




Mapping Climate Change Education in Primary Schools: A Bibliometric Analysis of Research Trends and Thematic Evolution

Bramianto Setiawan ^{1,*}, Septian Mukhlis ¹, Vina Iasha ²

¹ Department of Elementary Teacher Education, Universitas Pelita Bangsa, Indonesia

² SD Negeri Pondok Bambu 06 Jakarta Timur, Indonesia

*Corresponding authors: sbramianto@pelitabangsa.ac.id

Untuk mengutip artikel ini: Setiawan, B., Mukhlis, S., & Iasha, V/ (2026). Mapping Climate Change Education in Primary Schools: A Bibliometric Analysis of Research Trends and Thematic Evolution. *Jurnal Inovasi dan Riset Pendidikan Dasar*, 1(2), 54-63. <https://doi.org/10.64421/jirpd.v1i2.90>

Informasi Artikel	Abstrak
<p>Diterima : 01-04-2026</p> <p>Direvisi : 15-05-2026</p> <p>Diterima : 20-05-2026</p> <p>Dipublikasi : 30-05-2026</p>	<p>Pendidikan perubahan iklim pada tingkat sekolah dasar telah memperoleh perhatian akademik yang semakin meningkat dalam beberapa tahun terakhir; namun, pemetaan sistematis terhadap lanskap penelitiannya masih terbatas. Penelitian ini bertujuan untuk menganalisis tren publikasi, kontribusi ilmiah, struktur tematik, serta evolusi topik penelitian dalam pendidikan perubahan iklim di sekolah dasar. Pendekatan bibliometrik digunakan dengan memanfaatkan data yang diperoleh dari basis data Scopus pada periode 2012–2025. Pencarian dilakukan menggunakan kata kunci spesifik yang berkaitan dengan perubahan iklim, pendidikan, dan sekolah dasar, kemudian dilanjutkan dengan proses seleksi berbasis PRISMA. Data dianalisis menggunakan Microsoft Excel untuk statistik deskriptif, VOSviewer untuk analisis kemunculan bersama (co-occurrence) kata kunci dan visualisasi jaringan, serta Biblioshiny untuk analisis kolaborasi dan pemetaan tematik. Hasil penelitian menunjukkan adanya peningkatan publikasi yang signifikan setelah tahun 2020, dengan kontribusi yang didominasi oleh negara-negara Eropa dan berbahasa Inggris, meskipun partisipasi dari Asia dan Afrika juga mengalami peningkatan. Analisis tematik mengungkapkan adanya pergeseran dari penelitian yang berfokus pada dampak fisik dan kesehatan menuju pendekatan yang lebih pedagogis dan partisipatif, termasuk kewarganegaraan lingkungan (environmental citizenship) dan keterlibatan emosional siswa. Secara keseluruhan, bidang ini menunjukkan transisi menuju orientasi yang lebih holistik dengan menempatkan sekolah dasar sebagai ruang strategis untuk memperkuat literasi iklim dan kompetensi keberlanjutan.</p> <p>Kata kunci: Perubahan Iklim; Sekolah Dasar; Pendidikan Keberlanjutan; Evolusi Tematik; Kewarganegaraan Lingkungan; Literasi Iklim.</p> <p>Abstract</p> <p>Climate change education at the primary school level has gained increasing scholarly attention in recent years; however, a systematic mapping of its research landscape remains limited. This study aims to analyze publication trends, scientific contributions, thematic structures, and the evolution of research topics in climate change education in primary schools. A bibliometric approach was employed using data retrieved from the Scopus database covering the period 2012–2025. The search was conducted using specific keywords related to climate change, education, and primary schools, followed by a PRISMA-based selection process. Data were analyzed using Microsoft Excel for descriptive statistics, VOSviewer for keyword co-occurrence and network visualization, and Biblioshiny for collaboration and thematic mapping analysis. The findings indicate a significant growth in publications after 2020, with contributions dominated by European and English-speaking countries, although participation from Asia and Africa has increased. Thematic analysis reveals a shift from studies focusing on physical and health impacts toward more pedagogical and participatory approaches, including environmental citizenship and students' emotional engagement. Overall, the field demonstrates a transition toward a more holistic orientation that positions primary schools as strategic spaces for strengthening climate literacy and sustainability competencies.</p> <p>Keywords: Climate Change; Primary Schools; Sustainability Education; Thematic Evolution; Environmental Citizenship; Climate Literacy.</p>



1. INTRODUCTION

Climate change has become a global issue whose impacts are increasingly measurable through scientific evidence. Data indicate an increase in global temperatures of approximately 1°C above pre-industrial levels, accompanied by a rising frequency of extreme weather events over recent decades (Lyon et al., 2022). These impacts affect not only environmental and economic systems but also the physical and psychological well-being of children, including increased risks of respiratory disorders and climate-related anxiety (Parsons et al., 2025; Vergunst & Berry, 2022). In this context, education is widely recognized as a strategic instrument for fostering climate literacy and adaptive capacity from an early age. Primary schools represent a critical stage, as they provide the foundation for developing conceptual understanding and attitudes toward the relationship between humans and the environment.

Previous studies have shown that climate change education has evolved from merely delivering scientific concepts toward approaches that emphasize sustainability competencies, active participation, and students' emotional engagement (Eilam, 2025; Kranz et al., 2022). Various studies have examined curriculum integration (Rushton & Walshe, 2025), project-based learning (Kundariati et al., 2025), STEM/STEAM approaches (Djam'an, 2025), and the strengthening of affective dimensions such as environmental citizenship and eco-anxiety (El-Sayed et al., 2025; Goodale et al., 2025). On the other hand, existing bibliometric studies have generally focused on sustainability education or environmental education in broader contexts (Shen et al., 2025; Tafese & Kopp, 2025). Few have specifically examined climate change education at the primary school level over a comprehensive time period.

To the best of our knowledge, no previous bibliometric study has specifically mapped climate change education research at the primary school level within this time frame. This gap highlights the need for a systematic mapping capable of identifying publication trends, scientific contributions, thematic structures, and the evolution of research topics in an integrated manner. Therefore, this study focuses on Scopus-indexed publications from 2012 to 2025 by combining trend analysis, collaboration analysis, and thematic evolution analysis to provide a more comprehensive understanding of the dynamics of this research field. Based on this background, the study addresses the following research questions:

RQ1. What are the publication trends in climate change education research at the primary school level during the analyzed period?

RQ2. Which countries, institutions, and authors have made the most significant contributions to the development of climate change education research in primary schools?

RQ3. What thematic structures and clusters emerge from keyword co-occurrence analysis in climate change education research at the primary school level?

RQ4. How have research themes evolved over time, and which topics have shown increasing prominence in recent years?

2. METHOD

2.1. Research Design, Data Sources, and Search Strategy

This study employed a bibliometric approach to map the development of research on climate change education at the primary school level. Data were collected through a search of the Scopus database using the title, abstract, and keyword fields. The search query was as follows:

*TITLE-ABS-KEY ("climate change" OR "climate education" OR "climate change literacy") AND (education OR learning OR curriculum) AND ("primary school" OR "elementary school")***

The publication period was limited to 2012–2025 to capture research developments over more than a decade. Only English-language research articles and review articles were included in the dataset. The article selection process followed the PRISMA framework, consisting of identification, screening, eligibility assessment, and final inclusion stages, as illustrated in Figure 1.

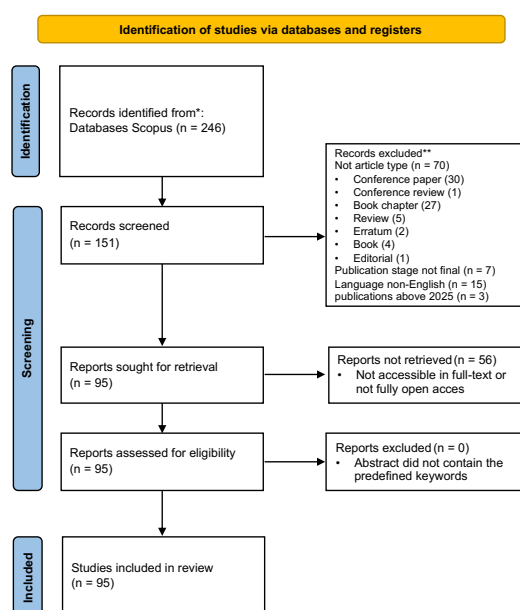


Figure 1. PRISMA flow diagram

The inclusion and exclusion criteria applied in this study are presented in Table 1.

Table 1. Inclusion and Exclusion Criteria

Category	Kriteria Inklusi	Kriteria Eksklusi
Topic	Climate change education	Not related to climate change education
Context	Elementary school or primary school	Higher education or non-formal context
Document Type	Research articles	Other document types
Language	English	Languages other than English
Period	2012–2025	Outside the range

2.2. Software and Analysis Techniques

Data analysis was conducted using several software packages. Microsoft Excel was employed for descriptive analyses, including annual publication trends, country distribution, and contributions of institutions and authors. Network and thematic structure analyses were performed using VOSviewer. In addition, Biblioshiny was utilized to generate country and author collaboration analyses, three-field plots, and thematic maps, thereby providing complementary insights and strengthening the interpretation of network visualization results.

3. RESULTS AND DISCUSSION

3.1. Analysis Results

3.1.1. RQ1 – Publication Trends in Climate Change Education Research at the Primary School Level

Figure 2 presents the trends in the number of publications and citations related to climate change education research at the primary school level during the period from 2012 to 2025.

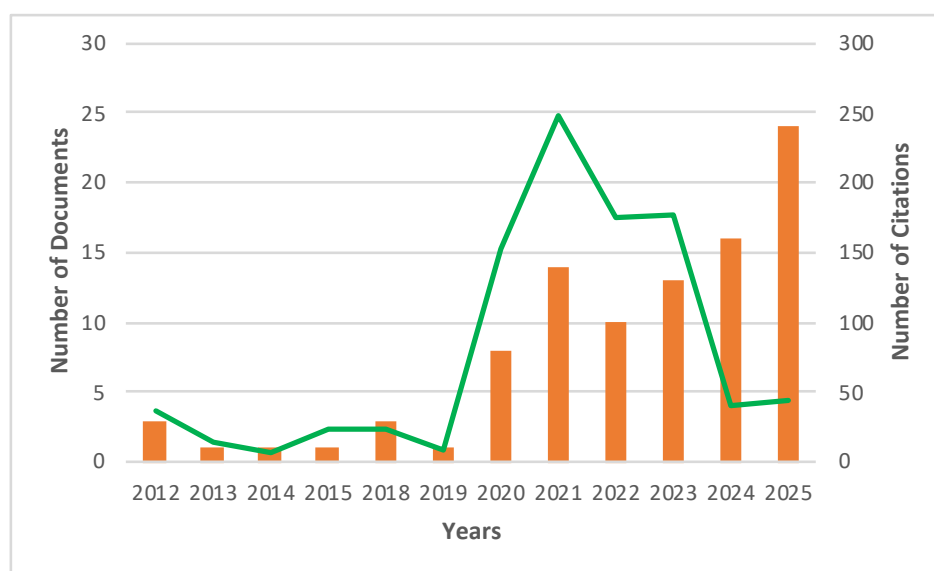


Figure 2. Publication Trends and Citation Growth (2012–2025)

As shown in Figure 2, the publication trend demonstrates substantial growth after 2020, following a relatively low level of research output during the 2012–2015 period. A marked increase occurred in 2020 and reached its peak in 2021, accompanied by a sharp rise in citation counts, indicating a phase of accelerated research activity in the field. Although both publication and citation counts fluctuated between 2022 and 2025, the overall trend reflects sustained growth and continued scholarly interest. Beyond the quantitative increase, the research topics have also become more diverse and contextually oriented, reflecting the expanding scope and maturity of climate change education research at the primary school level.

Based on the data presented in Figure 4, ten institutions emerged as the most productive contributors to the field. Five institutions each produced four publications: National Kaohsiung Normal University, South African Medical Research Council, Universitat Politècnica de Catalunya, University of Surrey, and University of York. The remaining five institutions each contributed three publications: Chinese Center for Disease Control and Prevention, Faculdade de Ciências da Universidade de Lisboa, Norwegian University of Science and Technology (NTNU), Pontificia Universidad Católica del Perú, and Tohoku University. These findings highlight the geographically diverse nature of research contributions, spanning Asia, Europe, Africa, and Latin America.

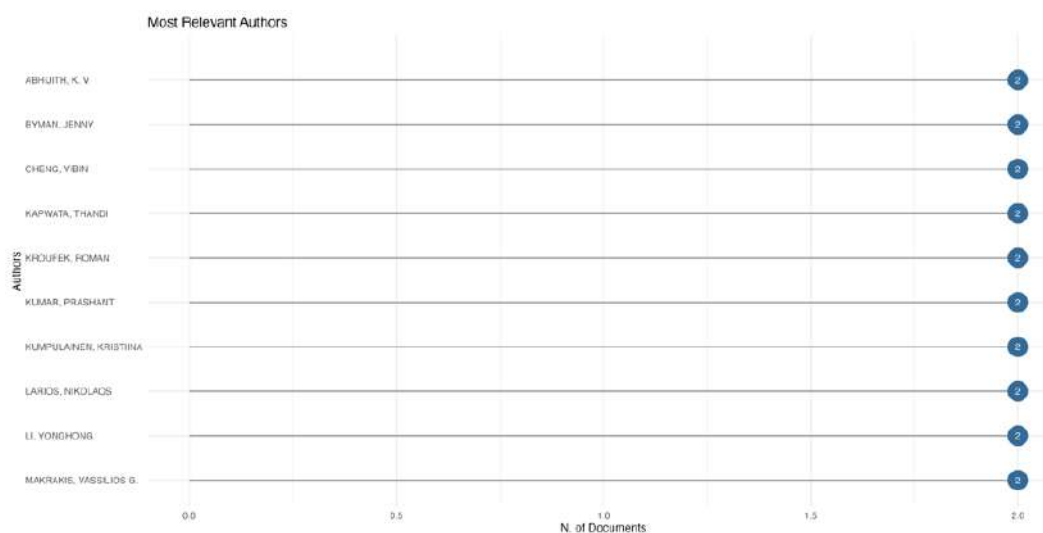


Figure 5. Contribution of Authors to Research

According to Figure 5, several authors recorded two publications each, including Abhijith K. V., Jenny Byman, Yibin Cheng, Thandi Kapwata, Roman Kroufek, Prashant Kumar, Kristiina Kumpulainen, Nikolaos Larios, Yonghong Li, and Vassilios G. Makrakis. Although these authors contributed an equal number of publications, differences in average citations per document indicate variations in their academic influence. Authors such as Roman Kroufek and Vassilios G. Makrakis achieved higher citation impacts compared with their peers. Overall, scholarly contributions within this field appear relatively balanced, with no single author demonstrating a dominant influence on the research landscape.

3.1.3. RQ3 – Thematic Structure and Clusters Based on Keyword Co-Occurrence Analysis

The keyword co-occurrence network visualization maps the thematic structure of climate change education research at the primary school level based on the relationships among terms appearing across multiple documents.

Figure 7 demonstrates a thematic shift from earlier research topics (blue–green) toward more recent themes (yellow). During the initial period, studies primarily focused on the physical impacts of climate change, student health issues, and survey-based quantitative investigations. More recent topics emphasize climate change education, environmental citizenship, and eco-anxiety, reflecting growing attention to the pedagogical and emotional dimensions of students' learning experiences. Overall, the field has evolved from an impact-oriented perspective toward a more participatory approach aimed at strengthening students' capacities to understand, respond to, and engage with climate-related challenges.

3.2. Discussion

The increase in publications after 2020 indicates that climate change education is increasingly being recognized as a strategic response to the global climate crisis and as a means of strengthening sustainability literacy among younger generations. This trend reflects a shift in both academic and policy attention toward the more systematic integration of climate-related issues into curricula, pedagogical approaches, and educational practices across different countries (Obi & Ojo, 2026). Furthermore, the transformation of research orientations from approaches emphasizing physical and health impacts toward more pedagogical, participatory, and action-oriented perspectives suggests that climate change education is no longer viewed merely as a process of knowledge transmission. Instead, it is increasingly understood as a means of developing students' competencies, attitudes, and engagement with sustainability issues (Nepraš et al., 2022). This shift further reinforces the role of primary schools as strategic spaces for fostering adaptive capacity and ecological responsibility from an early age.

4. CONCLUSION

This study demonstrates that research on climate change education at the primary school level has experienced significant growth, particularly after 2020. Although scholarly contributions continue to be dominated by European and English-speaking countries, participation has become increasingly global in scope. Thematic analysis reveals that research attention has shifted from issues related to physical and health impacts toward more pedagogical, participatory, and literacy-oriented approaches, with increasing emphasis on students' affective dimensions. These findings position primary schools as strategic environments for developing the capacities and resilience of younger generations in responding to climate change challenges.

5. REFERENCES

- Djam'an, N. (2025). Examining the implementation of environmental education in the STEAM approach for sustainability. *Discover Education*, 4(1), 410. <https://doi.org/10.1007/s44217-025-00837-4>
- Eilam, E. (2025). What does it take to develop an effective climate change curriculum? *Frontiers in Education*, Volume 10-2025. <https://www.frontiersin.org/journals/education/articles/10.3389/educ.2025.1572965>

- El-Sayed, M. M., Al-Hrinat, J., Aldirawi, A., Hamzaa, H. G., Alkubati, S. A., Mohammed, F. A., Hendi, A., Elrefaey, S. R. I., & Shalabi, H. S. M. (2025). Climate change-induced eco-anxiety and asthma control in pediatric patients: A cross-sectional nursing study. *Journal of Pediatric Nursing*, *85*, 285–293. <https://doi.org/10.1016/j.pedn.2025.08.009>
- Goodale, A. Y., Gilmore, M. P., & Griffiths, B. M. (2025). 21st-century stewardship: Infusing environmental stewardship education with global citizenship. *Environmental Education Research*, *31*(2), 364–389. <https://doi.org/10.1080/13504622.2024.2335614>
- Kranz, J., Schwichow, M., Breitenmoser, P., & Niebert, K. (2022). The (Un)political Perspective on Climate Change in Education—A Systematic Review. *Sustainability*, *14*(7), 4194. <https://doi.org/10.3390/su14074194>
- Kundariati, M., Ibrohim, I., Rohman, F., & Nida, S. (2025). Navigating climate change education: A problem-oriented project-based learning in secondary schools. *Science Activities*, *62*(2), 156–170. <https://doi.org/10.1080/00368121.2025.2463653>
- Lyon, C., Saupe, E. E., Smith, C. J., Hill, D. J., Beckerman, A. P., Stringer, L. C., Marchant, R., McKay, J., Burke, A., O’Higgins, P., Dunhill, A. M., Allen, B. J., Riel-Salvatore, J., & Aze, T. (2022). Climate change research and action must look beyond 2100. *Global Change Biology*, *28*(2), 349–361. <https://doi.org/https://doi.org/10.1111/gcb.15871>
- Nepraš, K., Strojčková, T., & Kroufek, R. (2022). Climate Change Education in Primary and Lower Secondary Education: Systematic Review Results. *Sustainability*, *14*(22), 14913. <https://doi.org/10.3390/su142214913>
- Obi, J. N., & Ojo, E. (2026). Mainstreaming climate change in school curricula: Critical review of pedagogy, policy and Global South perspectives. *Cogent Education*, *13*(1), 2613489. <https://doi.org/10.1080/2331186X.2026.2613489>
- Parsons, E. S., Jowell, A., Veidis, E., Barry, M., & Israni, S. T. (2025). Climate change and inequality. *Pediatric Research*, *98*(4), 1238–1245. <https://doi.org/https://doi.org/10.1038/s41390-024-03153-z>
- Rushton, E. A. C., & Walshe, N. (2025). Curriculum making and climate change and sustainability education: A case study of school teachers’ practices from England, UK. *Environmental Education Research*, *31*(5), 1083–1097. <https://doi.org/10.1080/13504622.2025.2471990>
- Shen, Y.-S., Wu, X., & Li, P.-Y. (2025). Environmental education and sustainable development: Trends, gaps, and future directions from a bibliometric perspective. *International Research in Geographical and Environmental Education*, 1–27. <https://doi.org/10.1080/10382046.2025.2581294>
- Tafese, M. B., & Kopp, E. (2025). Education for sustainable development: Analyzing research trends in higher education for sustainable development goals through bibliometric analysis. *Discover Sustainability*, *6*(1), 51. <https://doi.org/10.1007/s43621-024-00711-7>

Vergunst, F., & Berry, H. L. (2022). Climate Change and Children's Mental Health: A Developmental Perspective. *Clinical Psychological Science*, 10(4), 767–785.
<https://doi.org/10.1177/21677026211040787>