23 (2), 2022, 766-773

Jurnal Pendidikan MIPA

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jurnal.fkip.unila.ac.id/index.php/jpmipa/

Bibliometric Analysis of Students' Errors in Solving Problems on Sets using VOSviewer

Adryani Br Ginting, Ajeng Sucitra Haryanza, Alya Zulkhoirunnisa, Ghina Rizki Amali, Salma Nadhira, Muntazhimah*

Department of Mathematics Education, Universitas Muhammadiyah Prof. Dr. HAMKA, Indonesia

Abstract: Learning error can be interpreted as a certain condition marked by errors when someone completes a test. One of the causes of students' mistakes in answering questions is the lack of understanding of the concepts in the material. Research on student errors in solving problems related to set material uses the bibliometric method, which is still rarely done before. This research is indexed from Scholar with 500 articles obtained and extracted in the Publish or Perished (PoP) application. The articles obtained were published from 0 to 2022. The articles with the most article citations with 1837 citations occurred in 2020. After that, it was continued by visualizing the network, the number of cluster items was 10 red, 6 green and 4 blue, overlay and density by using the VOSviewer application. Therefore, it can be concluded that mathematical problem is one of the keywords that is still rarely studied.

Keywords: students' error, mathematics, bibliometric analysis, sets.

Abstrak: *Kekeliruan belajar dapat diartikan sebagai suatu kondisi tertentu yang ditandai dengan kesalahan-kesalahan sewaktu seseorang menyelesaikan tes. Salah satu penyebab kekeliruan siswa dalam menjawab soal adalah kurangnya pemahaman konsep pada materi tersebut. Penelitian kekeliruan siswa dalam menyelesaikan soal yang berkaitan dengan materi himpunan menggunakan metode bibliometrik, yang masih jarang dilakukan sebelumnya. Penelitian ini terindeks dari Scholar dengan 500 artikel yang di dapat dan di ekstrak pada aplikasi Publish or Perished (PoP). Artikel yang didapat di publish pada tahun 0 hingga 2022. Diperoleh artikel dengan Kutipan artikel yang terbanyak dengan 1837 kutipan terjadi pada tahun 2020. Setelah itu dilanjutkan dengan melakukan visualisasi network jumlah item cluster sebanyak 10 berwarna meraah, 6 berwarna hijau dan 4 berwarna biru, overlay dan density dengan menggunakan aplikasi VOSviewer. Sehingga dapat disimpulkan bahwa mathematica problem merupakan salah satu kata kunci yang masih jarang diteliti.*

Kata kunci: *kesalahan siswa, matematika, analisis bibliometric, himpunan.*

▪ INTRODUCTION

According to mathematics education experts, mathematics is a science that reviews patterns or consistency and levels (Shadiq, 2014). According to (Hanum, 2013) states that mathematics is a subject that must be studied at all levels of education. One of the mathematical materials studied is the set material. A set is a group of objects that can be clearly defined. However, there are still many students who experience errors or difficulties in solving set problems.

According to (Tall & Razali, 1993) states that one of the causes of student errors in answering questions is the lack of understanding of the concepts in the material. Therefore, mastery of concepts in mathematics is needed to solve problems. In research (Kesumawati, 2008) there are 4 problem-solving indicators, namely: 1) Identifying elements that are known and asked, 2) Developing mathematical models, 3) Selecting

Muntazhimah
*Email: muntazhimah@uhamka.ac.id

DOI: http://dx.doi.org/10.23960/jpmipa/v23i2.pp766-773
Received: 26 April 2022
Accepted: 06 June 2022
Published: 13 July 2022

and developing strategies for each problem, 4) Able to explain and check the correctness of the answers obtained. . According to (Herholdt & Sapire, 2014), students' learning difficulties can be solved by analyzing their mistakes. Therefore, this error analysis is needed, especially in solving set problems.

Learning errors are a good thing to discuss and also change students' learning difficulties, provide motivation and try to find student errors, encourage interesting responses and provide new views for defining mathematics according to (Borasi, 1989).

They also investigate the role of errors in the improvement of mathematical knowledge can help define the production of mathematical knowledge or science and provide a good approach. Error investigation can help to gain a deeper understanding or understanding of mathematics. In general, weighing errors can help students realize the limits of mathematics and pay attention to the humanistic side of the discipline (Căprioară, 2015).

Based on the aforementioned theoretical background, researchers can determine students' abilities and plan solutions to each problem by conducting research on student errors in solving problems related to sets. This research has been done quite a lot. Therefore, we need to do data processing or bibliometric studies. Bibliometrics comes from the words biblio and metric. Biblio means book and metric means measure (Pattah, 2013). Bibliometric studies are a way of analyzing and processing data obtained from various databases, such as Google Scholar. According to (Hasugian, 2009) through bibliometrics, we can find out the characteristics of a literature based on the title, index, citation, keywords, author, and year of publication.

Bibliometric analysis is a study of bibliographic analysis of scientific research, based on the assumption or hypothesis that the researcher carried out his research and must inform his colleagues of the results. This makes a progress and development of knowledge if a researcher carries out joint activities to review the research topic. In research, information is also needed from the results of previous scientific works that have also been done by friends before (Tupan et al., 2018). This bibliometric research was conducted to determine the trend of the development of articles about student errors in solving questions related to the set using the Google Scholar database from 0 to 2022. By analyzing the authors, grouping themes, and year of publication.

▪ METHOD

This research uses bibliometric analysis method. This bibliometric analysis is a quantitative method used to analyze biographical data in journals. This analysis makes it easier for researchers to monitor bibliographic content, citation analysis in every article obtained in international and national journals about Student Mistakes, in Solving Problems Related to Collection Materials Using VOSviewer

Participants

Based on international and national journals about students' mistakes in solving questions related to collection of material on Google Scholar from 00 – 2022. The following is data obtained from Publish or Perish using Google Scholar.

Table 1. Research subjects

Result	Explanation
Query	Bibliometric Analysis of Student Errors, In Solving Problems Related to Collection Materials Using VOSviewer
Publication Years	00 – 2022
Citation Years	470
Papers	500
Citations	16287
Cites/Year	34.653
Cites/Paper	32.574
Authors/Paper	1

Based on the table 1, publication of articles about Student Mistakes, In Solving Problems Related to Set Materials Using VOSviewer on google schollar from 00-2022 using Publish or Perish obtained 500 papers, 16287 citations, 34,653 citations per year, 32.574 citations per paper , and 1 author per paper.

Instrument

Data collection in this study was carried out using Google Schollar in the Publish or Perish application. The key words are student error, mathematics, set. The data obtained are stored in ris and CVC formats. The stored data is then processed in the VOSviewer application.

Data Analysis

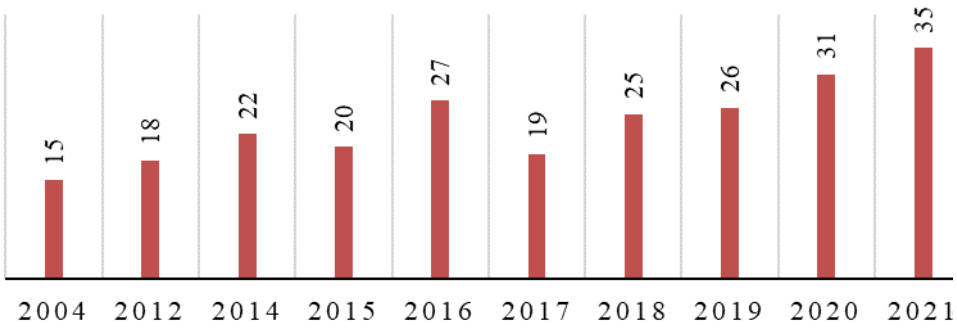
technique used in this research is bibliometric analysis. Bibliometrics is an analysis in a particular field qualitatively or quantitatively with statistical methods that measure the development of research, literature and so on (Judge, 2020). Meanwhile, according to Rohayani and Idhani, bibliometrics are scientific journals that are analyzed using a systematic way (Royani & Idhani, 2018). In this study, the steps that will be carried out in analyzing the data are by first collecting data using the Publish or Perish application in Google Scholar with the keywords student error, mathematics, set. After that the data is stored in certain formats such as ris, CVC. The stored data can be processed using the VOSviewer application.

▪ RESULT AND DISSCUSSION

The results of collecting data analysis on errors in solving problems related to the set material can be seen in table 1 below, from these results we can obtain the amount of data from 2004-2021 there are 238 total publications based on titles, keywords and in the database Google Scholar. Based on table 1 there are 15 (9.61%) publications in 2004, 18 (2.30%) publications in 2012, 22 (5.38%) in 2014, 20 (4.14%) in 2015, 27 (4.14%) in 2016, 19 (4.20%) in 2017, 25 (8.25%) in 2018, and 26 (7.67%) in 2019. Thus the most published research articles in the Google Scholar database regarding errors in solving problems related to sets is in 2021 with 35 publications while the least published research articles are in 2015 with 20 publications.

Table 2. Development of solve the problem articles in mathematics learning

Year of Publication	Total	Percentage
2021	35	9.00
2020	31	6.50
2019	26	7.67
2018	25	8.25
2017	19	4.20
2016	27	4.17
2015	20	4.14
2014	22	5.38
2012	18	2.30
2004	15	9.61



Figures1. Publication of solve the problem articles for mathematics learning

Based on the data in Figure 1a, it shows that the number of publications in 2004 to 2021 experienced a steady increase but in 2014 to 2015 and 2016 to 2017 the number of publications decreased. Based on Figure 1, it can be seen that the most citations were in 2009 with 4230 citations, and for the lowest citations in 1974, namely 271 citations. It can be seen from the results of the citation analysis obtained from 1950 to 2022 that the number of citations was 10,769.

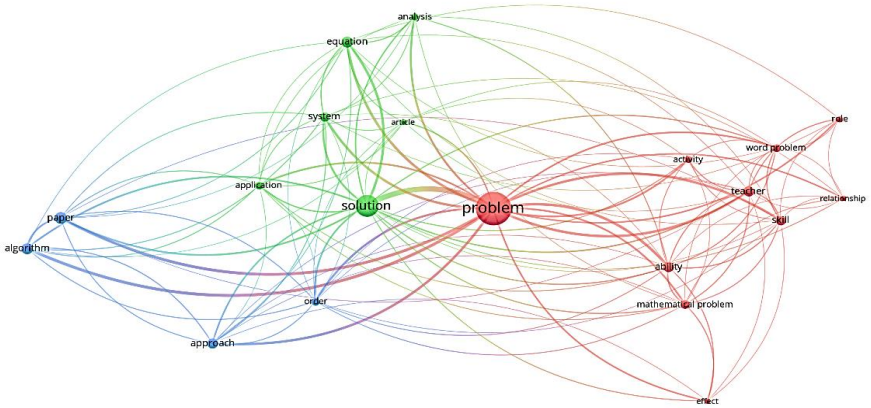


Figure 2. Network visualization

In mathematics, this case status is a learning situation imagined by the teacher to build a reflection and analysis study room condition with several cases or questions to be solved. This situation can allow students to broaden their knowledge, through new representations, and therefore, used for learning. Basically, every problem must have as a reason for contextualization & operationalization in processed knowledge in mathematics lessons. For an individual, an exclusive situation is defined as a punishment situation or a case situation, not only in itself, but by "the interaction that exists between the task & subject's abilities." (J.-F. Richard, quoted by Raynal & Rieunier 1997, p. 296). So, the case that the teacher will face is assessing the difficulties proposed and in the case situation, he must introduce a relative level of guidance or mediation to guide students to the situation as an execution situation for him. . The notion of case-space (Raynal & Rieunier, 1997, p. 295) balances using research spaces that are specific to each case: to form a good case representation one must identify research spaces that can be applied later, in which these estimates can be used (Căprioară, 2015)

Story questions are usually realized in sentences where the sentence can solve errors or problems whose solutions use counting skills (Suratih, 2020). According to (Sangadah, 2016) process skills errors include committed data and skills hierarchy problems with various errors made to students, namely errors in performing calculation operations, not performing an operation to find a solution or not finishing working on problems. According to Utami (2020), there are 2 student errors in solving students' mathematical spatial ability questions, namely conceptual errors and operating errors. Conceptual errors include errors in drawing, determining the position of the image, understanding the problem so that it cannot make an image, errors in determining the distance from the point to the line and to the plane. Operational errors, namely students can understand the concept but are wrong in the calculation process and problem solving due to lack of accuracy.

According to (Hananta & Ratu, 2019) students' mistakes in solving mathematical problems on three-dimensional material are errors in making steps to solving problems, because students do not understand the problems asked in the questions.

Cluster	Item
Red	Problem, activity, word problem, role, teacher, relationship, skill, ability, mathematical problem, effect.
Green	Solution, application, system, article, equation, analysis.
Blue	Order, paper, algorithm, approach

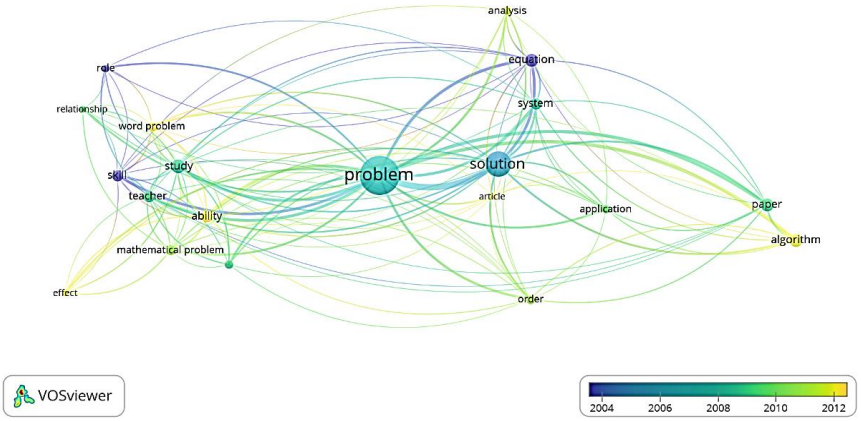


Figure 3. Overlay visualization

Based on data obtained from VOSviewers, the minimum number of keyword occurrences is 20 out of 1060 keywords. There are 20 keywords that meet the limit, from the 20 keywords generated in the image above, we found the keyword number of occurrences and also relevance. Among the keywords that emerged were "role, problem, skill, effect, relationship, solution, ability, word problem, algorithm, activity, mathematical problem, article, teacher, paper, approach, analysis, equation, system, application, order". We selected from some of the keywords above according to keywords that are relevant to the title or research theme. Then the keywords after being selected are "role, skill, problem, relationship, ability, algorithm, mathematical problem, teacher, approach, equation, application". of several keywords that have been selected, the problem keyword has the largest number of occurrences compared to the others with the number of 389, and the least is the relationship keyword with the number of occurrences is 13. The most frequently used are related to students errors in Solving Problems Related to Set Materials, namely problems and solutions, then for keywords that are not often used, namely articles and effects. In addition, there are 20 terms used. And the terms are not all in accordance with what you are looking for.

▪ CONCLUSION

In this study, the researcher used bibliometric analysis by selecting a database that suited the researcher's needs. Bibliomeric analysis is one of the methods used to examine research publications. Bibliometric analysis is the application of statistical and quantitative analysis of publications such as journals and citations. The conception of Bibliometric Analysis is the core of research publication outputs (for example, citation data, and research impact) through data derived from online publication databases (Dimisikiani, Sedianingsih, Amalia, & ZIiulingga, 2020)

One of the shortcomings of bibliometric analysis is the reliability of the database. . This is because dissimilar databases include various articles and citations. On some subjects, the number of articles will vary depending on the database used. In addition, the advantages will also differ according to the journal where the data will be taken. so

it is very important to find data that is accurate and in accordance with the research topic being carried out.

The impact of mathematical errors obtained on students, among others, students experiencing research articles on Student Mistakes in Solving Problems Related to Set Materials contained in journals on Google Scholar, generally experiences unstable growth every year. Based on the available data, the most articles were in 2016, 2020, and 2021. The articles with the highest number of citations were 4230 in 2009. Keywords are the reference for further research. Keywords that are often used are problems and solutions, then for keywords that are not often used, namely articles and effects. From the results of existing research, the authors suggest that further research can use a different database.

▪ REFERENCES

Borasi, R. (1989). Students Constructive Uses of Mathematical Errors: A Taxonomy. ERIC Journal, 58(58), 99–104. https://www.unhcr.org/publications/manuals/4d9352319/unhcr-protection-training-manual-european-border-entry-officials-2-legal.html?query=excom 1989

Căprioară, D. (2015). Problem Solving - Purpose and Means of Learning Mathematics in School. Procedia - Social and Behavioral Sciences, 191, 1859–1864. https://doi.org/10.1016/j.sbspro.2015.04.332

Erindah Dimisikiani, Sedianingsih, Riski Amalia, ZIiulingga, NA (2020). Bibliometric Analysis and Mapping of Online Registration System in Hospitals. 4(1).

Hakim, L. (2020). Bibliometric Analysis of Business Incubator Research on Scopus Indexed Scientific Publications. Scientific Journal of Management, 8(2), 176–189. http://www.ejournal.pelitaindonesia.ac.id/ojs32/index.php/PROCURATIO/index

Hananta, OFI, & Ratu, N. (2019). Analysis of Student Errors in Solving Logarithmic Problems. JPMI (Journal of Indonesian Mathematics Education), 4(1), 29. https://doi.org/10.26737/jpmi.v4i1900

Hanum, NS (2013). The effectiveness of e-learning as a learning medium (evaluation study of the e-learning learning model at SMK Telkom Sandhy Putra Purwokerto). Journal of vocational education, 3(1).

Hasugian, J. (2009). Bibliometric Analysis of Publication of AIDS Research Results in Indonesia. Article accessed on, 12.

Herholdt, R., & Sapire, I. (2014). An error analysis in the early grades mathematics-A learning opportunity? South African Journal of Childhood Education, 4(1), 43–60.

Kesumawati, N. (2008). Understanding of mathematical concepts in learning mathematics. National Seminar on Mathematics and Mathematics Education, 2, 231–234.

Pattah, SH (2013). Utilization of bibliometric studies as a method of evaluation and study in library and information science. Khizanah al-Hikmah: Journal of Library, Information, and Archival Sciences, 1(1), 47–57.

Royani, Y., & Idhani, D. (2018). Bibliometric Analysis Journal of Marine Research in Indonesia 1. Marine Research in Indonesia, 25(4), 63–68.

Sangadah, M. (2016). Error Analysis of Junior High School Students in Solving Main Mathematical Problems in Two Variable Linear Equation Systems. Equivalent, 20(1), 12–18.

Suratih, HP (2020). Analysis of students' errors in solving linear programming problems based on Newman's error analysis. 15(2), 111–123.

Tall, D., & Razali, MR (1993). Diagnosing students' difficulties in learning mathematics. International Journal of Mathematical Education in Science and Technology, 24(2), 209–222.

Tupan, T., Rahayu, RN, Rachmawati, R., & Rahayu, ESR (2018). Bibliometric Analysis of Research Developments in Instrumentation Science. Read: Journal of Documentation and Information, 39(2), 135. https://doi.org/10.14203/j.baca.v39i2.413

Utami, C. (2020). Student Errors in Solving Mathematical Spatial Ability Problems. Al-Khwarizmi: Journal of Mathematics and Natural Sciences Education, 8(2), 123–132. https://doi.org/10.24256/jpmipa.v8i2.1177