University, Brazil, led as the first ranked university with the most number of publications. This achievement shows us that large universities produce more articles compared to small universities. These differences demonstrate that each university has its own publications for fulfilling global needs for mathematics education. However, the ASEAN region is not left behind with Indonesia ranked 10th in the top 10 countries that publish articles on mathematics teachers (article Indonesia). This accomplishment places ASEAN countries on par with other developing nations. Indeed, this achievement demonstrates that ASEAN countries are increasingly emphasising the issue of student achievement in mathematics based first on teachers' achievement.

Overall, the analysed keywords are very important in the current situation, with most of them focusing on mathematics teachers. 'Teacher education', 'mathematics', 'professional developments' and 'problem-solving' are among the most frequently used keywords. According to the author's keyword review, the most used keyword to clue readers is 'mathematics education'. Research relating to teacher education, professional development, teaching and even problem-solving has received a lot of attention. Research on mathematics teachers is expected to grow in the coming years, according to this study's findings.

Based on the top ten RMT most cited publications, the topic of the COVID-19 pandemic topped the list. As a result, research involving math teachers during a pandemic is seen as a critical concern. The development of the COVID-19 titles on mathematics teachers in enhancing the development of teacher professionalism is interesting. Relevant issues on teacher stress during pandemics, limitations and coping mechanisms for mathematics teachers will help others in mathematics education.

We provided a global overview of research on mathematics teachers in this analysis. Research on mathematics teachers is expected to continue to grow as a result of the 1,145 papers collected from the Scopus database between 2012 and 2022. Overall, the gap in this research indicates that the direction of future research on mathematics teachers is very important to be studied. As a result, researchers from Asia and other developing countries will need to work together more.

## 5. Conclusion(s)

During the years 2012-2022, there was a rise in the total number of scholarly articles published on research pertaining to mathematics teachers. From 1145 articles retrieved from Scopus database, the number of research articles published by researchers from nations in Europe topped the chart and continued to rise. At the same time, Indonesia has surpassed all other ASEAN countries in terms of the number of scholarly publications it has published on the topic of mathematics teachers. Most of the research conducted reported findings based on descriptive statistics or regression and correlations analysis. The success of mathematics education is closely connected to the competency of the mathematics teacher in the classroom. Thus, identifying effective strategies for improving the performance of mathematics teachers is an important area for future research.

Meanwhile, when compared to other ASEAN nations, Indonesia has the most publish papers on the research of mathematics teachers. As a result, other ASEAN countries should work with Indonesia to share their expertise in mathematics education. In the long run, this collaboration will help the ASEAN countries produce more competent math teachers. One notable example is the widespread adoption of the Singapore Math curriculum by schools in several ASEAN member countries (Barnuti-Sarca & Ciascai, 2022). This has led to a dramatic acceleration in the rate at which children in these nations grasp fundamental arithmetic ideas.

This bibliometric also provided an overall of global research trend of research on mathematics teachers and its potential insight for future research. The results of this research show a growing interest in researching mathematics teachers, which is commensurate with how the field of education is progressing now. According to the findings of the analysis, numerous studies on mathematics educators are published in prestigious journals on an annual basis. These studies analyse a wide range of themes, including classroom management, professional development, teacher expertise, and the impacts of novel models, interventions, and programs. This research may be found to be published in reputable journals such as the *Eurasia Journal of Mathematics, Science and Technology Education*, and the *ZDM Mathematics Education*. This implies that increasing pressures of accountability systems and high-stake testing may direct researchers to focus on improving the mathematics teachers. Mathematics teachers play a key role in shaping the next generation by ensuring that their pupils get an academic reputation. Research in this area is still scarce in ASEAN countries. The formation of a high-quality educational system requires actions taken to boost the respectability of mathematics teachers.

Finally, it is anticipated that studies of mathematics teachers will lead to an increase in the widespread recognition that educators have the potential to actively involve, inspire, and motivate their pupils in several ways. As a profession, educators also need to improve their ability to collaborate, share expertise, and guide younger colleagues. Teachers might, for instance, participate in conferences, organise professional development sessions to aid their colleagues in doing their jobs better, and collaborate on the creation of brand new curricula and programmes for their pupils. Research in this area is encouraged since it may help educators in the future create more engaging lessons for their students.

## **6. Recommendations/Future directions**

Only articles from the filtered search results are used in the analysis. For a definitive answer, further research is required. As a result, not all studies in Scopus related to research on mathematics teachers may be represented in this data. Future studies should make use of larger samples by broadening the scope of the keywords they use, and by making the data in the database more easily accessible. It is possible that bibliometric data interpretation applications like *ScientoPyUI* and *CRExplorer* could be used in future studies. Also, researchers may conduct other review methodologies like a systematic literature review or scoping analysis to describe the relationships found in the study. Other than that, an analysis using the Scopus database is not produced exclusively for bibliometric analysis and therefore may still contain errors. To overcome these errors, scholars must carefully clean the bibliometric data by removing duplicates and erroneous entries. Further studies are recommended to use multiple academic databases that can be assessed publicly, such as *Web of Science*, *Pubmed*, *Dimensions*, *Lens*, *Google Scholar* and *Microsoft Academic*.

'Mathematics education', 'teacher education', 'professional developments', 'teacher beliefs', 'pre-services' and 'problem posing' were some of the most used keywords. With this growth, the study on RMT is expected to growth in the future. Particularly concerning the research trend, more sub-area and assessment methodologies are suggested.

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