

Exploring the Implementation of the Merdeka Curriculum in Physics Learning: A Bibliometric Perspective

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Abstrak

Kurikulum merdeka merupakan kurikulum terbaru yang diterapkan pada sistem pendidikan di Indonesia. Kurikulum ini diimplementasikan pada semua mata pelajaran termasuk pada mata pelajaran fisika. Penelitian ini bertujuan menganalisis perkembangan studi mengenai penerapan kurikulum merdeka dalam pembelajaran fisika di Indonesia. Data diperoleh melalui Dimension.ai pada periode 2015–2024 dan dianalisis menggunakan metode bibliometrik dengan aplikasi VOSviewer. Hasil penelitian menunjukkan adanya peningkatan penelitian hingga tahun 2023, kemudian mengalami penurunan pada 2024. Total temuan dokumen sebanyak 67 publikasi dengan sebagian besar berupa artikel jurnal. Temuan ini menunjukkan bahwa kajian penerapan kurikulum merdeka dalam pembelajaran fisika masih terbatas sehingga membuka peluang untuk penelitian lebih lanjut.

Kata kunci: Analisis Bibliometrik; Kurikulum Merdeka; Review Artikel; Pembelajaran Fisika

Abstract

The merdeka curriculum is the latest curriculum implemented in the Indonesian education system. This curriculum will undoubtedly be implemented across all areas of learning, including physics subjects and contexts. This study aims to analyze the development of studies on the implementation of the merdeka Curriculum in physics learning in Indonesia. Data were obtained from Dimension.ai for the period 2015–2024 and analyzed using bibliometric methods in VOSviewer. The results show an increase in research through 2023, followed by a decline in 2024. A total of 67 publications were found, with the majority being journal articles. These findings indicate that studies on the implementation of the merdeka curriculum in physics are still limited, thereby opening opportunities for further research.

Keywords: Article Review; Bibliometric Analysis; Merdeka Curriculum; Physics Learning

Introduction

Continuously changing developments require various adjustments by humans to balance demands with the quality of output in the form of human resources (HR). This condition must be implemented to prevent any inequality that reduces the quality of the output (Hasibuan et al., 2024; Nurhayati et al., 2020). One field experiencing an adjustment is education. Education is one of the essential pillars of a country in producing competent outputs able to compete in society (Sekuloska, 2014). With a high level of education, of course, it will produce good outcomes for a country (Anggraini et al., 2022). This is because education is the second place where individuals can learn, besides the family environment. One change in the world of education is the implementation of the latest curriculum, the merdeka curriculum. The merdeka curriculum features various extracurricular activities to help students perform optimally, deepen their understanding, and strengthen their competencies (Jannah et al., 2022). The curriculum shift from the 2013 Curriculum to the merdeka Curriculum stemmed from the need to adapt the

education system to the increasingly complex challenges of the times (Paramita et al., 2025). The 2013 curriculum was deemed too dense, overly focused on academic achievement, and insufficiently focused on the holistic development of students' competencies and character.

Furthermore, its implementation across regions faced obstacles, including teachers' limited mastery of scientific approaches and disparities in school facilities. The COVID-19 pandemic further exacerbated these conditions, as distance learning demands flexibility, independence, and creativity that were not fully accommodated in the 2013 curriculum. This is where the concept of the merdeka Curriculum emerged, offering simplified content, flexible learning, and an emphasis on character building, the Pancasila student profile, and differentiation based on student needs.

In addition to referring to students, the merdeka curriculum grants educators the freedom to choose and use various teaching materials deemed suitable and appropriate for students (Angga et al., 2022; Irchamni, 2022). This condition is, of course, tailored to each student's learning needs and interests (Rizaldi & Fatimah, 2023). The distinctive feature of the merdeka curriculum compared to the 2013 curriculum is the strengthening of the achievement of the Pancasila student profile, commonly known as the Pancasila Student Profile Strengthening Project (P5) (Ardianti & Amalia, 2022; Hamidah, 2022). Physics learning is one of the groups in the context of science (science) apart from biology and chemistry (Kaya & Erduran, 2024). Of course, in implementing the merdeka curriculum, physics is one of the many subjects that must be taught. The merdeka curriculum, with its new characteristics, is undoubtedly a challenge for schools and, of course, educators to adapt these new elements in physics learning, both in class and outside the classroom. The existence of the merdeka curriculum introduces a new approach that can be adopted by every educator in delivering material to students (Angraini et al., 2022; Lince, 2022).

The merdeka curriculum places greater emphasis on several characteristics of 21st-century competency skills, centered on students as the central axis of learning (Utari & Muadin, 2023). In this curriculum, students are encouraged to learn independently by involving their peers in problem-solving. In addition to emphasizing 21st-century skills — critical thinking, creativity, collaboration, and communication — the merdeka curriculum emphasizes differentiation in both learning resources and products (Hanipah, 2023; Saputra et al., 2024). This differentiation certainly does not limit each student's initial abilities in the learning process (Konstantinou-Katzi et al., 2013). Students are not pressured to use or do things that are not in accordance with their characteristics or abilities (Stavrou & Koutselini, 2016).

However, based on the author's needs analysis, there has been minimal writing to date on the implementation of the merdeka curriculum in physics instruction. Of course, in Indonesia, the implementation of the merdeka curriculum remains incomplete, with many schools and madrasas not making it mandatory (Angga et al., 2022; Jannati et al., 2023). This condition is prevalent in private madrasah institutions under the auspices of the Ministry of Religion. At the madrasah level, the merdeka curriculum is currently only applied in state madrasahs, so private madrasahs have not implemented it in their daily learning process. To obtain data describing the distribution and development of research on the implementation of the merdeka curriculum in physics learning, a bibliometric analysis can be used. Research on the bibliometric analysis of the implementation of the merdeka curriculum in physics learning remains very limited. Hence, this researcher sought to examine in greater depth the various obstacles physics teachers encounter in implementing the merdeka curriculum in schools. Of course, this is not only a new curriculum replacing the previous one; many technical obstacles in the field prevent the merdeka curriculum from being fully implemented in physics instruction in schools.

Researchers can use a bibliometric analysis approach to examine the results of various studies over a given time span (Effendy et al., 2021; Farida, 2020). This aligns with the statement by Muhammad et al. (2023), which emphasizes that bibliometric analysis is one method for

analyzing publications in a particular field. Bibliometric analysis is an approach that uses qualitative or quantitative indices, such as year of publication, citations, publication sources, countries, and keyword use (Donthu et al., 2021). Based on these problems, researchers are interested in determining the extent to which research on the implementation of the merdeka curriculum in the physics learning process has been carried out to date. This study can provide an overview and help readers, especially future researchers, identify novelty or newness that could be a topic, particularly related to the implementation of the merdeka curriculum in physics learning in schools or madrasahs.

Method

This study uses a quantitative research type using a descriptive and evaluative approach. The data sample used in this study was obtained from Dimension.ai and comprised 67 scientific publications that matched the selected keywords during the 2015-2024 period. Researchers use Dimensions.ai as a reference source for obtaining article data for several reasons, including:

1. Broad coverage and accessibility
Dimensions provides access to more than 106 million articles and over 1.2 billion citations, most of which are freely accessible through the dimensions.ai app. Research shows that Dimensions has a larger journal collection than Scopus, with up to 48% more journals. While SINTA plays a crucial role in local publications in Indonesia, its reach is limited to national journals, whereas Scopus and Dimensions capture many more international journals.
2. Richer Analysis Features
Dimensions collects information on research grants, patents, clinical outcomes, and publications—offering a deeper understanding of research impact. The platform facilitates bibliometric analysis and visualization of data such as citation patterns, author collaborations, and research progress—features typically more limited in Scopus or SINTA.
3. Easy Access
Dimensions offers a highly functional free version, making it easy for students and researchers to access without paying a high subscription fee. On the other hand, Scopus requires an institutional subscription, which is expensive for universities or individual researchers.

The merdeka Curriculum dimension.ai provides a variety of study data, such as 1. advancements in research over a specific time frame, and 2. We review research developments by publication type, source, and number of citations. The study data gathered by Dimension.ai is subsequently evaluated using the bibliometric visualization method.

This study uses the VOSviewer tool for bibliometric analysis and visualization. Generally speaking, this tool seeks to examine, display, and assess publication data gathered over a predetermined period.

Using the VOSviewer application, researchers can obtain at least three main data sets related to systematic review research, including network, overlay, and density visualizations. According to Dewi (2020), research stages in bibliometric analysis methods include.

1. Keyword research
2. Initial search reduction
3. Initial search total reduction
4. Compilation of initial statistical images
5. Data interpretation in analytical narratives

Result and Discussion

This study was conducted to identify, analyze, and describe the development of research on the implementation of the merdeka curriculum in physics learning from 2015 to 2024. This study examined 67 scientific publications published within the time span determined by the researcher. The distribution of research on the implementation of the merdeka curriculum in physics learning is shown in the following figure.

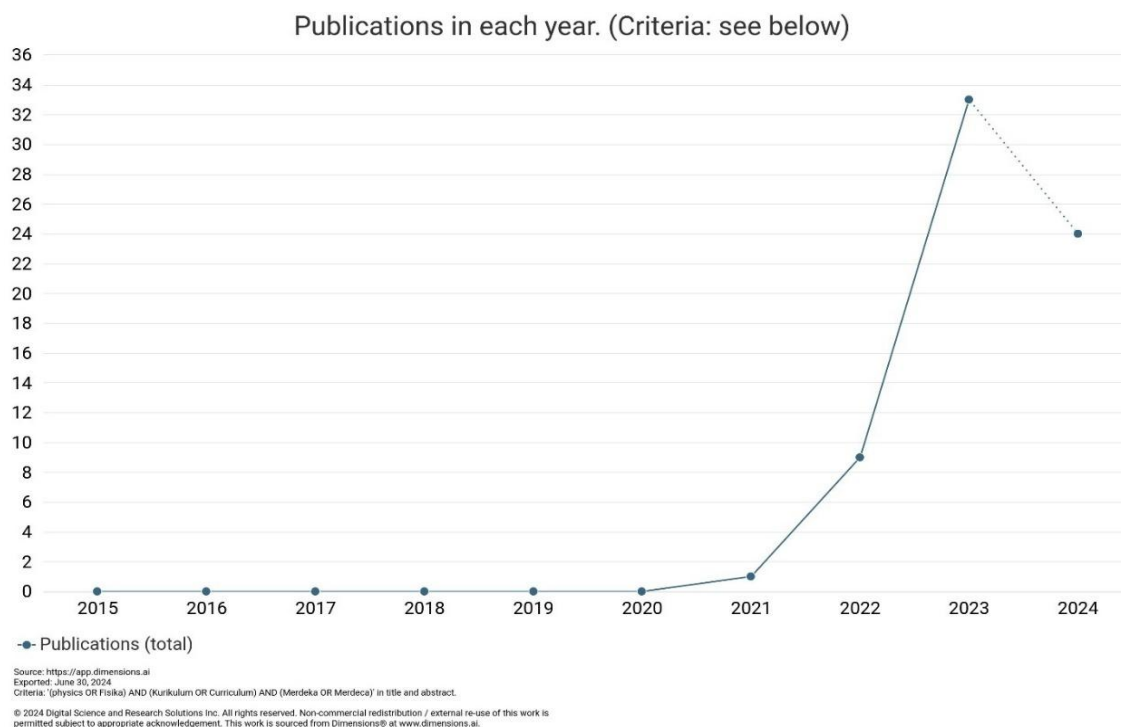


Figure 1. Development of Research on the Implementation of The Merdeka Curriculum in Physics Learning

Based on Figure 1, research on the implementation of the merdeka curriculum in physics learning began only in 2021. This condition certainly illustrates that, in essence, the merdeka curriculum has only just started to be implemented in Indonesia in 2021. It was also implemented on a limited basis in several pioneering schools spread across several districts/cities (Darmawan et al., 2024). From 2021 to 2023, there has been an increasing trend in research on the implementation of the merdeka curriculum in physics learning. The increase in the number of studies indicates that the government is increasingly promoting or introducing the merdeka curriculum, leading many schools to adopt it, especially in physics instruction (Prahani et al., 2021; Santoso et al., 2022). A decline occurred in 2024, as indicated by the dotted line. This sign indicates that the number of research documents in 2024 may continue to increase through the end of the year. Of course, because the analysis limit used as a reference by researchers is mid-2024, the graph shows a decrease because the total for all documents in 2024 has not been obtained.

Specifically, in 2021, there was only one publication document related to the implementation of the merdeka curriculum in physics learning. Of course, at the beginning of the year of its implementation, in general, not many researchers focused on physics research. Researchers have focused more on the challenges and potential of implementing the merdeka curriculum following Indonesia's emergence from the COVID-19 pandemic (Alawi et al., 2022; Manik et al., 2022). The increase was first observed in 2022, when nine documents on the implementation of the merdeka curriculum in physics learning were published. After that, in

2023, there was a spike of 33 published documents. Over time, of course, many researchers have come to understand better the context of implementing the merdeka curriculum in physics learning. In 2024, precisely in the middle of the year, 24 documents were published, and it is hoped that by the end of 2024, there will be an increase in researcher interest in implementing the merdeka curriculum focused on physics learning. This is supported by the issuance of the main regulation implementing the merdeka curriculum, namely the Minister of Education, Culture, Research, and Technology Regulation Number 12 of 2024 concerning the curriculum for Early Childhood Education, Elementary Education, and Secondary Education. This regulation provides the legal basis for all educational units, including private schools, to implement this curriculum. This regulation serves as the basic framework for the national curriculum, ensuring that private schools adhere to the same provisions as public schools. This will undoubtedly continue to encourage private schools, especially in accelerating the adaptation and implementation of the merdeka curriculum, particularly in the physics learning process. The following is the distribution of published documents related to the development of research on the implementation of the merdeka curriculum in physics learning, as shown in the table below.

Table 1. Trends in Research on the Implementation of the Merdeka Curriculum in Physics Learning Based on Publication Type

Publication Type	Number of Publications
Article	60
Chapter	0
Proceeding	7
Preprint	0
Edited Book	0

Based on Table 1, 89% (60 of 67) of the publications related to the implementation of the merdeka curriculum in physics learning were articles, and the remaining 11% were scientific proceedings. The percentage of publications in the form of articles indicates that researchers are more likely to publish their research results in various scientific journals than in other publication types (Callaham, 2002). Several factors, such as a more straightforward publication process and a relatively short publication time, are driving researchers' interest in publishing their research results as scientific articles. Several publications that have published research on the implementation of the merdeka curriculum in physics learning are listed in the following table.

Table 2. Top 10 Source Title Research on the Implementation of the Merdeka Curriculum in Physics Learning Research in 2015-2024

Rank	Source Name	Publications	Citations	Citations Mean
1	Jurnal Penelitian Pendidikan IPA	6	15	2.5
2	AIP Conference Proceedings	3	0	-
3	Prosiding Seminar Nasional Fisika (E-Journal)	3	0	-
4	Jurnal Pendidikan Fisika	2	0	-
5	Berkala Ilmiah Pendidikan Fisika	2	4	2.0
6	EduFisika Jurnal Pendidikan Fisika	2	0	-
7	OPTIKA Jurnal Pendidikan Fisika	2	0	-
8	Ideguru Jurnal Karya Ilmiah Guru	2	1	0.5

Rank	Source Name	Publications	Citations	Citations Mean
9	Journal of Special Education and Rehabilitation	1	2	2.0
10	Jurnal Pengajaran Matematika dan Ilmu Pengetahuan Alam	1	0	-

Based on Table 2, the Science Education Research Journal is currently the largest source of documents that produce scientific publications on the implementation of the merdeka curriculum in physics learning. A total of 6 publications were successfully published, including 2 in 2022, 1 in 2023, and 3 in 2024. Referring to the table above, for positions 2-10, there is no significant difference in the documents published. As the leading source of research on the implementation of the merdeka curriculum in physics learning, the Science Education Research Journal has an appeal that attracts authors to publish their research results in the journal.

Jurnal Penelitian Pendidikan IPA (JPPIPA) is one of the journals in Indonesia with a good reputation, as evidenced by its current SINTA 2 status. This journal uses anonymous review, thereby increasing the potential for outputs that have undergone expert review and ensuring published products have high-quality writing. This journal is also open access, allowing readers to access and download all published documents for free. Of course, this is one of the main factors that attracts many researchers to publish their work in this journal. The main goal of the researcher is that the writing produced can provide an overview or experience for other researchers who, in the future, want to research the same topic (Darmalaksana & Suryana, 2018; Retnowati et al., 2018). Another factor supporting this journal as one of the researcher's goals is its monthly publication frequency. Some of the focuses and scopes related to this journal include 1) science, including chemistry, physics, and biology; 2). science education; 3). chemistry education; 4). physics education; 5). Biology education; 6). education technology; 7). Application science includes chemistry, physics, biology, and agriculture 8. Models, Methods, and Strategies of Learning in Science Education

Table 3. Top 5 Citations on Research Trends on the Implementation of Merdeka Curriculum in Physics Learning Research in 2015-2024

Rank	Citation	Year	Author	Citation	Title
1	23	2022	Jufriadi, A., Huda, C., Aji, S. D., Pratiwi, H. Y., & Ayu, H. D.	(Jufriadi et al., 2022)	Analisis Keterampilan Abad 21 melalui Implementasi Kurikulum Merdeka Belajar Kampus Merdeka
2	8	2022	Marlina, L., Dariyani, N., Sriyanti, I., Sudirman, S., & Meilinda, M.	(Marlina et al., 2022)	Development Of Differentiated Physics Teaching Modules Based on Kurikulum Merdeka
3	5	2022	Mairizwan, M., Hidayati, H., Dewi, W. S., Afrizon, R., & Jarlis, R.	(Mairizwan et al., 2022)	Increasing The Competence of Physics Teachers in Designing PjBL-Based Teaching Aids for The Implementation of The Merdeka Curriculum
4	4	2021	Jauhariyah, M. N. R., Wasis, W.,	(Jauhariyah et al., 2021)	Need Assessment of Physics Learning Evaluation Course on the COVID-19

Rank	Citation	Year	Author	Citation	Title
			Sunarti, T., Setyarsih, W., Zainuddin, A., & Hidayat, S.		Pandemic Era in Bloom's Taxonomy Topic
5	2	2023	Arrohman, D. A., & Lestari, T.	(Arrohman & Lestari, 2023)	Analisis Keragaman Peserta Didik dan Implementasi Kurikulum Merdeka pada Mata Pelajaran Fisika

After reviewing the document sources and author citations, the researcher also conducted a computational mapping analysis using VOSviewer. This analysis was conducted to determine the distribution of topics or keywords that frequently appear in research on the implementation of the merdeka curriculum in physics learning. Through the analysis process using the VOSviewer application, three outputs are the subject of study in the research, including: 1) Network Visualization, 2). Overlap Visualization, and 3) Density Visualization. The three datasets serve different purposes.

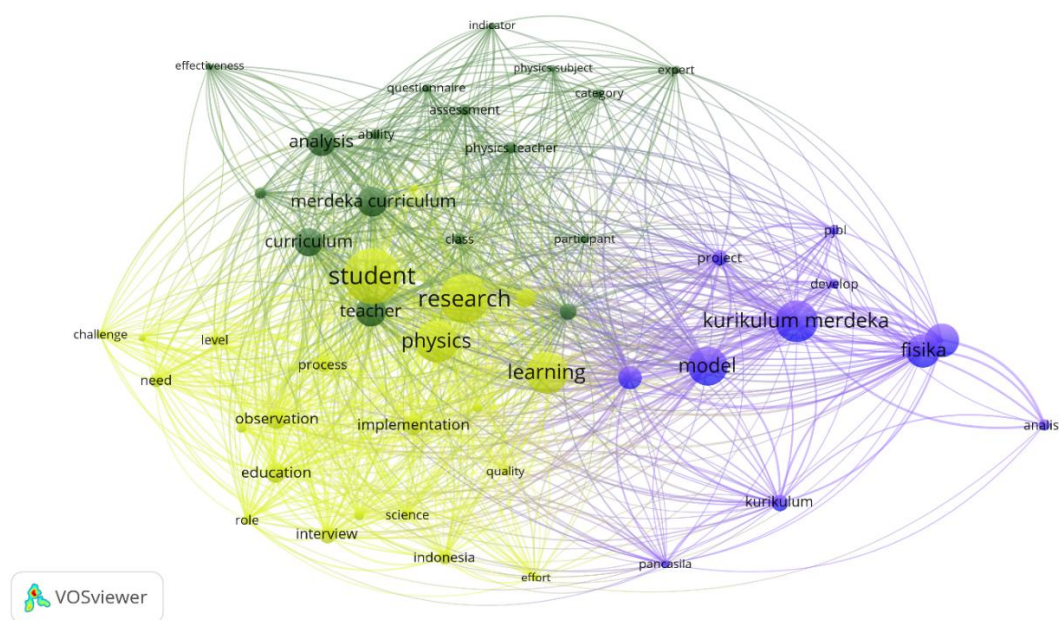


Figure 2. Network Visualization of the Development of Research on the Implementation of the Merdeka Curriculum in Physics Learning

Data related to network visualization shows the relationship between terms or keywords depicted in an interconnected network. Based on Figure 2, there are three main clusters in research on the application of the merdeka curriculum in physics learning. Each cluster is marked with a different color and circle size based on the term's frequency. The larger the circle on a term or keyword, the more the term appears in the title and abstract of a scientific paper (Indriyanti et al., 2023; Nandiyanto & Al Husaeni, 2021). Based on Figure 2, the three keywords most often used by authors in research on the trend of applying the merdeka curriculum in physics learning are the merdeka curriculum, students, and the merdeka curriculum. The terms in each cluster are detailed in the following table.

Table 4. Clustering Based on Keywords in Alphabetical Order

Cluster	Frequently Appearing Keywords
Cluster 1 (red), 15 item	Ability, analysis, assessment, category, class, curriculum, effectiveness, expert, indicator, Merdeka Curriculum, participant, physics subject, physics teacher, questionnaire and teacher.
Cluster 2 (blue), 9 item	Analisis, develop, fisika, kurikulum, kurikulum merdeka, model, pancasila, PjBL and project.
Cluster 3 (yellow), 17 item	Challenge, education, effort, implementation, Indonesia, interview, learning, level, need, observation, physics, process, quality, research, role, science and student.

After obtaining a mapping or clustering related to the research topic or term, the data for the overlay visualization is displayed. Researchers can use this data to determine the state of the art regarding research trends on the development and implementation of the merdeka curriculum in the physics learning process. With this data, researchers can later assess the extent of previous studies to determine the novelty of future research.

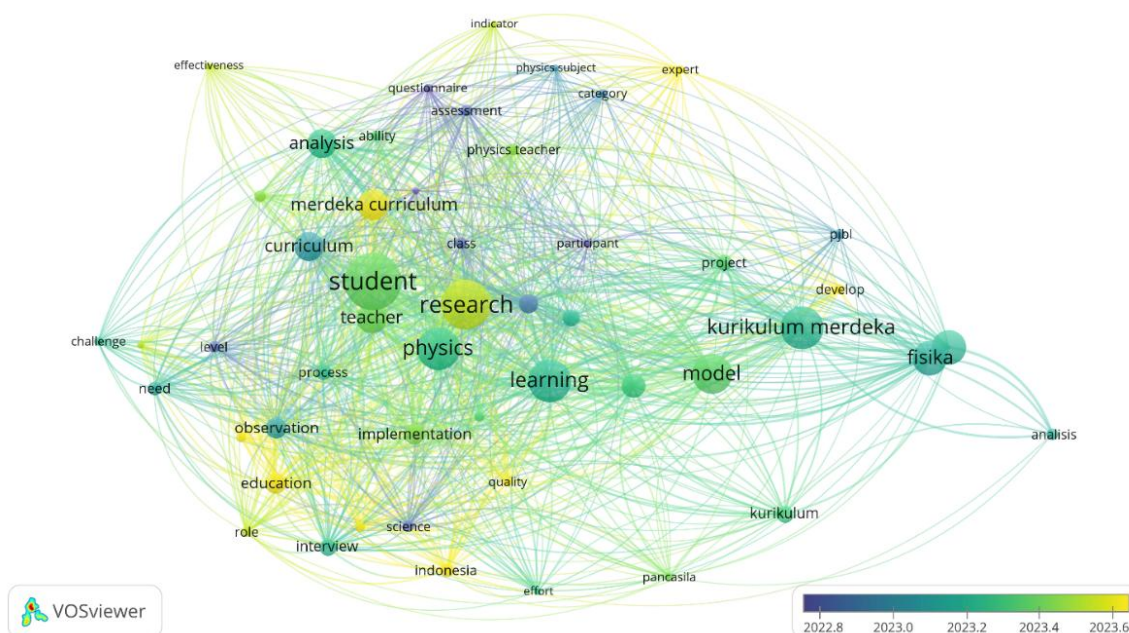


Figure 3. Overlay Visualization of the Development of Research on the Implementation of the Merdeka Curriculum in Physics Learning

Data related to overlay visualization refers to the color that represents the year a research article was published, based on the distribution of topics. The darker the color of the node distribution, the longer the term has been in use. Therefore, if researchers are going to conduct the latest research, they should refer to the various terms in the nodes marked in bright colors, because the more colorful the node, the more it indicates that the term is currently under active research and a current research trend. According to Indriyanti et al. (2023), the color difference between years indicates the publication year range, with purple indicating the oldest publication year and yellow the latest.

In the merdeka curriculum, raising awareness or motivating students to learn physics is not easy, especially in private schools. This is because the implementation of demands for a merdeka curriculum across various aspects, especially in facilities and infrastructure, is one of the fundamental pillars. But to overcome this, teachers are given opportunities to innovate in learning through interesting, project-based models or methods. So that it can raise students' enthusiasm for learning, as it aligns with the demands of the merdeka curriculum, namely, learning merdeka. Students can experiment with the given project so that we can implement learning aligned with the current curriculum, namely merdeka learning.

Conclusion

1. Conclusion

Based on the description above, the latest curriculum is the merdeka curriculum, which is applied across all educational units in Indonesia, especially in physics subjects. The research is quantitative, with a descriptive and evaluative approach. Research data were obtained through the Dimension.ai feature from 2015 to 2024. In 2023, research on the application of the merdeka curriculum in physics learning increased, followed by a decrease in 2024. The data were analyzed using bibliometric methods and VOSviewer visualization tools. Most of the research files were articles, totaling 60 research titles. The application of the merdeka curriculum in physics learning remains very limited, providing an opportunity for researchers to raise this topic as a reference for its implementation.

2. Recommendation

Research on the merdeka curriculum remains a hot topic in education. Not only for physics subjects, but for all subjects in each educational unit can be studied, so that the implementation of the curriculum we use runs well according to expectations. The experience in each academic unit can be channeled through writing, to serve as a reference for implementation across all learning in schools.

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