



Discovery Learning Research in Mathematics Learning: A Bibliometric Review

Ilham Muhammad¹, Rani Darmayanti², Viky Risnanda Arif³, and Adebayo Ola Afolaranmi⁴

1. Universitas Pendidikan Indonesia, Indonesia

2. Universitas PGRI Wiranegara, Indonesia

3. SMA Negeri 1 Grati, Indonesia

4. Lead City University, Ibadan, Nigeria

E-mail correspondence to: ranidarmayanti1990@gmail.com

Abstract

Discovery Learning is a learning model that changes learning from teacher-centred learning to student-centred learning so that students learn actively by discovering themselves, investigating themselves and cultivating a scientific attitude. The purpose of this research is to discover the research focus related to Discovery Learning in learning mathematics and its novelty. The method used is bibliometric analysis. The data taken comes from the Scopus database. The study results show increased publications related to Discovery Learning in mathematics learning from 2017 to 2023. The highest citation trend occurred in the 2017 publication, which has been cited 41 times. The country that has had a major impact on Discovery Learning research in mathematics learning is Indonesia. The research focus is divided into three parts, namely, 1) Discovery Learning, Mathematics Learning and student; 2) problem-solving and Indonesia; 3) junior high school and Geometry. New themes in this field are e-learning, teaching and learning, mathematical software, pre-service teachers, and technology.

Keywords: Bibliometric; discovery learning; mathematics learning.

Introduction

Education is very important and can improve the quality of human resources (Qin et al., 2021; Sohila, 2021; Widiyanti et al., 2022). According to (Sudarsana et al., 2019; Widyanti et al., 2021) Education is a conscious effort to create a learning process that can develop students' self-potential and become human beings with noble character. In improving the quality of education in learning (Choirudin et al., 2021; Sohila, 2021), educators can apply several

learning methods, one of which is by applying Discovery Learning (Mulbar, 2021; Murni, 2017; Wang, 2020). According to (Honomichl & Chen, 2012) Discovery Learning is an important but controversial topic in the fields of psychology, education, and cognitive science. The discovery learning method was first developed by Bruner (Khadijah et al., 2023).

According to (Bruner, 1961), Discovery Learning is a process where students can understand meaning, concepts, and relationships through a process of intuition until finally, they can find a conclusion adapted to their cognitive development. (Bruner, 1961) considers that discovery learning is in accordance with the active search for knowledge by humans and gives the best results. (Bruner, 1961) suggested that students should learn through active participation with concepts and principles so that they are encouraged to gain experience and conduct experiments that allow them to discover the principles themselves. Discovery Learning is a learning model that changes learning from teacher-centred learning to student-centred learning so that students learn actively by discovering themselves, investigating themselves and cultivating a scientific attitude (Donato, 2022; Santiago et al., 2016). Meanwhile, according to (Affandi et al., 2022; and Recio, 2021), the learning model with Discovery Learning is a constructivist learning model that combines learning principles by discovery and radical constructivism with the principles of constructivism learning design theory. Discovery Learning is also interpreted as a series of activities in learning that involve students' abilities to find systematically (Affandi, 2022; González, 2017; Swandi, 2020), critically and analyze so that they can formulate their own findings covering cognitive, affective and psychomotor aspects (Batubara, 2019; Syarif et al., 2020). So, Discovery Learning is a student-centred learning model that involves students' ability to discover a concept.

Through Discovery learning, students can also learn to think analytically and try to solve problems (Fahmi et al., 2019; Linggile & Payu, 2022; Marta et al., 2022). Meanwhile according to (Sunarsih et al., 2020), through learning Discovery Learning provides opportunities for students to discover a concept through examples found in everyday life (Laila et al., 2023; Sugianto et al., 2017; Vedyanty et al., 2023). Discovery Learning is not only able to improve students' metacognitive abilities but also to improve communication skills and student learning outcomes (Fauza et al., 2022; In'am et al., 2023; Sah et al., 2023). In addition, using discovery learning models also impacts the development students' creative thinking abilities (Cholily et al., 2023; Hasanah et al., 2022; Sekaryanti et al., 2022). The discovery learning method has six sequences: stimulation, problem identification, data collection, data processing verification and generalization (Anggraini et al., 2022; Rizqi et al., 2023; Widodo et al., 2023).

Mathematics is an important knowledge for students to acquire which is useful in solving problems in everyday life (Afriyanti et al., 2018; H Sinambela et al., 2018). Discovery learning is appropriate to be applied to mathematics learning because it has a better influence on learning outcomes (Afriyanti et al., 2018; Mengel-From, 2018). Learning model with Discovery learning for learning mathematics can improve students' learning achievement in mathematics (Amiyani, 2018; Hudaefi, 2022). Meanwhile according to (Liao, 2016) learning models with Discovery learning can improve problem solving skills, so many researchers are researching related to discovery learning.

Discovery learning research has developed very rapidly in the last decade, Discovery learning research has also produced many findings in various fields of study (Kurniati et al., 2017; Sukma & Supriyono, 2019). Discovery learning research in education has indeed increased in recent years, but not only in education in general, discovery learning research in mathematics learning has also increased in recent years (Pratiwi & Miriam, 2022; Zhang et al., 2022). This means that an increase in research related to discovery learning in education is also followed by an increase in research on discovery learning in education, especially in the field of mathematics. For this reason, it is necessary to apply a statistical method to analyze the results of these studies in knowing the research focus and finding research novelty. One method that can be used in analyzing research in certain studies is using bibliometric analysis.

Bibliometric analysis can be used in analyzing publications

(Agarwal, 2016; León-Castro, 2021; Liang, 2018). According to (Muhammad et al., 2022) bibliometric is a statistical method that contains a variety of information about research in a particular study. Many research has been using this bibliometric analysis, especially in the educational field (Hidayati et al., 2018; Oh, 2019; Wulandari et al., 2016). In obtaining this information from publications related to discovery learning in mathematics education, a database is needed (Darmayanti et al., 2023a; Gilar Jatisunda et al., 2020; Khoir et al., 2018). The research used in this research is derived from the Scopus database.

Research related to this research is like research conducted by (Wicaksono et al., 2021) regarding bibliometric analysis related to research on Discovery learning in general in science education taken from Scopus database publications (Chertow, 2021; Segarra-Saavedra, 2020). The bibliometric analysis presented in this study provides relevant information about the main themes learned about discovery learning in mathematics learning, which can be seen in increasing creativity (Martín-Martín, 2018; Pereira, 2023), learning outcomes, and student achievement in teaching and learning activities at school (Karim & Zoker, 2023; Schabas, 2023; Winson et al., 2023). Therefore, this study suggests that further researchers discuss discovery learning in other fields of science such as mathematics.

The purpose of this research is to find out the focus of research related to discovery learning in learning mathematics along with its novelty. Therefore, researchers conducting research on novelty and the focus of research on Discovery learning in learning mathematics with the Scopus database from 2017-2023. The research questions include; (1) how are the publication trends and citation trends related to discovery learning research in mathematics learning?; (2) how is the distribution of publications mappings and relations between countries in research related to discovery learning in mathematics learning?; (3) what are the novelties and research focus on discovery learning in learning mathematics?

Research Methode

This study uses a bibliometric analysis method. Publications related to Discovery learning in mathematics learning taken from the Scopus database from 2017 to 2023 were analyzed using descriptive bibliometric analysis. The steps in collecting data are starting from identification, screening, eligibility and inclusion (Moher et al., 2009).

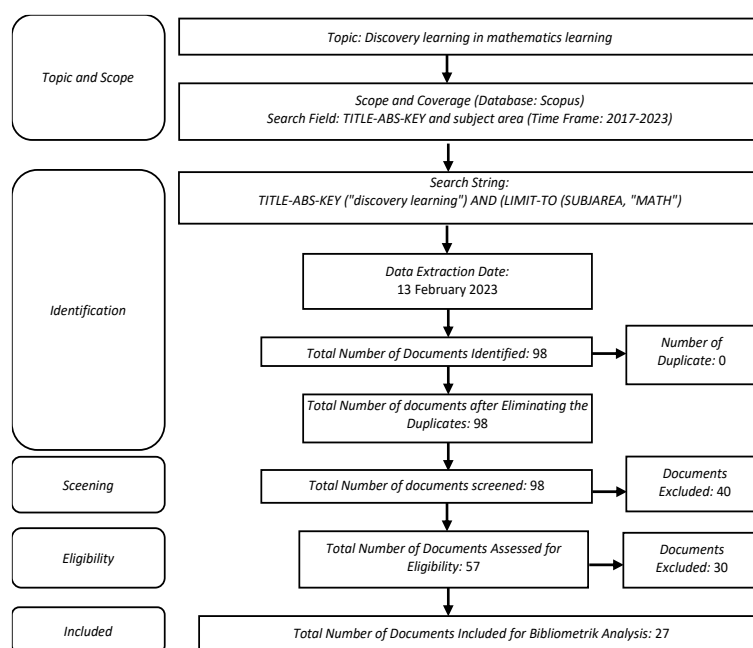


Figure 1. Data Collection Process

Identification is done by entering keywords according to the research theme you want to study. In this study, research on discovery learning in learning will be discussed. For this reason, the researcher entered the keywords "discovery learning" and "education" in the Scopus database. After entering the keywords,

data is obtained for 98 publications according to the specified criteria as shown in figure 2. The data for 98 publications is then checked whether there are duplicate data or not. Because there were no duplicate data, the 98 publications could proceed to the next stage.

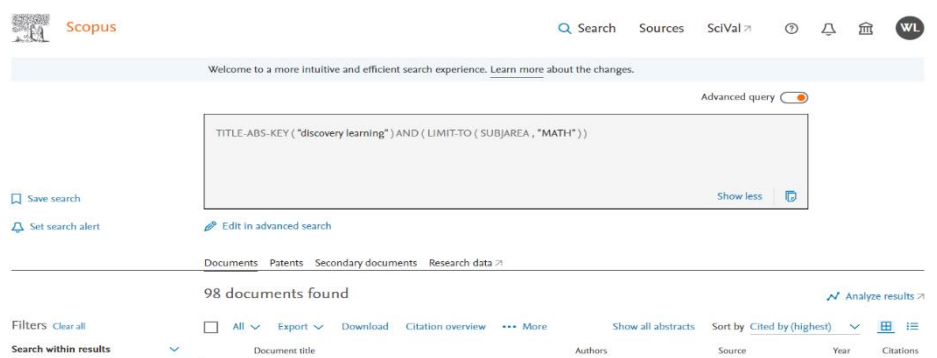


Figure 2. Searching Data from Scopus Database

Screening is carried out to select publications from the first stage, publications must comply with the following criteria, namely articles published in the form of journals and conference papers and publications in English. After screening, 40 articles were discarded and did not proceed to the next stage. A total of 57 who met the criteria will then be carried out at the eligibility stage.

Eligibility is doing feasibility, titles and abstracts of 57 documents from the previous stage will be seen whether the documents meet the criteria, namely, titles and abstracts contain the words discovery learning and mathematics learning, after eligibility is carried out, 27 publications that meet the criteria are obtained which can be continued at the inclusion stage.

Data analysis method

Data obtained from the Scopus database is then stored in 2 different formats, first we save in CSV form and save in RIS form, CSV data will be entered and analyzed with the help of VOSviewer while RIS data will be entered into Harzing's Publish or Perish Software. The publication trend and trend of research citations of discovery learning in mathematics learning are seen from the year of publication, and the distribution of countries and country relations is seen from the country of origin of the authors which will then be seen by novelty and research focus will be analyzed with the help of the VOSviewer application. Software Microsoft excel and Software Harzing's Publish or Perish. VOSviewer is used in displaying the visualization of relations between countries, the focus of research. Harzing's Publish or Perish software is used to calculate h-index and g-index values and other data about citations and Microsoft excel software is used to display country distribution on a world map.

Results and Discussion

In presenting the research results, the researcher ranks the research questions starting from publication trends, citation trends, geographic distribution, patterns of relations between countries, and research focus. The publications were analyzed that is from 2017 to year 2023.

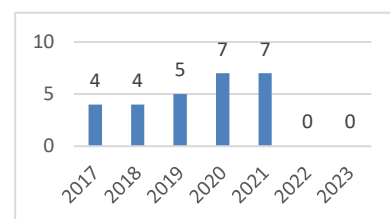


Figure 3. Publication trends (1992-2023)

Publications related to discovery learning in mathematics from 2017 to 2023 are separated by year of publication with a total of 27 publications. Number of publications 2020 and year 2021 is the most compared to other years. The trend of publications in this field has increased in several ways year. Publications in recent years have increased viz from 2017 to the year 2021. This thing in accordance with what is conveyed by (Pratiwi & Miriam, 2022; Wicaksono et al., 2021; Zhang et al., 2022) that research related to Discovery Learning is growing rapidly, especially in the field of mathematics. The biggest increase occurred from 2019 to 2020. In 2019 the total published articles were 5 and increased to 7 publications in the following year. Although from 2017 to 2021 total publication Keep going increased, however not in 2022 and in 2023, in the No There is published articles.

Table 1. Citation Analysis of Publications

Year	TP	NCP	TC	C/P	C/CP	h	g
2023	-	-	-	-	-	-	-
2022	-	-	-	-	-	-	-
2021	7	2	3	0.43		1	1
2020	7	4	6	0.86		2	2
2019	5	4	7	1.40		2	2
2018	4	4	31	2.75		2	4
2017	4	4	41	10.25		4	4

Notes. TP=total of publication, NCP= number of cited Publication, TC=total citations, C/P= average citations per publication, C/CP= average citations per cited publication, h=h- index, g=g- index

Discovery related publications Learning mathematics is analyzed based on the number of citations per year starting from 2017 to 2023. From table 1 above it can be seen that the highest NCP value is in 2017 to 2020 with 4 publications that have been cited at least 1 time out of the total publications in each that year.

Meanwhile, the highest total citations were in the 2017 publication with a total of 41 citations. The highest h- index and g- index values were in 2017 with h- index = 4 and g- index = 4. This means that publications in 2017 have had a huge impact on Discovery research Learning in current mathematics learning. In 2017 there were 4

publications that have been cited which can be seen in table 2

below.

Table 2. Articles published in 2017

No	Author (Year)	Title	Sources	Citation
1	(Ramdhani et al., 2017b)	Discovery Learning with Scientific Approach on Geometry	International Conference on Mathematics and Science Education, ICMScE 2017	16
2	(Yurniwati & Hanum, 2017)	Improving mathematics achievement of Indonesian 5th grade students through guided discovery learning	Journal on Mathematics Education	14
3	(Kartikaningtyas et al., 2017)	Contextual Approach with Guided Discovery Learning and Brain Based Learning in Geometry Learning	International Conference on Mathematics and Science Education, ICMScE 2017	6
4	(Tokada et al., 2017)	Discovery Learning for Mathematical Literacy Ability	International Conference on Mathematics and Science Education, ICMScE 2017	5

Research conducted by (Ramdhani et al., 2017; Rionanda et al., 2022) entitled "Discovery Learning with Scientific approach on Geometry" gets the highest number of citations, namely 16 times, the article discusses. Publication source from table above can also be used as a reference for researchers who want to publish their articles related to Discovery Learning in learning mathematics like journal "Journal on Mathematics Education".

How is the geographical distribution of publications and

patterns of relations between countries related to Discovery research Learning in learning mathematics?

The geographical distribution of countries and patterns of relations between countries are seen based on the origin of the authors of documents that have been published regarding Discovery Learning in mathematics learning from 2017 to 2023.

Aaa

Selected	Country	Documents ▼	Citations	Total link strength
☒	indonesia	22	62	4
☒	germany	1	0	82
☒	switzerland	1	0	82
☒	egypt	1	2	36
☒	saudi arabia	1	2	36

Figure 4 Geographic Distribution

Spread geographical from the country of origin writer can seen in Figure 4 above. Countries with the highest total publications are on the continent of Asia, namely Indonesia with 22 publications, second to fifth from the continents of Asia, Africa and Europe, namely Saudi Arabia, Egypt, Switzerland, and Germany having published 1 document each, geographic distribution Discovery-related publications Learning in mathematics learning is spread over almost all continents, starting from the continents of Asia, Africa, and Europe. This means that America and Australia have not there is an article published related field this. Viewed from amount the citation publication from Indonesian state writers became the most with 62 times cited. America and Australia have not published an article yet, this does not mean that these two continents do not apply the discovery learning model in mathematics learning. it's just that these two continents are not included in the continents that publish articles on the Scopus database about discovery learning, especially in mathematics from 2017 to 2023. Indonesia is a country that has a big impact on research related to this field, this is in accordance with what was conveyed by (Darmayanti et al., 2023b; Pratiwi & Miriam, 2022) that Indonesia is one of them countries that publish the most related articles Discovery Learning in learning mathematics.

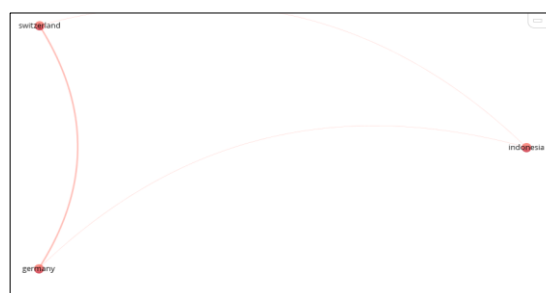


Figure 5. Patterns of relations between countries

On the picture on seen that only There is three countries, meaning two other countries No including into the signifying image both countries no own cooperation relations with other countries. Relations between countries can be seen from the number of links, from Figure 5 on seen that the three countries mutually related. This means that Indonesia, Germany and Switzerland are countries with a level of cooperation equivalent. Then n on the image can also be seen only there is One color that is red, meaning only there is one cluster because the number of countries of course No many.

What is the focus of research and novelty related to Discovery research Learning in learning mathematics?

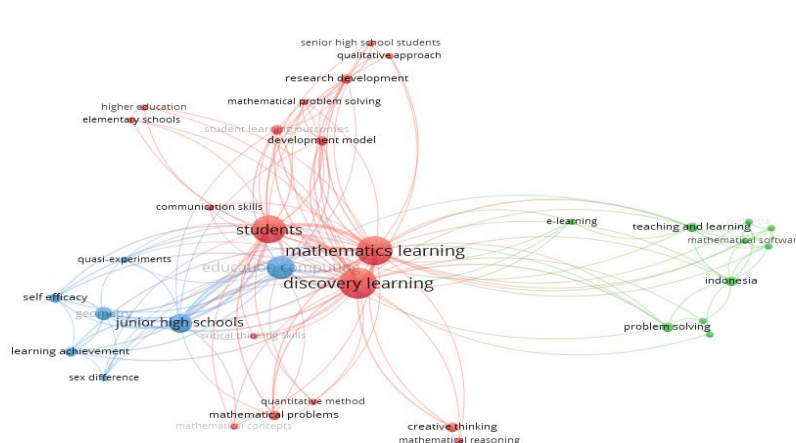


Figure 6. Network Visualization

Keywords used shared by the author can be seen in Figure 6 above. The total keywords displayed are 35 items. Discovery's research focus Learning in mathematics learning from 2017 to 2023 is divided into three parts. These three parts can be seen from the color of the circle. The red circle is the largest cluster and is the focus of the first study, followed by green and blue. The largest circle indicates these keywords have been used together frequently. The bigger the occurrence value, the bigger the circle.

The first research focus is the keyword with a red circle consisting of 18 items, the largest circle shows the research focus. In the first research focus, the keyword that has the largest circle is the Discovery keyword Learning, Mathematics Learning and student, meaning that these keywords are the focus of the first research. Discovery Learning and Mathematics Learning indeed become theme on research this. Research conducted by (Roza et al., 2018) which discusses the practicality of Discovery based mathematics learning devices Learning for the topic of sequence and subsequent series, the research also explains that learning uses Discovery learning not only enhances student learning, but also decreases their chances of leaving the learning process at an early stage. It means study furthermore can choose other material with device learning certain.

The second research focus is the keyword with a green circle consisting of 10 items, the largest circle shows the focus of the research. In the second research focus, the keywords that have the largest circle are problem solving and Indonesia. This means that these keywords are the focus of the second research. This in accordance with spread geographic in figure 4, that the country of Indonesia is a country with publication the most related field this, by No direct Most research conducted is at in Indonesia. Research conducted by (Herdiana et al., 2017) which discusses about the effectiveness of the Discovery learning model in solving problem math in one schools in the Province West Java, Indonesia. Study This study competence solving problem student before and after learning with using the discovery learning model where the Discovery learning model is effective For increase ability solving problem mathematical student. Strategy used tend not enough effective. Besides that, students who do not get a learning model invention use knowledge algebra that has studied previous and relevant concepts in the form of a mathematical model. It covers exists difference results between ability solving problem mathematical students who get a discovery learning model with a model other than discovery learning. For this reason, further research is needed regarding Discovery Learning and technology in learning mathematics.

The third research focus is the keyword with a blue circle consisting of 7 items, the largest circle shows the research focus. In the third research focus, the keywords that have the largest circle are junior high school and Geometry. For That researcher do keyword grouping based on Relevant Education Level field this. This

can be seen in table 3 below this.

No	Education Level	Clusters	Link	Total Link Strength	Occurrences
1	Higher Education	1	4	4	1
2	Senior High School	1	5	5	1
3	Junior High School	3	14	45	8
4	Elementary School	1	4	4	1

In table 3 above, taken based on keyword occurrence that has been shown in figure 6, is visible that deep discovery learning research learning mathematics Lots carried out at the junior high school level viz with the number of occurrences is 8 and the total link strength is 45. Research conducted by (Maarif, 2016) which discusses about influence method learning invention to mathematics ability analogy junior high school students. Study mentioned suggest that research furthermore before use method discovery, the teacher should identify ability student. this aim for create condition Where high and medium students will help low students.

Third focus study This can be used as a reference for future researchers who want to take a theme in accordance with this field. Furthermore will seen novelty and theme new related study Discovery Learning in learning mathematics from 2017 to year 2023.

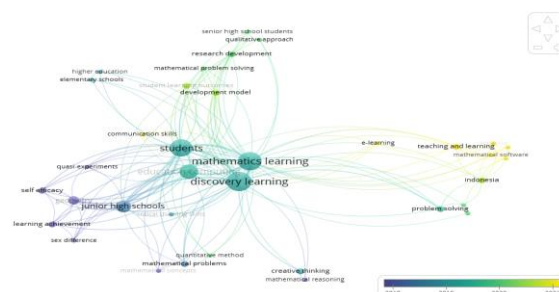


Figure 7. Overlays Visualization

Novelty research related to Discovery Learning in mathematics learning from 2017 to 2023 can be seen from the links between keywords and the color of the keyword circles displayed from the overlay visualization in figure 7 above. In looking at novelty, researchers focus on 2 categories, namely keywords that are the focus of research and keywords that become new themes. The new themes are indicated by a yellow circle, such as e-learning, teaching

and learning, mathematical software, pre-service teacher, and technology. This means that these keywords have only been used together in the last few years. Theme This new research can be used as a reference for future researchers who want to take a theme in accordance with this field. Key words of discovery learning together with mathematics learning is not directly connected with the theme keywords new such as, mathematical software, pre service teacher, and technology. The relationship between these keywords can be used as a research novelty related to Discovery Learning in mathematics learning that is useful for further research.

Conclusion

Based on the results and discussion above it can be concluded that the increase in publications regarding Discovery Learning in learning mathematics is from 2017 years up to 2023. The most citation trend occurred in the 2017 publication which has been cited 41 times. Countries that have had a major impact on Discovery research Learning in learning mathematics is the country of Indonesia. The research focus is divided into three parts, namely, 1) Discovery Learning, Mathematics Learning and students; 2) problem solving and Indonesia; 3) junior high school and Geometry. New themes in this field are e-learning, teaching and learning, mathematical software, pre-service teacher, and technology. Key words of discovery learning together with mathematics learning is not directly connected with the theme keywords new such as, mathematical software, pre service teacher, and technology.

The research focus that has been discussed in this paper can be used as a reference for future researchers who wish to take a theme in accordance with this field. The relationship between these keywords can be used as a research novelty related to Discovery Learning in mathematics learning that is useful for further research. Researchers can also search for data with sources from other databases such as Wos, Google scholars and others.

Reference

- Affandi, Y. (2022). The Evaluation of JIDI (Jigsaw Discovery) Learning Model in the Course of Qur an Tafsir. *International Journal of Instruction*, 15(1), 799–820. <https://doi.org/10.29333/iji.2022.15146a>
- Affandi, Y., Darmuki, A., & Hariyadi, A. (2022). The Evaluation of JIDI (Jigsaw Discovery) Learning Model in the Course of Qur'an Tafsir. *International Journal of Instruction*, 15(1), 799–820.
- Afriyanti, I., Mulyono, M., & Asih, T. S. N. (2018). Mathematical Literacy Skills Reviewed From Mathematical Resilience in The Learning of Discovery Learning Assisted by Schoology. *Unnes Journal of Mathematics Education Research*, 7(1).
- Agarwal, A. (2016). Bibliometrics: Tracking research impact by selecting the appropriate metrics. *Asian Journal of Andrology*, 18(2), 296–309. <https://doi.org/10.4103/1008-682X.171582>
- Amiyani, R. (2018). The Excellence of Guided Discovery Learning on Mathematical Knowledge-Based, Skill-Based, and Attitude. *Journal of Physics: Conference Series*, 1097(1). <https://doi.org/10.1088/1742-6596/1097/1/012145>
- Anggraini, N. A., Ningsih, E. F., Choirudin, C., Darmayanti, R., & Triyanto, D. (2022). Application of the AIR learning model using song media to improve students' mathematical representational ability. *AMCA Journal of Science and Technology*, 2(1), 28–33.
- Batubara, I. H. (2019). Improving Student's Critical Thinking Ability Through Guided Discovery Learning Methods Assisted by Geogebra. *International Journal for Educational and Vocational Studies*, 1(2), 116–119. <https://doi.org/10.29103/ijevs.v1i2.1371>
- Bruner, J. S. (1961). *The act of discovery*. Understanding Children.
- Chertow, M. R. (2021). Tracking the diffusion of industrial symbiosis scholarship using bibliometrics: Comparing across Web of Science, Scopus, and Google Scholar. *Journal of Industrial Ecology*, 25(4), 913–931. <https://doi.org/10.1111/jiec.13099>
- Choirudin, C., Anwar, M. S., Azizah, I. N., Wawan, W., & Wahyudi, A. (2021). Pengembangan LKPD Matematika Berbasis Kaligrafi dengan Pendekatan Guided Discovery Learning. *Jurnal Pendidikan Matematika (JPM)*, 7(1), 52. <https://doi.org/10.33474/jpm.v7i1.6738>
- Cholily, Y. M., Darmayanti, R., Lovat, T., Choirudin, C., Usmiyatun, U., & ... (2023). Si-GEMAS: Serious game mathematical crossword puzzle learning media for students critical thinking ability. *Al-Jabar: Jurnal Pendidikan Matematika*, 14(1), 165–179.
- Darmayanti, R., Utomo, D. P., Choirudin, C., & Usmiyatun, U. (2023a). E-MODULE GUIDED DISCOVERY LEARNING MODEL IN THE HOTS-BASED INDEPENDENT LEARNING CURRICULUM. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(1), 1–10.
- Darmayanti, R., Utomo, D. P., Choirudin, & Usmiyatun. (2023b). E-MODULE GUIDED DISCOVERY LEARNING MODEL IN THE HOTS-BASED INDEPENDENT LEARNING CURRICULUM. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(1), 1–10.
- Donato, F. Di. (2022). Defining discovery: Is Google Scholar a discovery platform? An essay on the need for a new approach to scholarly discovery. *Open Research Europe*, 2. <https://doi.org/10.12688/openreseurope.14318.2>
- Fahmi, Setiadi, I., Elmawati, D., & Sunardi. (2019). Discovery Learning Method for Training Critical Thinking Skills of Students. *European Journal of Education Studies*, 6(3), 342–351. <https://doi.org/10.5281/zenodo.3345924>
- Fauza, M. R., Inganah, S., Darmayanti, R., Maryanto, B. P. A., & Lony, A. (2022). Problem solving ability: strategy analysis of working backwards based on polya steps for Middle School Students YALC Pasuruan. *JEMS: Jurnal Edukasi Matematika Dan Sains*, 10(2), 353–363.
- Gilar Jatisunda, M., Suciawati, V., & Nahdi, D. S. (2020). Discovery Learning with Scaffolding To Promote Mathematical Creative Thinking Ability And Self-Efficacy. *Jurnal Pendidikan Matematika*, 11(2), 351–370. <http://ejournal.radenintan.ac.id/index.php/al-jabar/index>
- González, M. F. (2017). Opportunity discovery and creation in social entrepreneurship: An exploratory study in Mexico. *Journal of Business Research*, 81, 212–220. <https://doi.org/10.1016/j.jbusres.2016.10.032>
- H Sinambela, J., Elvis Napitupulu, E., Mulyono, M., & Sinambela, L. (2018). The Effect of Discovery Learning Model on Students Mathematical Understanding Concepts Ability of Junior High School. *American Journal of Educational Research*, 6(12), 1673–1677. <https://doi.org/10.12691/education-6-12-13>
- Hasanah, N., In'am, A., Darmayanti, R., Choirudin, C., Nurmalitasari, D., & ... (2022). DEVELOPMENT OF AL-QUR'AN CONTEXT MATH E-MODULE ON INVERS FUNCTION MATERIALS USING BOOK CREATOR APPLICATION. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(4), 3502–3513.
- Herdiana, Y., Wahyudin, & Sispiyati, R. (2017). Effectiveness of discovery learning model on mathematical problem solving. *AIP Conference Proceedings*, 1868(August 2017). <https://doi.org/10.1063/1.4995155>
- Hidayati, F., Kartono, & Masrukan. (2018). Analysis of Mathematical Connection Ability Based on Student Characteristics Thinking on Discovery Learning Scientific Approach. *Unnes Journal Of Mathematics Education Research*, 7(1).
- Honovich, R. D., & Chen, Z. (2012). The role of guidance in children's discovery learning. *Wiley Interdisciplinary Reviews: Cognitive Science*, 3(6), 615–622. <https://doi.org/10.1002/wcs.1199>
- Hudaefi, F. A. (2022). Maqāsid al-Sharī'ah on Islamic banking performance in Indonesia: a knowledge discovery via text mining. *Journal of Islamic Marketing*, 13(10), 2069–2089.

- https://doi.org/10.1108/JIMA-03-2020-0081
25. In'am, A., Darmayanti, R., Maryanto, B. P. A., Sah, R. W. A., & Rahmah, K. (2023). DEVELOPMENT LEARNING MEDIA EAV ON MATHEMATICAL CONNECTION ABILITY OF JUNIOR HIGH SCHOOL. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(1).
26. Karim, S., & Zoker, E. M. (2023). Technology in Mathematics Teaching and Learning: An Impact Evaluation in Selected Senior Schools in Masingbi Town. *Assyfa Learning Journal*, 1(2), 60–72.
27. Kartikaningtyas, V., Kusmayadi, T. A., & Riyadi. (2017). Contextual Approach with Guided Discovery Learning and Brain Based Learning in Geometry Learning. In R. L.S., N. A.B.D., Riandi, & A. A.G. (Eds.), *International Conference on Mathematics and Science Education, ICMScE 2017* (Vol. 895, Issue 1). Institute of Physics Publishing. https://doi.org/10.1088/1742-6596/895/1/012024
28. Khadijah, M., Minarni, A., Medan, U. N., Learning, D., Problem-, M., Ability, S., & Ability, P. (2023). Application of Digital Books through Guided Discovery Learning to Improve Mathematical Problem Solving Ability of Class VIII Students at SMP Swasta Dharma Patra Penerapan Buku Digital Melalui Guided Discovery Learning Untuk Meningkatkan Kemampuan Pemecaha. *Asian Journal of Applied Education (AJAE)*, 2(1), 77–98.
29. Khoir, N. L., Winarti, E. R., & Agoestanto, A. (2018). Spesifikasi Literasi Siswa Berdasarkan Kemampuan Penalaran Adaptif pada Discovery Learning Berpendekatan Saintifik Berbantuan Media. *Prisma*, 1.
30. Kurniati, I. W., Pujiastuti, E., & Kurniasih, A. W. (2017). Model Pembelajaran Discovery Learning Berbantuan Smart Sticker untuk Meningkatkan Disposisi Matematik dan Kemampuan Berpikir Kritis. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 8(2), 109–118. https://doi.org/10.15294/kreano.v8i2.5060
31. Laila, A. R. N., Cholily, Y. M., Syaifuddin, M., Darmayanti, R., Sugianto, R., & ... (2023). Desain Modul Matematika Bilingual: Urgensi Pengembangan Media Matematika Bilingual dengan konten Islami. *Assyfa Journal of Islamic Studies*, 1(2).
32. León-Castro, M. (2021). Bibliometrics and Science Mapping of Digital Marketing. *Smart Innovation, Systems and Technologies*, 205, 95–107. https://doi.org/10.1007/978-981-33-4183-8_9
33. Liang, T. (2018). Research Landscape of Business Intelligence and Big Data analytics: A bibliometrics study. *Expert Systems with Applications*, 111, 2–10. https://doi.org/10.1016/j.eswa.2018.05.018
34. Liao, X. (2016). Acing the IOC game: Toward automatic discovery and analysis of open-source cyber threat intelligence. *Proceedings of the ACM Conference on Computer and Communications Security*, 24, 755–766. https://doi.org/10.1145/2976749.2978315
35. Linggile, F., & Payu, C. S. (2022). The Effect of Discovery Learning Based on Blended Learning on Student Learning Outcomes at SMA Negeri 1 Boliyohuto. *Jurnal Pendidikan Fisika Dan Teknologi (JPFT)*, 8(2).
36. Maarif, S. (2016). Improving junior high school students' mathematical analogical ability using discovery learning method. *International Journal of Research in Education and Science*, 2(1), 114–124. https://doi.org/10.21890/ijres.56842
37. Marta, E., Suryani, F. B., & Ismaya, E. A. (2022). The Effectiveness of Think Talk Write and Discovery Learning on Learning Achievement in Elementary School. *ANP JOURNAL OF SOCIAL SCIENCE AND HUMANITIES*, 2(1), 1–6.
38. Martín-Martín, A. (2018). A novel method for depicting academic disciplines through Google Scholar Citations: The case of Bibliometrics. *Scientometrics*, 114(3), 1251–1273. https://doi.org/10.1007/s11192-017-2587-4
39. Mengel-From, J. (2018). Circulating microRNAs disclose biology of normal cognitive function in healthy elderly people – a discovery twin study. *European Journal of Human Genetics*, 26(9), 1378–1387. https://doi.org/10.1038/s41431-018-0157-8
40. Moher, D., Liberati, A., Tetzlaff, J., & Douglas. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Journal of Chinese Integrative Medicine*, 7(9), 889–896. https://doi.org/https://doi.org/10.1136/bmj.b2535
41. Muhammad, I., Marchy, F., Rusyid, H. K., & Dasari, D. (2022). Analisis Bibliometrik: Penelitian Augmented Reality Dalam Pendidikan Matematika. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, 11(1), 141–155. https://doi.org/10.25273/jipm.v11i1.13818
42. Mulbar, U. (2021). The Influence of Discovery Learning with Scientific Approach on Students' Creative Thinking Ability. *Journal of Physics: Conference Series*, 1899(1). https://doi.org/10.1088/1742-6596/1899/1/012134
43. Murni, V. (2017). GeoGebra Assist Discovery Learning Model for Problem Solving Ability and Attitude toward Mathematics. *Journal of Physics: Conference Series*, 895(1). https://doi.org/10.1088/1742-6596/895/1/012049
44. Oh, K. E. (2019). A comparative study of perceptions and use of google scholar and academic library discovery systems. *College and Research Libraries*, 80(6), 876–891. https://doi.org/10.5860/crl.80.6.876
45. Pereira, F. A. (2023). Mapping the use of Google Scholar in evaluative bibliometric or scientometric studies: A bibliometric review. *Quantitative Science Studies*, 4(1), 233–245. https://doi.org/10.1162/qss_a_00231
46. Pratiwi, N. I., & Miriam, S. (2022). Model of Discovery learning in Science Learning : Bibliometric Analysis of the Current State of the art and Perspectives. *Journal of Mathematics, Science, and Computer Education (JMSCEdu)*, 2, 114–127.
47. Qin, Y., Kumon, M., & Furukawa, T. (2021). Estimation of a Human-Maneuvered Target Incorporating Human Intention. *Sensors*, 21(16), 5316. https://doi.org/10.3390/s21165316
48. Ramdhani, M. R., Usodo, B., & Subanti, S. (2017). Discovery Learning with Scientific Approach on Geometry. *Journal of Physics: Conference Series*, 895(1). https://doi.org/10.1088/1742-6596/895/1/012033
49. Recio, T. (2021). Discovering geometric inequalities: The conourse of geogebra discovery, dynamic coloring and maple tools. *Mathematics*, 9(20). https://doi.org/10.3390/math9202548
50. Rionanda, L. S., Farida, F., Putra, F. G., Damayanti, E., & Pradana, K. C. (2022). ICT-Based Lajur Bata Game Media Using Guided Discovery Method on Flat-sided Space Geometry Subject. *Journal Corner of Education, Linguistics, and Literature*, 1(4), 235–248. https://doi.org/10.54012/jcell.v1i4.47
51. Rizqi, P. A. D., Darmayanti, R., Sugianto, R., Choirudin, C., & Muhammad, I. (2023). Problem Solving Analysis Through Tests in View Of Student Learning Achievement. *Indonesian Journal of Learning and Educational Studies*, 1(1), 53–63.
52. Roza, N., Arnawa, I. M., & Yerizon. (2018). Practicality Of Mathematics Learning Tools Based On Discovery Learning For Topic Sequence And Series. *International Journal of Scientific & Technology Research*, 7(5).
53. Sah, R. W. A., Laila, A. R. N., Setyawati, A., Darmayanti, R., & Nurmalitasari, D. (2023). Misconception analysis of minimum competency assessment (AKM) numeration of high school students from field dependent cognitive style. *JEMS: Jurnal Edukasi Matematika Dan Sains*, 11(1), 58–69.
54. Santiago, M., Ramírez-Sarmiento, C. A., & ... (2016). Discovery, molecular mechanisms, and industrial applications of cold-active enzymes. *Frontiers in ...* https://doi.org/10.3389/fmicb.2016.01408
55. Schabas, A. (2023). Game-Based Science Learning: What are the Problems with Teachers Practicing It in Class? *Assyfa Learning Journal*, 1(2).
56. Segarra-Saavedra, J. (2020). Bibliometric, social networks and google scholar references analysis of the doctoral thesis defended in Spain about addictions (1976-2018). *Health and Addictions / Salud y Drogas*, 20(2), 170–181. https://doi.org/10.21134/HAAJ.V20i2.551
57. Sekaryanti, R., Cholily, Y. M., Darmayanti, R., Rahma, K., &

- Maryanto, B. P. A. (2022). Analysis of Written Mathematics Communication Skills in Solving Solo Taxonomy Assisted Problems. *JEMS: Jurnal Edukasi Matematika Dan Sains*, 10(2), 395–403.
58. Sohilait, E. (2021). Pengaruh model discovery learning terhadap kemampuan berpikir kreatif matematis siswa. *Riemann: Research of Mathematics and Mathematics Education*, 3(1). <https://doi.org/10.38114/riemann.v3i1.108>
59. Sudarsana, I. K., Nakayanti, A. R., Sapta, A., Haimah, Satria, E., Saddhono, K., Achmad Daengs, G. S., Putut, E., Helda, T., & Mursalin, M. (2019). Technology Application in Education and Learning Process. *Journal of Physics: Conference Series*, 1363(1). <https://doi.org/10.1088/1742-6596/1363/1/012061>
60. Sugianto, R., Darmayanti, R., Amany, D. A. L., Rachmawati, L. N., Hasanah, S. N., & ... (2017). Experiment on Ability to Understand Three Dimensional Material Concepts Related to Learning Styles Using the Geogebra-Supported STAD Learning Model. *Al-Jabar: Jurnal Pendidikan Matematika*, 8(2), 205–212.
61. Sukma, Y., & Supriyono, A. (2019). Peningkatan Hasil Belajar Siswa Materi Limit Fungsi Aljabar Menggunakan Discovery Learning Di Sman 10 Palembang. *Lentera Sriwijaya : Jurnal Ilmiah Pendidikan Matematika*, 1(2), 13–24. <https://doi.org/10.36706/jls.v1i2.10041>
62. Sunarsih, S., Rahayuningsih, M., & Setiati, N. (2020). The Development of Biodiversity Module Using Discovery Learning Based on Local Potential of Wonosobo. *Jise (Journal of Innovative Science Education)*, 9(1), 1–11.
63. Swandi, I. W. (2020). The digital comic Tantri Kamandaka: A discovery for national character education. *International Journal of Innovation, Creativity and Change*, 13(3), 718–732.
64. Syarif, E., Syamsunardi, S., & Saputro, A. (2020). Implementation of Discovery Learning to Improve Scientific and Cognitive Attitude of Students. *Journal of Educational Science and Technology (EST)*, 6(1), 23–31. <https://doi.org/10.26858/est.v6i1.11975>
65. Tokada, D., Herman, T., & Suhendra. (2017). Discovery Learning for Mathematical Literacy Ability. In R. L.S., N. A.B.D., Riandi, & A. A.G. (Eds.), *International Conference on Mathematics and Science Education, ICMScE 2017* (Vol. 895, Issue 1). Institute of Physics Publishing. <https://doi.org/10.1088/1742-6596/895/1/012077>
66. Vedianity, A. S. A., Darmayanti, R., Lestari, A. S. B., Rayungsari, M., & da Silva Santiago, P. V. (2023). What is the need for "UBUR-UBUR GABUT" media and its urgency in high school mathematics learning? *Assyfa International Scientific Journal*, 1(1).
67. Wang, Y. (2020). Web-scale discovery and Google Scholar: A study in use patterns. *Journal of Electronic Resources Librarianship*, 32(1), 1–10. <https://doi.org/10.1080/1941126X.2019.1709722>
68. Wicaksono, A. G., Sunarno, W., Ashadi, & Adi Prayitno, B. (2021). Research Trends of Discovery Learning from 2015 to 2019: A Bibliometric Analysis. *Journal of Physics: Conference Series*, 1842(1). <https://doi.org/10.1088/1742-6596/1842/1/012026>
69. Widiyanti, D., Susanto, P., & ... (2022). Re-Interpretation of women's position in religious texts: A gender humanistic study. *AMCA Journal of ...* <http://journal.amca2012.org/index.php/ajrs/article/view/152>
70. Widodo, T., Muhammad, I., Darmayanti, R., Nursaid, N., & Amany, D. A. L. (2023). Manajemen keuangan pendidikan berbasis digital: Sebuah kajian pustaka. *Indonesian Journal of Educational Management and Leadership*, 1(2), 146–167.
71. Widyanti, Zetriuslita, Suripah, & Qudsi, R. (2021). Pengembangan Perangkat Pembelajaran Matematika Berbasis Kontekstual pada Materi Kubus dan Balok Kelas VIII SMP. *Jurnal Pendidikan Matematika Raflesia*, 06(03), 47–57.
72. Winson, V. R. V, Arunkumar, V., & Rao, D. P. (2023). Exploring the Landscape of Teaching and Learning English as a Second Language in India. *Assyfa Learning Journal*, 1(2).
73. Wulandari, S. P., Budiyo, B., & Slamet, I. (2016). The Development of Learning Module with Discovery Learning Approach in Material of Limit Algebra Functions. *Proceeding of ICMSE*, 3(1).
74. Yurniwati, & Hanum, L. (2017). Improving mathematics achievement of Indonesian 5th grade students through guided discovery learning. *Journal on Mathematics Education*, 8(1), 77–84.
75. Zhang, L., Carter, R. A., Qian, X., Yang, S., Rujimora, J., & Wen, S. (2022). Academia's responses to crisis: A bibliometric analysis of literature on online learning in higher education during COVID-19. *British Journal of Educational Technology*, 53(3), 620–646. <https://doi.org/10.1111/bjet.13191>