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Implementation of Geography Curriculum and Learning Methods: A Bibliometric Analysis

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ABSTRACT

Purpose – This study examines the execution of the geography curriculum and pedagogical strategies through a bibliometric analysis technique. By utilizing data from the Scopus database, the research identifies publication trends, thematic clusters, and key factors influencing the development of geography education.

Methodology – This research uses a bibliometric analysis approach using data from the Scopus database. The analysis employed VOSviewer to visualize co-occurrence networks and bibliographic coupling. Thematic clusters were identified to map research directions, authorship collaboration, and methodological developments in geography education.

Findings – The findings identify five primary study clusters: (1) curriculum implementation in geography education, (2) methodologies for geography learning, (3) academic performance and evaluation, (4) citizenship-oriented learning development, and (5) international curriculum execution. Innovative methods such as project-based learning and integrating Geographic Information Systems (GIS) are among the most frequently discussed strategies. The study also highlights challenges such as gaps between curriculum planning and implementation, limited infrastructure, and the need for teacher training.

Significance – Using a bibliometric approach, this study provides a comprehensive overview of trends and directions in implementing geography learning curriculum and methods. The findings provide a basis for designing more effective educational policies and valuable insights for future research development.

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INTRODUCTION

Curriculum in geography learning has a strategic role in shaping students' spatial and critical thinking skills contextually with real problems in everyday life (Maude, 2018). Through a structured and contextualized curriculum, students can understand various geosphere phenomena systematically and systematically. A

well-designed curriculum improves understanding of geography concepts and encourages optimal problem-solving skills (Béneker et al., 2024). In a dynamic and complex global context, the importance of improving the quality of geography curriculum implementation becomes increasingly important to equip students to deal with global issues such as climate change, environmental sustainability, and natural disasters to problems in the anthroposphere to equip them with a sense of responsible thinking as citizens (Yli-Panula et al., 2020). However, the implementation of the geography curriculum is not free from challenges. In Indonesia, curriculum policy changes often occur following the direction of new government policies with continuous adjustments (Anggraena et al., 2021). However, studies on the gap between curriculum planning and implementation are minimal (Zulaiha et al., 2023). Curriculum implementation is influenced by many factors, ranging from teacher readiness and availability of learning facilities to the geographical and social context in which the curriculum is implemented. The geography curriculum should ideally be tailored to regional characteristics so that students can relate learning to their environment directly (Rawling et al., 2022). However, curriculum approaches are often generalized and pay little attention to local wisdom and the specific needs of each region.

Various solutions to address the challenges of curriculum implementation in geography learning, such as innovative approaches in geography learning, have been attempted to be developed in schools. One of them is the application of project-based learning methods that integrate technology, such as the use of Geographic Information Systems (GIS), to improve students' spatial understanding (Romadlon et al., 2021). In addition, students' activeness in learning is greatly influenced by the learning strategies teachers use, such as variations in learning models, relevant media, and the teacher's role as an active learning facilitator (Azizah et al., 2022). The integration of local wisdom is also proven to provide more profound meaning in the learning process, for example, in the context of disaster mitigation adapted to local experiences (Wahyudin et al., 2024). Experiential learning and cooperative learning methods have also shown effectiveness in improving learning outcomes and student engagement (Fauzan et al., 2023).

On the other hand, adapting the geography curriculum to the current digital era and globalization is also a challenge that must be faced. In implementing the geography learning curriculum, geography teachers must be able to utilize technological advances to support the learning process that is relevant, interesting, and meaningful to students (Mustaghfirin & Zaman, 2025). The constructivist approach of developing environment-based learning media and textbooks suitable for local needs is one example of efforts to connect theory and practice in geography education (Herianto & Ali, 2020). In addition to the teaching aspect, technology is also important in the education evaluation system in order to produce fair, objective assessments and encourage students' higher-order thinking skills (Panjaitan et al., 2024).

Based on these complexities and dynamics, a systematic study is needed to map the research development on geography curriculum implementation. Trend analysis of scientific publications can be one way to identify knowledge gaps, issue maps, and relevant research directions in the future (Merigó & Yang, 2017). This study uses the bibliometric approach as the primary method. It can present quantitative data on publications and their visuals regarding publication patterns, scientific collaboration, and thematic focus in geography education literature (Donthu et al., 2021). This approach allows researchers to understand how the discourse of geography curriculum implementation develops, as well as what factors are often discussed or ignored so that it can be the basis for education and curriculum developers in determining geography learning curriculum development strategies by adjusting the conditions of students and the school environment in each region. In particular, the novelty of this research lies in its explicit attempt to fill the gap in the literature on mapping trends in geography curriculum implementation using bibliometric analysis. While many previous studies have partially addressed learning models or curriculum evaluation, this study seeks to present a comprehensive synthesis based on data from scholarly publications from when geography learning first emerged. Thus, this study provides theoretical contributions in the form of understanding the structure and dynamics of previous research and practical contributions for educational policy designers, teachers, and curriculum developers.

Thus, to achieve these objectives, this study formulates two research questions that become the primary focus: RQ (1) What is the trend and direction of the development of geography curriculum implementation research during the early emergence of the geography learning curriculum until early January 2025? and RQ (2) What factors influence the success of geography curriculum implementation based on analyzing global scientific publications?

These questions are expected to answer the need for a systematic and critical mapping of curriculum implementation practices and a foothold for future research in geography education. The main objective of this study is to map and visualize research trends on curriculum implementation in geography learning. In addition, this study aims to identify factors that influence the success of geography curriculum implementation. The theoretical contribution of this study lies in presenting a scientific synthesis that describes the current research landscape, while the practical contribution is to provide evidence-based inputs for policymakers and educational practitioners in developing geography curriculum implementation strategies that are more effective and adaptive to global challenges.

METHODOLOGY

This research is library research using the bibliometric analysis method. This research uses bibliometric analysis to examine various scientific elements, such as research topics, methodologies, leading academic organizations, and publications (Lim & Kumar, 2024). In addition, bibliometric analysis is used because it can analyze and visualize scientific publications' patterns quantitatively, making it possible to provide a comprehensive overview of research trends, author collaboration, and the influence of journals or institutions in relevant fields (Passas, 2024). Bibliometric analysis is conducted by looking at the distribution of publications to evaluate the contribution of articles to the advancement of science in various literatures through a statistical approach (Marchiori et al., 2021). This can provide a comprehensive understanding of the entire discipline. **Figure 1** presents the stages of bibliometric analysis in this study.

Figure 1. Stages of Bibliometric Analysis

The data collection technique in this study uses secondary data in the form of articles. The first bibliometric analysis step is determining the research Keyword Search String (Passas, 2024). Table 1 shows the research Keyword Search String. The second stage determines the inclusion and exclusion criteria, such as using the central database in this study using Scopus (Oladinrin et al., 2023). Data collected in 1961-2025 is to find out in detail the development of the geography learning curriculum from the past—data collected using Boolean keywords as in Table 1. Table 2 presents the inclusion and exclusion criteria used in this study. The search results on the Scopus database are stored in the Research Information System (RIS) format. The third stage is to get the initial search results. At this stage, the RIS format results are imported into the Mendeley desktop software to continue sorting the search results and completing article metadata such as title, abstract, keywords, volume, year, issue, author, and DOI (Lim & Kumar, 2024). The fourth stage is the sorting stage of the data search results. The sorted data is rechecked in detail metadata, and then the fifth stage collects the data information that has been obtained. If it is complete, the data saved in RIS format is input using VOSviewer software (Amiri et al., 2023). The sixth stage is the process of analyzing data with bibliometric analysis in this study using the help of tools in the form of VOSviewer (Martins et al., 2024). The VOSViewer application is used to visualize and analyze bibliographic data networks and the relationship between various elements in a collection of scientific publications (Vargas et al., 2022). Researchers use Bibliometrics with co-occurrence and bibliographic coupling analysis types to achieve the research objectives. Researchers use the co-occurrence analysis type to map the theme of the research topic so that it can contribute to relevant research related to the theme of the research topic and have implications for estimating future research while

bibliographic coupling to analyze publication citation relationships to understand past, periodic and current publications related to the development of themes in the research field under study (Donthu et al., 2021). The minimum number of occurrences is eight terms, meaning that the words that will be displayed are words that have a relationship of 8. The final stage is the bibliometric analysis. The results obtained are then interpreted to answer the objectives of this study. **Figure 1** presents the stages of bibliometric analysis of this study.

Table 1. Research Keywords Search String

Keywords	Explanation
"curriculum" OR "pedagogical" OR "Compendium"	To identify literature related to the education curriculum
AND	
"geograph* learning" OR "geograph* education"	To identify literature related to geography learning and education

To answer the study's focus and ensure the analysis results' accuracy, the data collection process was carried out through the Scopus database using a Boolean formula that was systematically organized based on key terms relevant to the research topic ((Patel et al., 2021)). **Table 1** presents this study's Boolean formula, which was designed to cover various publications related to geography curriculum and learning by combining general keywords and specific terms using logical operators. The construction of the Boolean formula started with the identification of the main keywords such as "curriculum," "pedagogical," and 'compendium' to cover curriculum and pedagogy aspects, and "geography* education" and "geography* learning" to cover the variety of terms in geography education and learning. The use of a wildcard (*) in "geography" is intended to make the search system include various derivatives of the word, such as "geography," 'geographical,' or "geographic." The final formula used is: ("curriculum" OR "pedagogical" OR 'compendium') AND ("geography* education" OR "geography* learning"). The search timeframe was set between 1961 and January 2025. The selection of this period was based on historical and substantive considerations, namely that 1961 was the beginning of the development of modern approaches in geography education characterized by increased attention to spatial-based curricula and concept-based learning, while 2025 was chosen to cover the most recent publications available in the Scopus index. Thus, this period reflects the dynamics and transformation of the geography curriculum from the postcolonial era, technological integration, to globalization-based learning.

This study used PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and systematicity in the data selection process. PRISMA clearly describes the flow of identification, screening, and selection of articles used in this bibliometric analysis (Haddaway et al., 2022). From the initial search results using the Boolean formula in the Scopus database, 1,642 documents were obtained. A total of 381 documents were automatically deleted because they were deemed ineligible based on the initial screening tool based on Table 2 inclusion and exclusion criteria. Furthermore, 1,261 documents were further screened by evaluating the title, abstract, and metadata completeness. No documents were excluded or inaccessible at this stage. From the 1,261 available documents, eligibility was assessed based on open access criteria, and 990 were excluded as they did not meet the criteria. Finally, 271 documents were found eligible and used in the bibliometric analysis. This data selection process is visualized in the PRISMA flowchart shown in Figure 2, which illustrates the stages of data identification, screening, eligibility selection, and inclusion in this study systematically and transparently.

Table 2. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication Period		
January 1961 – Januari 2025	x	
Other		x
Type of Publication		
Journal articles	x	
Conference papers		x
Reports		x
Book and book chapters		x
Dissertations		x
Language		
English	x	
Other		x
Place of Study		
Worldwide	x	
Type of Study		
Empirical investigations	x	
Literature reviews		x
Theoretical reviews		x
Participants in the Study		
Elementary school students	x	
Junior high school students	x	
Senior high school students	x	
Vocational high school students		x
Undergraduate students	x	
Postgraduate student	x	
Doctoral student	x	
Accessing		
Open Access	x	
Other		x

The validity and reliability of the data in this bibliometric analysis are ensured through several technical strategies. First, all data comes from the Scopus database, which has been curated and internationally recognized. Second, double-checking of duplicate documents was carried out, both automatically by software and manually by researchers. Third, term adjustment was done by compiling a simple thesaurus to harmonize the terms used in the article. Fourth, to ensure the stability of the visualization results, a sensitivity test was conducted on the co-occurrence and bibliographic coupling analysis using the parameter of the minimum number of occurrences of terms so that only terms with strong relationships were analyzed. In the final stage, the visualization results were analyzed and interpreted using VOSviewer software to map inter-topic relationships, publication trends, and researcher collaboration patterns relevant to implementing geography curriculum and learning methods.

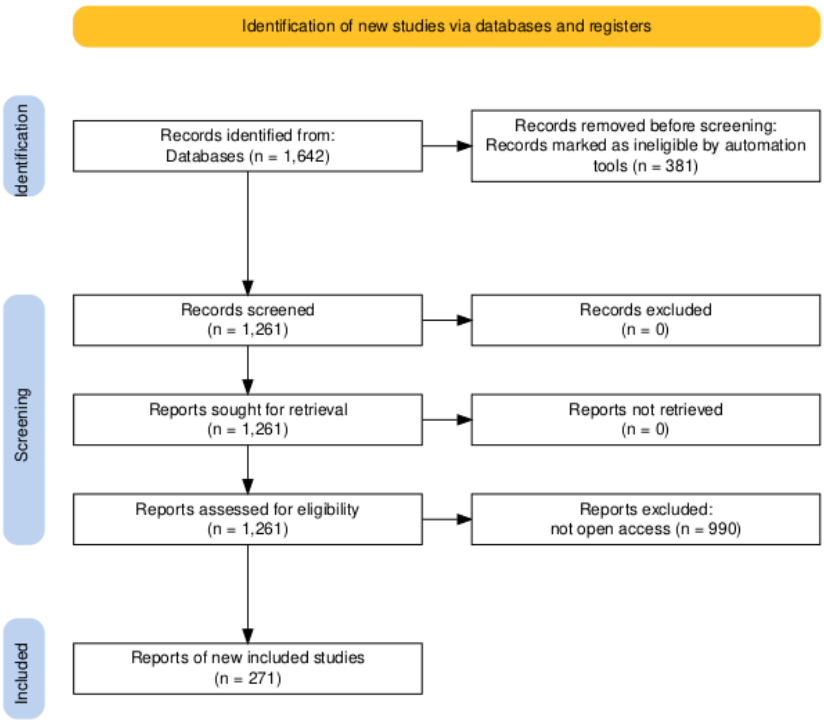

Figure 2. Flowchart PRISMA – ScR

FINDINGS

Based on the acquisition of data from Scopus with bibliometric analysis with the results of 1,642 documents referring to Boolean Keywords in Table 1, the results of the trend graph of the number of records per year show the research development in this topic in Figure 3.

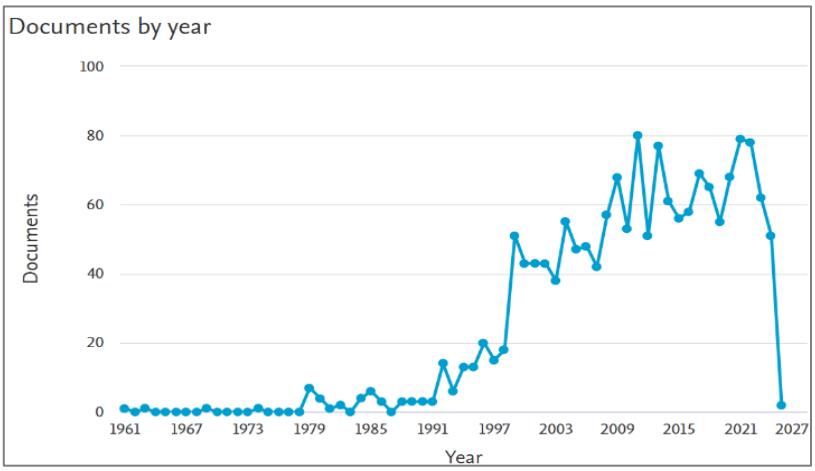

Figure 3. Trends in the Growth of Curriculum Implementation in Geography Learning Methods

Based on Figure 3, the graph of the number of documents per year in the 1960s to 1980s has a relatively low number of publications. This shows that attention to curriculum development and geography learning approaches is still limited to conceptual or descriptive approaches, and these methods can only be used directly in formal education. For example, Scarfe's (1969) research emphasized the importance of curriculum planning in geography education to provide contextual and in-depth insights. Fien (1979) presents the results of his study, stating that this humanistic approach in geography education allows teachers to implement a learner-centered curriculum approach under the supervision of a disciplinary framework. Bartlett (1979) also began to measure students' enthusiasm toward learning geography subjects so that in this era of years, it focused on curriculum planning approaches for geography learning.

The number of publications increased in the 1990s, marking the beginning of attention to new methods in geography education. This period included early studies of more relevant learning approaches, such as incorporating global issues into the curriculum and using simple technology to learn geography. Teachers must have optimal pedagogical skills and international insights to teach students relevant geography learning models and methods (Ormrod & Cole, 1996). A massive surge occurred from 2000 to 2015, showing rapid study growth. Current research focuses on improving learners' spatial skills through new methodologies such as project-based learning, outdoor learning, and GIS-based technology. The changes in the geography learning paradigm in this era are so rapid that geography can contribute to the field of education to deliver learning that focuses on changes in the natural and human environment (Hopkin, 2011). The role of geography learning in welcoming 21st-century skills is also a concern in developing learning methods and models in schools by prioritizing active learning and problem-oriented approaches in delivering learning materials to prepare students to face global challenges (Whalley et al., 2011).

From 2016 to 2021, publications peaked on curriculum implementation and geography learning. This period shows strong attention to changes in the geography curriculum to meet the digital era's and globalization's demands. A STEM-based approach (Science, Technology, Engineering, and Mathematics) is used in geography education. This approach combines modern technology with ideas about geography. In addition, the research noted the development of a locally and globally based-curriculum. It is expected that the development of an appropriate curriculum in geography learning can harmonize learning objectives in schools and improve the ability of learners based on school environmental conditions (Uhlenwinkel et al., 2017). The development of Geo-inquiry allows learners to understand geographical issues in a global context and apply them in daily life through learning implemented at school (Oberle, 2020).

However, the publication trend declines after 2022. This may be due to many reasons, such as a change in research focus, the impact of the COVID-19 pandemic on access to field research, or limited data on recent publications. This decline can be considered an opportunity to re-identify new research needs, especially related to creating a geography curriculum that aligns more with the changing times. Overall, the research trend is the application of technology in geography education, curriculum planning based on local and global issues, and new pedagogical approaches such as project-based and collaborative learning.

Co-Occurrence Analysis

Co-Word Analysis requires that the article must contain 23 or more keywords. Table 3 summarizes the 15 most frequently used keywords from the 70 that emerged from this analysis. Table 3 presents the summary results of implementing geography curriculum and learning based on the co-word analysis of color clusters, labels, number of articles, and representative articles. Figure 4 visualizes the keyword co-occurrence network of geography curriculum implementation and learning, consisting of five distinct but interconnected clusters.

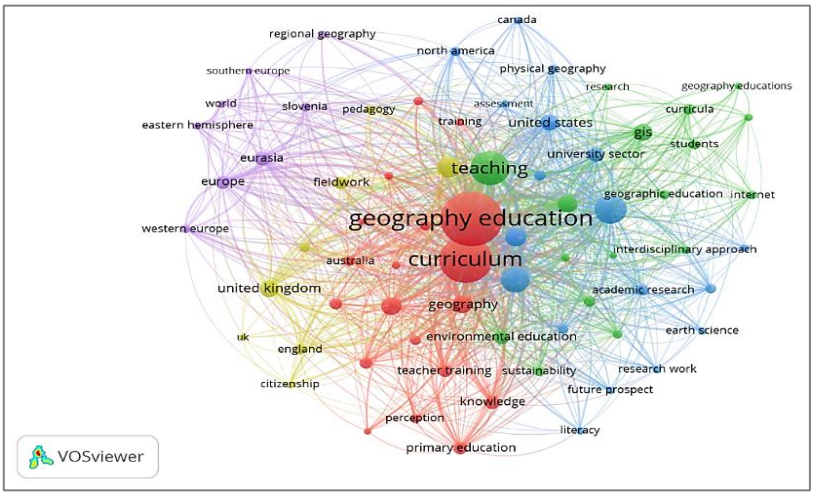

Figure 4. Co – Occurrence Analysis with VOSviewer

Table 3. Top 15 Curriculum Implementation and Geography Learning Keywords Analysis

Rank	Keywords	Occurrences	Total Link Strength
1	Geography Education	1303	5063
2	Curriculum	927	4079
3	Teaching	516	2442
4	Student	349	1789
5	Learning	299	1585
6	Higher Education	192	966
7	Educational Development	168	875
8	United Kingdom	134	744
9	Geography	148	702
10	Secondary Education	144	674
11	Eurasia	91	664
12	Education	134	634
13	Europe	85	632
14	United States	117	596
15	GIS	131	584

Interpretation of Table 3 and Figure 4 shows that "geography education" and "curriculum" have the highest frequency and total link strength compared to other terms, indicating that these concepts are the dominant focus in related scientific publications. Other keywords such as "teaching," "student," 'learning,' and "higher education" also have strong linkages, reflecting the tendency of research to be oriented towards teaching contexts and student learning outcomes at various levels of education. Meanwhile, the emergence of the term "GIS" confirms that integrating spatial information technology is an important element in current geography learning trends. The clustering resulting from this analysis shows five major groups of topics, including curriculum and pedagogy, technology-based learning methods, academic performance, civic-based learning, and country context. This shows that geography curriculum implementation research develops in diverse but interconnected directions.

Bibliographic Coupling Analysis

Based on reports documents, there is a minimum number of citations for a document of 40, so 65 documents meet the threshold and are selected. For each of the 65 documents, the total strength of bibliographic links with other documents will be calculated. The document with the most significant total link strength will be selected. The top 15 articles are cited for Bibliographic coupling analysis by interpreting Table 4. Meanwhile, Figure 5 visualizes the linking network of Bibliographic coupling analysis of curriculum implementation and geography learning, and Table 4 presents a summary of the summary of curriculum implementation and geography learning based on Bibliographic coupling analysis consisting of number, cluster color, label, number of articles, and representative articles.

Table 4 and Figure 5 shows that the articles that appear most frequently and have high citation strength are from authors and institutions that have been in the geography curriculum field for a long time, such as Whalley (2011), Roberts (2014), and Lambert (2015). This analysis shows that most citations focus on pedagogical approaches, assessment, and technology integration in geography education. Thus, bibliographic coupling provides a deeper insight into the primary sources that the scientific community refers to in discussing geography curriculum innovation and implementation. This finding reinforces the importance of innovation in learning approaches, especially those based on inquiry, technology, and global understanding.

Table 4. Top 15 Bibliographic coupling analysis cited articles.

Articles	Citation	Total of Link Strenght
France (2018)	70	60
Whalley (2011)	51	40
Catling (2003)	41	36
Herrick (2010)	85	32
Standish (2008)	41	32
Roberts (2014)	81	30
Milson (2007)	47	29
Panelli (2005)	49	29
Nielsen (2011)	43	25
Sidaway (2002)	53	25
Collins (2018)	63	24
Nairn (2005)	95	21
Mcewen (1996)	62	21
Hennemann (2010	81	20
Lambert (2015)	130	19

The figure below is a summary visualization of the data displayed in Table 4 using VOSviewer software.

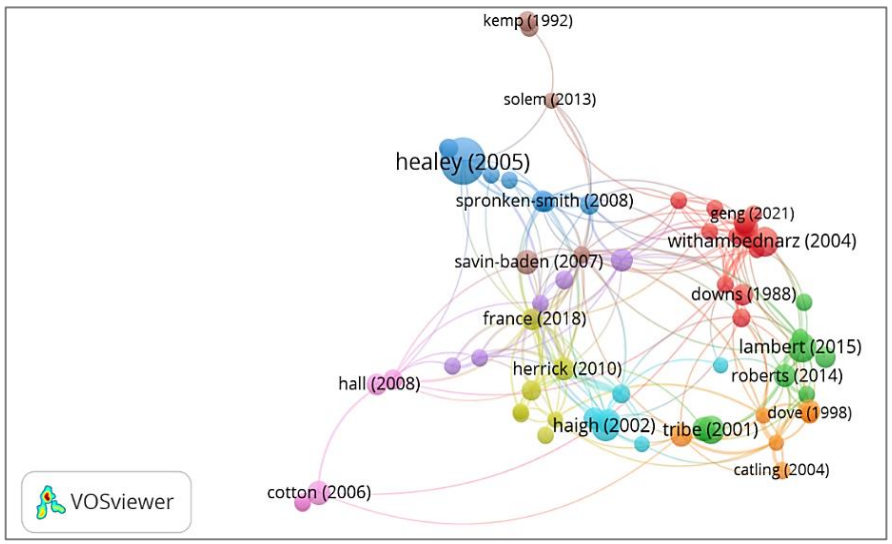

Figure 5. Bibliographic Coupling Analysis with VOSviewer

DISCUSSION

Co-Occurrence Analysis

Based on Figure 4, the Co-Occurrence analysis with the VOSviewer network of Curriculum Implementation and geography learning, the author managed to interpret the cluster as follows:

Cluster 1 (Red)

This cluster contains 19 keyword items with focus topics, including geography education, curriculum, environmental education, and learning. This resulted in the primary research trend of curriculum implementation in geography learning. In the context of curriculum implementation in geography learning, this cluster shows various challenges, opportunities, and strategies to improve the effectiveness of geography learning at the secondary education level. (Béneker et al., 2024), The Geo-Capabilities Project highlighted the importance of curriculum planning with a "Future Three" approach that focuses on empowering learners through education and emphasizes powerful knowledge to provide critical competency development for

learners through geography education to face global and future challenges. Oktavianto et al. (2024) identified essential issues in applying field learning in the geography curriculum with increased cooperation between educational institutions and the government to train teachers to encourage more optimal learning methods. Seitz et al. (2024), The STEMification phenomenon in geography education, which integrates science, technology, engineering, and mathematics education into the geography curriculum, has an excellent opportunity to increase the relevance of geography learning by developing cross-disciplinary skills. Practical pedagogical approaches, such as inquiry-based learning and collaboration, can encourage learners to develop higher-order thinking skills (Roberts, 2023).

Cluster 2 (Green)

This cluster contains 17 keyword items focusing on teaching, education, GIS, geography education, students, and curricula. This resulted in the primary research trend on geography learning methods. Geography learning methods have undergone many changes, mainly due to new methods that use technology and experiential activities. In addition, GIS technology is one of the main tools in modernizing geography learning methods. Kim (2024) mentioned that geospatial technologies such as digital mapping and GIS have great potential to improve learners' geographic knowledge. Before providing GIS learning to students, it is important to train teachers to utilize GIS to effectively integrate it into the learning process (Demeuov et al., 2021). Schuber (2021) used Geo-Boxes to conduct experiments in the geography classroom to improve learners' geographic skills. This method involves real activities that allow learners to better understand geographic concepts through independent exploration and analysis. The use of digital platforms in geography learning not only increases learner participation and understanding of geographic dynamics but can overcome limitations and further improve to prepare learners for globalization (De Miguel González & De Lázaro Torres, 2020). In addition, educational methods emphasizing global issues such as social inequality and climate change allow learners to understand their role in a global society (Türk & Atasoy, 2020). The geo-inquiry approach method allows learners to ask geographical questions, collect data, and analyze the results, which improves critical and investigative thinking skills, which are important components in learning geography (Oberle, 2020). According to Campbell et al. (2020), learning media using disaster-themed video games effectively attracted learners' interest and increased their understanding of disaster mitigation. Integrating technology with effective pedagogy has been proven to improve the quality of geography learning (Yani et al., 2019).

Cluster 3 (Blue)

This cluster contains 13 keyword items with focus topics including Student learning, educational development, academic performance, and academic research, resulting in the primary research trend on academic performance and student assessment. Virranmäki et al. (2021) found that a geography curriculum that aims to improve higher-order thinking skills can improve learners' academic outcomes. Assessment of learners' academic performance in geography learning is critical to understanding how effective teaching is and how it relates to learning outcomes. By using powerful knowledge strategies, learners can better understand the complex relationships between geographic phenomena and their lives, maximizing and improving their academic outcomes (M. Kim, 2024). Through the Geo-Capabilities approach, this learning model is designed to improve learners' spatial thinking and spatial analysis skills in understanding environmental and global issues through a deeper understanding of geography learning materials (He et al., 2024). factors that influence learners' and teachers' interest in geography in schools is the relevance of the curriculum with innovative learning approaches that can be implemented in real life, so the importance of adjusting the geography curriculum and learning by conducting assessments that can improve learner engagement and academic performance (Kidman, 2018). Teachers can do many things to innovate in providing learning methods and media, such as the development of Geo-Smart-based applications for learning hydrosphere material that contributes positively to students through relevant and practical approaches (Widyastuti et al., 2018). Sugiyanto et al. (2018) added the importance of geography literacy based on social

learning models in improving 21st-century skills in teachers so that it can influence teaching methods that have implications for improving student learning outcomes. Through good pedagogical competence, teachers can optimally improve the delivery of learning materials to students (Bahari et al., 2021). The importance of learner-centered learning strategies through the STEM approach in geography learning can also improve concept understanding and provide opportunities for students to be actively and directly involved in the learning process to maximize their knowledge and skills (Benabentos et al., 2021).

Cluster 4 (Yellow)

This cluster has eight keyword items focusing on citizenship, geography teaching, pedagogy, higher education, and fieldwork. This resulted in the primary research trend of learning development based on citizenship. The development of learning by approaching regional issues in the country can improve spatial thinking and geographical understanding of the material studied (G. Kim, 2023). Educational methods emphasizing global issues such as climate change and social inequality help learners actively understand their role in global society and provide a contextual understanding of the material (Türk & Atasoy, 2020). With a regional and civic approach, geography skills benefit teachers, learners, and governments in developing geography learning curricula (Béneker et al., 2024). Using digital platforms for geography education increases learners' participation and understanding of geographic dynamics. It can provide hands-on learning experiences by engaging learners in civic life as members of Society (Mitchell et al., 2022).

Cluster 5 (Purple)

This cluster has eight keyword items with focus topics, including Eurasia, Europe, the United Kingdom, Regional Geography, the world, Slovenia, and the United States. To produce the primary research trend regarding the country by implementing a geography learning curriculum. The implementation of geography learning curricula in various countries shows a diversity of approaches, challenges, and focuses that are influenced by their respective national contexts. In the Czech Republic, Spurná et al. (2021) explained that the national geography curriculum provides space for developing critical thinking skills and integrating local contexts. Although there are challenges in adopting, geography learning can be enjoyable through innovative learning with good pedagogical skills from teachers.

Meanwhile, in Indonesia, Oktavianto et al. (2024) highlighted the challenges in implementing field-based learning with existing curriculum implementation, such as limited resources and institutional support that can hinder the effectiveness of field-based learning methods in the geography subject curriculum. In the context of the UK, Finland, and Sweden, according to Hammond et al (2024), flexibility in the curriculum can support the development of global and sustainable awareness. In other regions such as China, according to Yuan & Yu (2024), the Education curriculum, by integrating sustainable development goals (SDGs) as a systematic approach to educating learners about sustainability, provides a new direction for global issue-based curriculum development. In Kazakhstan, the geography curriculum is important in strengthening national identity while providing global insights for learners (Sergeyeva et al., 2023). Meanwhile, Miao et al. (2022) compared the contribution of geography curricula to sustainability education in China and the United States, focusing on the different approaches influenced by the social structure and prioritization of educational goals in each country. Wilmot and Dube (2015) noted that South Africa's reforms to the post-apartheid geography curriculum focused on social justice and inclusion, although teachers faced significant challenges in adjusting to these changes. In Australia, however, Casinader (2015) states that the geography curriculum often fails to fulfill the potential to develop deep knowledge competencies in learners. Although there are still opportunities to improve, there needs to be a deep reconstruction of the curriculum applied to school geography learning.

The author summarizes the VOSViewer results of Curriculum Implementation and geography learning through Table 5, which presents the results of curriculum implementation and geography learning as follows.

Table 5. Co-Occurance clusters on Curriculum Implementation and Geography Learning

Cluster	Cluster Label	Number of Keywords	Representative Keywords
1 (Red)	Curriculum Implementation in Geography Learning	19	Australia, China, Comparative Study, Curriculum, Education Policy, Education Reform, Geographical Education, Geographical Knowledge, Geography, Geography Curriculum, Geography Education, Knowledge, Perception, Primary Education, Secondary Education, South Africa, Teacher Training, Textbook, Training.
2 (Green)	Geography Learning Methods	17	Climate Change, Curricula, Curriculum Development, Education, Environmental Education, Geographic Education, Geographic Information, Geography Educations, GIS, Globalization, Interdisciplinary Approach, Internet, Research, Students, Sustainability, Sustainability Development, Teaching.
3 (Blue)	Academic Performance and Assessment for Student	13	Academic Performance, Academic Research, Assessment, Conceptual Framework, Earth Science, Future Prospect, Human Geography, Learning, Literacy, Physical Geography, Research Work, Student, University Sector
4 (Yellow)	Development Of Learning Based on Citizenship	8	Citizenship, England, Fieldwork, Geography Teaching, Higher Education, Pedagogy, UK, United Kingdom.
5 (Purple)	Country With the Implementation of Geography Learning Curriculum	8	Eastern Hemisphere, Eurasia, Europe, Regional Geography, Slovenia, Southern Europe, Western Europe, World

Bibliographic Coupling Analysis

Based on Figure 5, Bibliographic coupling analysis with the VOSviewer network of Curriculum Implementation and geography learning, the author successfully interpreted the cluster.

Cluster 1 (Red)

This cluster consists of 14 items with the cluster label geography learning media. Geography learning has technology integration and innovative approaches that significantly improve students' spatial understanding (Ridha et al., 2020). Collins (2018) compares the effectiveness of digital maps with paper maps on students' spatial thinking skills, and the results show that digital maps provide advantages in supporting the exploration of spatial data. This shows that digital media is critical as a tool in geography learning. The use of Geographic Information Systems in higher education is also important in the learning process for students; according to Diana (2009), using technology in expanding spatial insights to maximize the learning process contextually and deeply. Doering & Veletsianos (2008) support real situation-based learning relevant to everyday life. In addition, the concept of Technological Pedagogical Content Knowledge, adapted by Doering et al. (2014), offers a conceptual framework for integrating technology in geography learning so that learning is not limited to mastery of technology but also pays attention to appropriate pedagogical approaches. The importance of adapting geospatial concepts to the needs of geography subjects, thus creating a link between geospatial theory and its practical application in learning (Golledge et al., 2008). The development of interactive media, such as video-based virtual reality, also provides an immersive learning experience in geography, as found by Jong et al. (2020), who showed that modern technology could support engaging and

effective geography learning and help to understand spatial concepts well and develop learners' thinking skills.

Cluster 2 (Green)

This cluster consists of 8 items with cluster label geography learning curriculum. The geography learning curriculum emphasizes the importance of learning design that can support interdisciplinary understanding through strong mastery of the material and developing student's critical thinking skills (Amri et al., 2022). Bradbeer (1999) identifies barriers to the interdisciplinary approach in the curriculum, including the discourse of science studies that can limit learners' perspectives in understanding geography materials. Therefore, curriculum design needs to accommodate the integration of various disciplines to increase the relevance of learning (Downs et al., 1988). Research conducted by (Butt & Lambert, 2014) reviewed geography curricula internationally and highlighted the need for global standardization to improve the quality of geography education. The curriculum should not only cover basic geographical knowledge but also introduce global issues such as sustainability and climate change Butt & Lambert (2014). This is also in line with the idea of Maude (2018) that powerful knowledge in geography learning will equip students with relevant knowledge to understand and solve global problems. Educators need to make geography material look simple through learning media relevant to secondary school material so that learning becomes interesting and innovative (Firth, 2011). As in the research of M. Kim & Shin (2016), through SimCity video game-based learning, students learn and play and interactively increase their understanding of the concepts of urban geography material. Lambert et al. (2015) proposed the concept of the Capabilities Approach in creating a geography curriculum to develop human potential through geography education that focuses on not only knowledge but also the skills needed in 21st-century life.

Cluster 3 (Dark Blue)

This cluster consists of 8 items with cluster label implications for the geography. Geography learning curriculum should pay attention to various aspects, such as employability so that students are given skills and knowledge relevant to spatial analysis, problem-solving, and collaboration Arrowsmith et al. (2011). According to Bradbeer et al. (2004), learners' understanding of geography and its teaching methods can be strengthened by the geography phenomena approach that explores learners' learning experiences. This is also supported by Healey (2005), stating the importance of linking research and learning to create a more in-depth and relevant learning experience to create a comprehensive learning experience with learners' critical thinking skills. Through an active learning approach, as proposed by Dengler (2008), utilizing online discussion forums to teach sustainability materials has increased learner engagement. Other research also supports blended learning, combining face-to-face and digital teaching for effective learning outcomes. An inquiry-based learning strategy was also provided by Spronken-Smith et al. (2008); this approach not only enhances learners' curiosity but also improves their critical and analytical thinking skills.

Cluster 4 (Yellow)

This cluster consists of 7 items with cluster label geography learning challenges. Challenges in geography learning include technical, pedagogical, and infrastructure aspects that affect the effectiveness of the teaching-learning process. For example, fieldwork is considered an important element in the geography learning process, but its implementation has limitations in funding, time, and accessibility (France & Haigh, 2018). According to Golubchikov (2015), the concept of "feel-trip" is a field of learning that combines emotional experience and critical learning, so it is very relevant to geography learning—in the pedagogical context, Grant (1997) proposed case studies as a way to overcome the limitations of traditional learning in schools. Through learning projects, students can develop and integrate aspects of skills and knowledge during the learning process to achieve learning objectives (Hindle, 1993).

Cluster 5 (Purple)

This cluster consists of 6 items with cluster label impact of geography learning. Geography learning significantly impacts the development of students' attitudes, behavior, and understanding of various aspects of life. As revealed by the research of Amahmid et al. (2019), geography learning can increase students' awareness of the importance of using water wisely and efficiently. Gedye et al. (2004) revealed that geography graduates often feel more prepared to face the world of work thanks to the ability to understand global issues and spatial analysis skills obtained during education. Through active engagement, learners can better understand geography material while strengthening interpersonal relationships (Moore-Cherry et al., 2016).

Cluster 6 (Light Blue)

This cluster consists of 6 items with cluster label geography lesson planning. It is essential to design meaningful and relevant learning experiences for learners. Sanders (2007) states that photography serves not only as a tool to keep records but also as a tool to study and reflect on geographical ideas. This is supported by Sidaway (2002), who emphasizes that photography is an important part of geography fieldwork as it allows learners better to understand landscape and spatial dynamics through a visual perspective. It is important to standardize and internationalize the geography learning curriculum (Miao et al., 2022).

Cluster 7 (Orange),

This cluster consists of 6 items with cluster label implementation of geography learning in schools. The importance of prospective teachers' understanding of geography to ensure learning appropriate to the needs of learners at the primary level (Catling, 2004). Catling and Martin (2011) extend this perspective by proposing that the geography curriculum should make it possible to connect learners' ethno-geographical experiences with academic geography, thus providing a more relevant context for them. According to Standish (2009), geography curricula should incorporate a global perspective to enhance learners' understanding of the interconnected world and provide a moral framework. This is important to help learners understand global issues such as social justice, conflict, and sustainability. In addition, research by Dove (1998) found that learners often have alternative understandings or misconceptions about earth science, affecting their understanding of geography materials. This suggests that clear teaching strategies are needed to build appropriate scientific knowledge while maintaining learners' prior understanding.

The author summarizes the results of bibliographic coupling analysis through VOSViewer of Curriculum Implementation and Geography Learning through Table 6, which presents the summary results of curriculum implementation and geography learning as follows.

The urgency mentioned in the introduction, namely, the lack of systematic knowledge regarding the implementation of geography curricula worldwide—is immediately addressed by the study's key findings. Using a bibliometric approach, this study effectively charts the patterns, difficulties, and paths of curricular development and geography teaching strategies over the past 60 years. The prevalence of topics like project-based learning, multidisciplinary methods, and GIS integration indicates that pedagogical innovations have developed in response to challenges in curriculum implementation, such as the disconnect between planning and practice. This implies that the study is more than just descriptive; it provides a conceptual basis and guidance for educators, curriculum designers, and policymakers to offer better contextualized and adaptable geography instruction. This work significantly contributes to the future of geography education by guiding subsequent research towards modern challenges such as climate change, sustainability, and spatial justice. By presenting a map of academic collaborations and research networks, the results of this study also provide opportunities for young researchers to find unexplored research gaps. Thus, this study's results reflect past developments and prospective future innovations in geography education.

Table 6. Bibliographic Coupling Analysis Clusters on Curriculum Implementation and Geography Learning

Cluster	Cluster Label	Number of Keywords	Representative Keywords
1 (Red)	Geography Learning Media	14	Collins (2018), Diana (2009), Doering (2007), Doering (2014), Downs (1988), Geng (2021), Goldstein (2013), Golledge (2008), Gregg (1994), Jong (2020), Lloyd (2001), Milson (2007), Nielsen (2011), Withambednarz (2004).
2 (Green)	Geography Learning Curriculum	8	Bradbeer (1999), Butt (2014), Firth (2011), Kim (2016), Lambert (2015), Roberts (2014), Tribe (2001).
3 (Dark Blue)	Implications for the Geography Learning Curriculum	8	Arrowsmith (2011), Bradbeer (2004), Dengler (2008), Healey (2005), Moore (2010), Nast (1999), Spronken – Smith (2008), Walkington (2011).
4 (Yellow)	Geography Learning Challenges	7	Diprose (2012), France (2018), Golubchikov (2015), Grant (1997), Herrick (2010), Hindle (1993), Mcewen (1996).
5 (Purple)	Impact of Learning Geography	6	Amahmid (2019), Gedye (2004), Hennemann (2010), Hill (2021), Moore-Cherry (2016), Panelli (2005).
6 (light Blue)	Geography Lesson Planning	6	Castleden (2013), Haigh (2002), Mahtani (2004), Nairn (2005), Sanders (2007), Sidaway (2002).
7 (Orange)	Implementation of Geography Learning in Schools	6	Catling (2003), Catling (2004), Catling (2011), Dove (1998), Marsden (1997), Standish (2008)

CONCLUSION

Using Scopus data and VOSViewer tools, the researchers could map and analyze the implementation of geography curriculum and learning methods through a bibliometric approach. The results show significant progress in this research on this subject. The main clusters in this research include geography learning media, curriculum development, academic achievement and assessment, and challenges and consequences in geography learning. Incorporating technologies such as GIS and project-based learning along with new approaches usually determines the success of the geography curriculum. This trend shows how important it is for geography education to accommodate local and global changes. Some of the challenges identified are the mismatch between curriculum planning and implementation, limited resources for field learning implementation, and the need for teacher training to improve pedagogical skills.

In addition, this research emphasizes the importance of geography learning centered on local and global issues, such as climate change, sustainability, and disaster mitigation, that relate to students' daily lives. In addition, one of these studies focuses on improving the quality of geography education through assessment based on higher-order thinking skills. This research uses a bibliometric approach to provide a comprehensive overview of trends and avenues of research in curriculum implementation and geography learning. The findings are expected to serve as a basis for designing better education policies and provide insights for future research related to this topic.

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