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MAPPING THE LANDSCAPE OF SCIENTIST-SCHOOL PARTNERSHIPS IN STEM EDUCATION: A BIBLIOMETRIC ANALYSIS

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Abstract:

Scientist-School Partnerships (SSP) in Science, Technology, Engineering, and Mathematics (STEM) education have garnered increasing attention as a transformative model. It seeks to enrich science teaching, foster authentic inquiry, and bridge formal education with scientific practice. However, despite the growing implementation of such collaborations, a comprehensive overview of global research trends, influential contributors, and thematic directions remains limited. This bibliometric analysis aims to map the scholarly landscape of SSP in STEM education, identifying research patterns, dominant countries, institutions, and evolving themes. Using a structured search strategy in the Scopus database, we applied a keyword combination of "scientist," "school," "partnership," and "STEM education," yielding a total of 1,054 documents. Data were refined and standardized using OpenRefine to ensure consistency and eliminate redundancies. Quantitative analyses were performed using Scopus Analyzer, while network visualizations and co-occurrence maps were generated with VOSviewer to identify keyword clusters and author collaboration networks. Results indicate that the United States (US) leads in research output and citation impact, followed by the United Kingdom (UK), Canada, and Australia. Thematic mapping reveals core research domains centered on inquiry-based learning, science communication, professional development, and interdisciplinary curriculum integration. Furthermore, the collaboration patterns demonstrate a concentration of contributions from high-income countries, with emerging participation from Latin America and Asia. This study contributes a systematic bibliometric perspective to the literature, offering insights into current knowledge structures and gaps. In addition, the findings underscore the significance of expanding inclusive international collaborations. This is particularly relevant in supporting underrepresented regions and suggests future research directions focusing on sustainable models of scientist-school engagement that are contextually and culturally relevant.

Keywords:

Scientist And School, Partnership, STEM Education, Bibliometric

Introduction

The global emphasis on Science, Technology, Engineering, and Mathematics (STEM) education has intensified in recent decades. It is driven by the growing need to cultivate a scientifically literate society capable of addressing complex technological and societal challenges (Bybee, 2020; Li et al., 2020; Zhan et al., 2022). In this context, Scientist-School Partnerships (SSP) have emerged as a promising strategy to enhance the authenticity, engagement, and contextual relevance of STEM learning across educational levels (Abramowitz, Antonenko, et al., 2024; Abramowitz, Ennes, et al., 2024; Ufnar & Shepherd, 2021; Westbrook et al., 2023). These partnerships, which embed practicing scientists into classroom environments, aim to bridge the divide between academic research and school science by promoting inquiry-based learning, mentorship, and real-world scientific practices (Bopardikar et al., 2023; McCollough et al., 2016; Peterson et al., 2024; Taylor et al., 2022).

SSP provides students with authentic learning experiences that foster curiosity, scientific literacy, and interest in STEM careers. For instance, the PlantingScience program substantially improved students' science content knowledge and attitudes toward scientists, underlining the positive impacts of such engagements (Westbrook et al., 2023). Through hands-on, inquiry-driven activities, students gain exposure to scientific processes that extend beyond textbook learning, enhancing both conceptual understanding and procedural competence (Fadzil et al., 2019).

In addition to student outcomes, SSP yields substantial professional benefits for teachers. Collaborative engagements with scientists allow educators to update their STEM content knowledge, improve pedagogical approaches, and build confidence in delivering enriched science instruction. Evidence from Malaysia's Scientist-Teacher-Student Partnership (STSP) initiative revealed enhanced teacher enthusiasm, professional growth, and expanded networks between schools and universities (Fadzil et al., 2019; Ismail et al., 2024; Saat et al., 2021, 2023). Similarly, the US-based Math and Science Partnership program demonstrated that teachers improved their content mastery and instructional strategies through sustained interactions with STEM faculty (Zhang et al., 2011). These partnerships support educators in integrating advanced scientific concepts into the curriculum, thereby enriching students' learning experiences (Brown et al., 2014; Madden et al., 2007).

Nevertheless, the implementation and sustainability of SSP present several challenges. Note that misalignments between the professional cultures, goals, and communication styles of scientists and educators can hinder collaboration (Falloon, 2013). Effective partnerships require ongoing negotiation of roles, expectations, and resource sharing to ensure mutual benefit (Ma & Green, 2023). Moreover, logistical barriers, including curriculum constraints, teacher workload, and limited access to scientific resources, must be strategically addressed (Ng & Fergusson, 2019; Tytler, 2018).

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Despite increasing global interest and promising outcomes, the literature on SSP remains dispersed across diverse disciplinary, contextual, and methodological boundaries. This fragmentation hinders the accumulation of cohesive knowledge and impedes the development of strategic frameworks to guide future practice. Therefore, a bibliometric mapping of the intellectual landscape is urgently needed. This study responds to this gap by conducting a comprehensive bibliometric analysis of SSP in STEM education. In particular, it aims to identify key trends, influential contributors, collaborative networks, and emerging research themes that can inform policy, research, and practice in this evolving field.

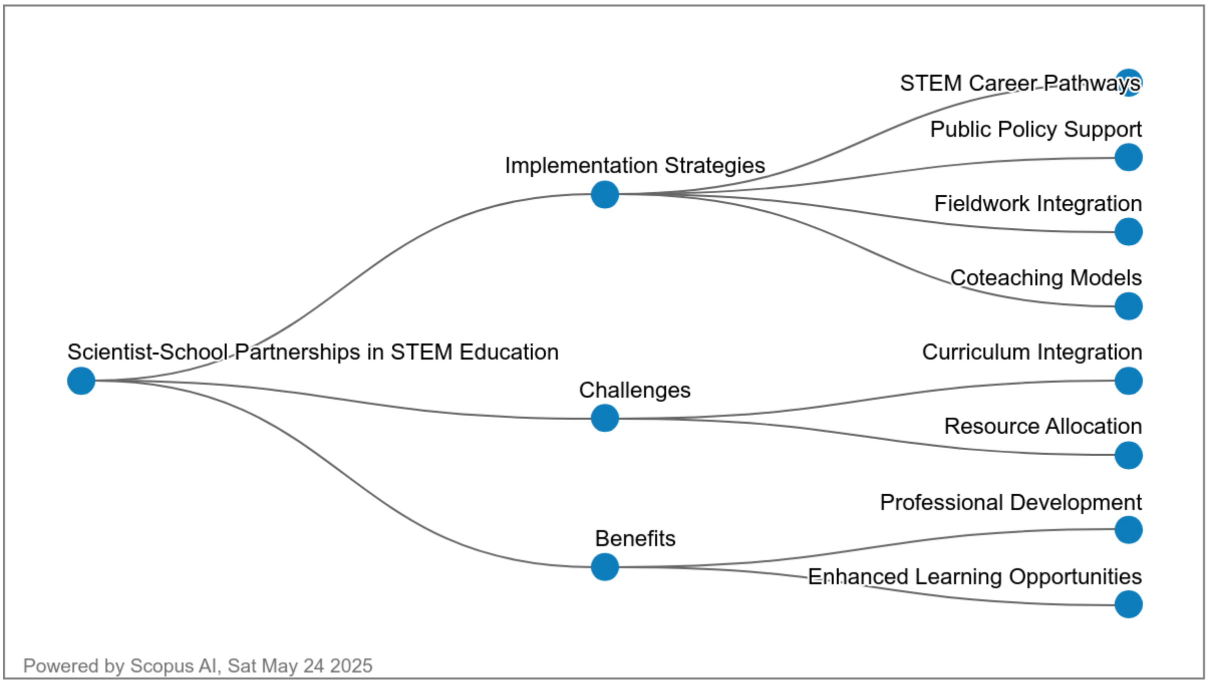

Figure 1: Overview Of The Study Scientist-School Partnership In STEM Education

Research Question

RQ 1: What are the research trends in SSP in STEM education according to the year of publication?
RQ 2: What are the most cited articles?
RQ 3: What are the top 10 countries based on the number of publications?
RQ 4: What are the popular keywords related to the study?
RQ 5: What is the co-authorship collaboration between countries?

Methodology

Bibliometrics involves gathering, organizing, and analyzing bibliographic data from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). Beyond basic statistics, such as identifying publishing journals, publication years, and leading authors (Wu & Wu, 2017), bibliometrics includes more sophisticated techniques like document co-citation analysis. Conducting a successful literature review requires a careful, iterative process to select suitable keywords, search the literature, and perform an in-depth analysis. This approach helps to compile a comprehensive bibliography and achieve reliable results (Fahimnia et al., 2015). With this in mind, the study focused on high-impact publications, as they provide meaningful

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insights into the theoretical frameworks that shape the research field. Scopus served as the primary source for data collection to ensure data accuracy (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Additionally, to maintain quality, the study only considered articles published in peer-reviewed academic journals, deliberately excluding books and lecture notes (Gu et al., 2019). Using Elsevier's Scopus, known for its broad coverage, publications were collected from 1971 through May 2025 for further analysis.

Data Search Strategy

The study employed a screening sequence to determine the search terms for article retrieval. Afterwards, the query string was revised to ensure that the search terms were scientist, school, and partnership in STEM education. This process yielded 1,560 results, which were additionally scrutinized to include only research articles based on subject and selected year, and were also excluded, as referenced in Table 2. The final search string refinement included 1,052 articles, which were used for bibliometric analysis. As of May 2025, all articles from the Scopus database relating to the SSP in STEM education were incorporated in the study.

To ensure a rigorous and comprehensive data collection process, a systematic bibliometric search was conducted using the Scopus database, one of the most authoritative and extensive sources for peer-reviewed literature in the sciences and social sciences. The search was executed with a well-defined Boolean search string designed to capture scholarly works related to scientist-school collaborations within the STEM education context. The following search query was employed as summarized in Table 1 below:

Table 1: The Search String

Scopus	TITLE-ABS-KEY ((scientist* AND (school* OR classroom* OR teacher* OR student*) AND (stem OR science OR technology OR engineering OR mathematic*) AND (partnership OR collaborat*) AND education)) AND (LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "CHEM") OR LIMIT-TO (SUBJAREA, "MATH") OR LIMIT-TO (SUBJAREA, "MULT") OR LIMIT-TO (SUBJAREA, "ENGI"))

This query was applied to the Title, Abstract, and Keywords (TITLE-ABS-KEY) fields to retrieve publications that explicitly address the intersection of scientist involvement and school-level STEM education partnerships. Meanwhile, the use of truncation symbols (e.g., scientist*, mathematic*, collaborat*) enabled the retrieval of various word forms (e.g., scientist/scientists, mathematics/mathematician, collaborate/collaboration), thereby broadening the search coverage. The search was further refined by limiting the subject areas to those most relevant to STEM education and interdisciplinary collaboration: social sciences, chemistry, mathematics, multidisciplinary, and engineering, as provided in Table 2 below.

Table 2: The Selection Criterion Is Searching

Criterion	Inclusion	Exclusion
Subject Area	Social Sciences, Engineering, Chemistry, Mathematics, Multidisciplinary	Besides Social Sciences, Engineering, Chemistry, Mathematics, Multidisciplinary

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Data Analysis

VOSviewer is an intuitive bibliometric software developed by Nees Jan van Eck and Ludo Waltman at Leiden University in the Netherlands (van Eck & Waltman, 2010, 2017). It is widely recognized for its capabilities in visualizing and analyzing scientific literature. In particular, VOSviewer excels in creating user-friendly network visualizations, clustering related items, and generating density maps. The software enables researchers to explore co-authorship, co-citation, and keyword co-occurrence networks, offering a comprehensive insight into research landscapes. Its interactive interface and regular updates allow for efficient and dynamic exploration of extensive datasets. Furthermore, VOSviewer possesses the ability to compute various metrics, customize visualizations, and is compatible with multiple bibliometric data sources. This renders it an invaluable resource for scholars seeking depth and clarity in complex research domains.

One of the standout features of VOSviewer is its ability to transform complex bibliometric datasets into visually interpretable maps and charts. With a strong emphasis on network visualization, the software excels at clustering related items, analyzing patterns of keyword co-occurrence, and generating density maps. Researchers appreciate its user-friendly interface, enabling novice and experienced users to explore research landscapes efficiently. The continuous development of VOSviewer ensures that it remains at the forefront of bibliometric analysis, providing valuable insights through the computation of metrics and customizable visualizations. Its versatility in overseeing various types of bibliometric data, such as co-authorship and citation networks, positions VOSviewer as an indispensable tool for scholars seeking a more profound understanding and meaningful insights within their research fields.

Datasets containing information on publication year, title, author name, journal, citation, and keywords in PlainText format were acquired from the Scopus database, covering the period from 1971 to May 2025. These datasets were subsequently analyzed using VOSviewer software, version 1.6.19. By utilizing VOS clustering and mapping techniques, the software facilitated the examination and creation of visual maps.

Unlike the Multidimensional Scaling (MDS) approach, VOSviewer focuses on situating items within low-dimensional spaces, ensuring that the proximity between any two items accurately reflects their relatedness and similarity (van Eck & Waltman, 2010). While VOSviewer shares certain similarities with the MDS approach (Appio et al., 2014), it distinguishes itself by relying less on similarity metrics such as cosine and Jaccard indices. Instead, VOS employs a more suitable method for normalizing co-occurrence frequencies, referred to as Association Strength (AS_{ij}), which is calculated as follows (Van Eck & Waltman, 2007):

$$AS_{ij} = \frac{C_{ij}}{w_i w_j},$$

which is "proportional to the ratio between on the one hand the observed number of co-occurrences of i and j and on the other hand the expected number of co-occurrences of i and j under the assumption that co-occurrences of i and j are statistically independent" (Van Eck & Waltman, 2007).

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Result and Findings

What Are The Research Trends In SSP In STEM Education According To The Year Of Publication?

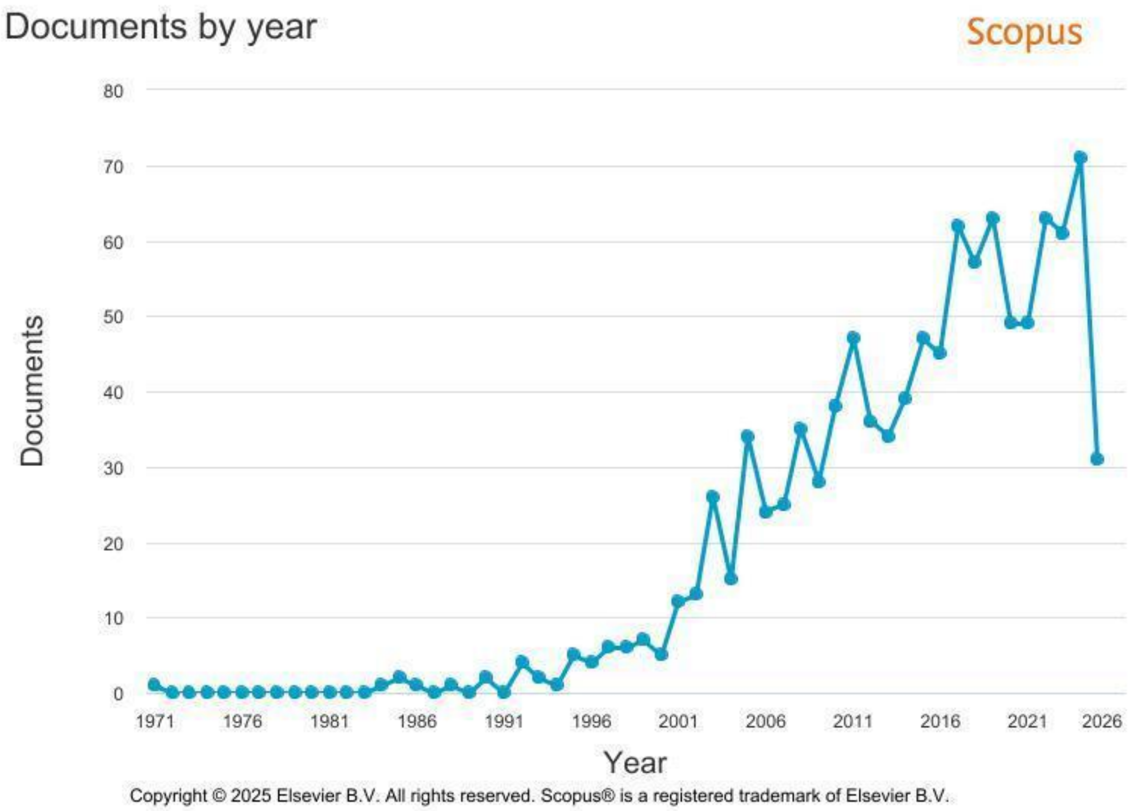

Figure 2: Trend of Research in Scientist-School Partnership in STEM Education by Years

Table 3: The Number of Publications and Percentage Research Trends in Scientist-School Partnership in STEM Education According to the Year of Publication

Year	Number of Publications	Percentage (%)
2025	31	2.95
2024	71	6.75
2023	61	5.80
2022	63	5.99
2021	49	4.66
2020	49	4.66
2019	63	5.99
2018	57	5.42
2017	62	5.89
2016	45	4.28
2015	47	4.47
2014	39	3.71
2013	34	3.23
2012	36	3.42
2011	47	4.47

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2010	38	3.61
2009	28	2.66
2008	35	3.33
2007	25	2.38
2006	24	2.28
2005	34	3.23
2004	15	1.43
2003	26	2.47
2002	13	1.24
2001	12	1.14
2000	5	0.48
1999	7	0.67
1998	6	0.57
1997	6	0.57
1996	4	0.38
1995	5	0.48
1994	1	0.10
1993	2	0.19
1992	4	0.38
1990	2	0.19
1988	1	0.10
1986	1	0.10
1985	2	0.19
1984	1	0.10
1971	1	0.10

The bibliometric trend of publications on SSP in STEM Education from 1971 to 2025 reveals a clear trajectory of increasing scholarly interest over time, particularly within the last decade. The earliest entry appears in 1971, followed by sporadic contributions through the 1980s and 1990s, indicating that this field was largely underexplored during those decades. From 2000 onwards, there has been a gradual yet steady rise in publication output, suggesting a growing awareness of the significance of collaborative engagement between scientists and educational institutions. Notably, the field began gaining significant traction in the post-2010 period, aligned with global STEM education reform initiatives and increased advocacy for authentic scientific experiences in school settings.

Between 2015 and 2024, the field experienced a period of consistent and relatively high publication rates, with annual outputs ranging from 39 to 71 publications. The years 2022 and 2019 both recorded 63 publications (5.99%), while 2024 saw the highest peak with 71 publications (6.75%), underscoring heightened scholarly engagement. This growth corresponds with broader educational policy shifts emphasizing STEM integration, interdisciplinary pedagogy, and public engagement in science. Remarkably, the COVID-19 pandemic years (2020–2021) did not significantly hinder research activity in this domain, with each year maintaining a stable output of 49 publications. This reflects the resilience and continued prioritization of educational innovation during global disruptions.

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In 2025, the publication count (n = 31; 2.95%) presents a partial annual result, assuming data were extracted mid-year. This suggests a likely continuation of the upward trend. The distribution over time demonstrates the field's evolution from marginal interest to a focal area of STEM education research and the increasing institutional and policy-level investment in bridging formal education with scientific expertise. Overall, the rising pattern highlights both the maturity and the strategic significance of SSP in cultivating inquiry-based, culturally relevant, and humanized STEM learning environments.

What Are The Most Cited Articles?

Table 4: The Top 10 Cited Authors

Authors	Title	Year	Source title	Cited by
Osborne J.	Arguing to learn in science: The role of collaborative, critical discourse (Osborne, 2010)	2010	Science	645
Bell T.; Urhahne D.; Schanze S.; Ploetzner R.	Collaborative inquiry learning: Models, tools, and challenges (Bell et al., 2010)	2010	International Journal of Science Education	321
Straus S.E.; Chatur F.; Taylor M.	Issues in the mentor-mentee relationship in academic medicine: A qualitative study (Straus et al., 2009)	2009	Academic Medicine	249
Brownell S.E.; Hekmat-Scafe D.S.; Singla V.; Chandler Seawell P.; Conklin Imam J.F.; Eddy S.L.; Stearns T.; Cyert M.S.	A high-enrollment course-based undergraduate research experience improves student conceptions of scientific thinking and ability to interpret data (Brown et al., 2014)	2015	CBE Life Sciences Education	202
Hyldegård J.	Collaborative information behaviour-exploring Kuhlthau's Information Search Process model in a group-based educational setting (Hyldegård, 2006)	2006	Information Processing and Management	161
Sandi-Urena S.; Cooper M.; Stevens R.	Effect of cooperative problem-based lab instruction on metacognition and problem-solving skills (Sandi-Urena et al., 2012)	2012	Journal of Chemical Education	126
Williamson B.	Policy networks, performance metrics and platform markets: Charting	2019	British Journal of Educational Technology	106

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	the expanding data infrastructure of higher education (Williamson, 2019)			
Martin T.; Rivale S.D.; Diller K.R.	Comparison of student learning in challenge-based and traditional instruction in biomedical engineering (Martin et al., 2007)	2007	Annals of Biomedical Engineering	104
Winter H.H.; Mours M.	The cyber infrastructure initiative for rheology (Winter & Mours, 2006)	2006	Rheologica Acta	101
Florence M.K.; Yore L.D.	Learning to write like a scientist: Coauthoring as an enculturation task (Florence & Yore, 2004)	2004	Journal of Research in Science Teaching	100

The citation data for the top ten most cited authors in the field of SSP in STEM Education highlights a diverse range of influential contributions that extend across disciplines, pedagogical strategies, and educational contexts. Osborne (2010) leads the list with 645 citations for the seminal work "Arguing to learn in science," published in Science, underscoring the critical role of collaborative discourse in scientific learning. This high citation count reflects the foundational importance of dialogic and argument-based pedagogy in STEM education. Similarly, Bell et al. (2010), with 321 citations, emphasized collaborative inquiry learning models, demonstrating that research into structured, participatory STEM learning environments has had a broad and sustained influence on the field.

The presence of Straus et al. (2009) and Brownell et al. (2015), whose works focused on mentoring relationships in academic settings and course-based undergraduate research experiences, respectively. This illustrates the extended relevance of scientist-educator interactions beyond primary and secondary education. These studies bridge the gap between higher education mentorship and school-level partnership models, offering insights into how authentic research practices can be scaffolded through structured collaborations. Moreover, Hyldegård (2006) and Sandi-Urena et al. (2012) contributed significant findings on group-based inquiry and cooperative learning strategies. This indicates a thematic convergence on metacognitive development and collaborative problem-solving, which are key pillars in effective SSP frameworks.

Notably, the top-cited works span journals from disciplinary education (e.g., Journal of Chemical Education, CBE Life Sciences Education) and interdisciplinary or policy-oriented outlets (e.g., British Journal of Educational Technology). This reflects the inherently cross-cutting nature of STEM partnerships, involving pedagogical innovation, systemic infrastructure, and performance evaluation, as discussed by Williamson (2019). Meanwhile, the presence of Florence and Yore (2004), who explored scientific writing through coauthoring, aligns directly with the aims of humanizing STEM by integrating authentic scientific practices in education. Collectively, these top-cited works map a rich, multidimensional research landscape that underscores the necessity of collaboration, inquiry, and institutional support in advancing STEM partnerships between scientists and schools.

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What Are The Top 10 Countries Based On The Number Of Publications?

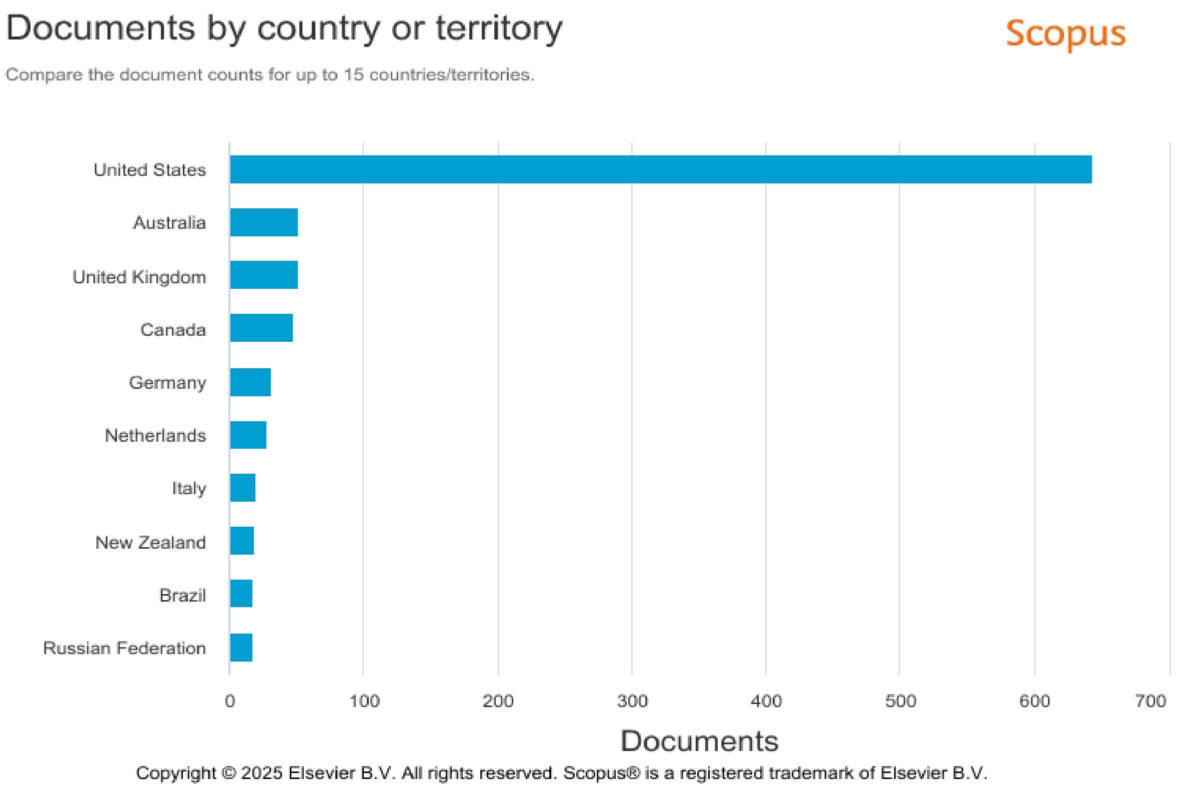

Figure 3: The Top 10 Countries Based on the Number of Publications in the Scientist-School Partnership in STEM Education

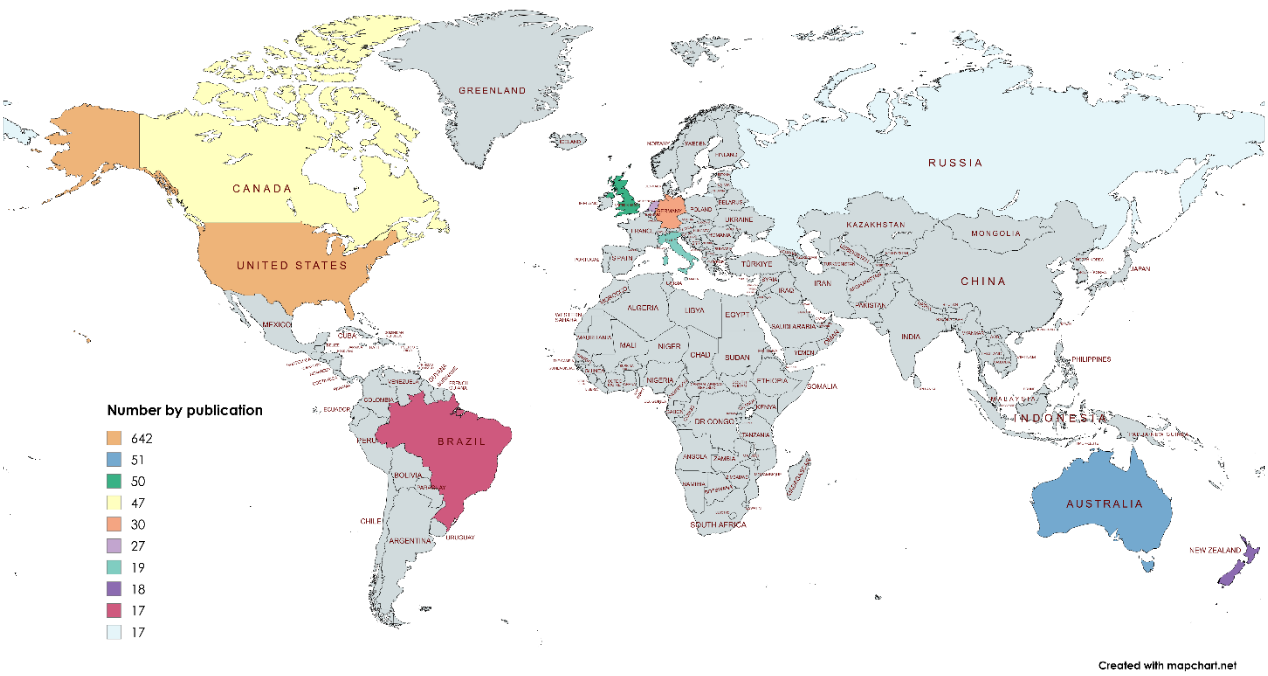

Figure 4: The Top 10 Countries Based on the Number of Publications in the Scientist-School Partnership in STEM Education

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The distribution of publications by country underscores the dominant role of the United States (US), which accounts for a remarkable 642 publications, representing a significant majority in the global research landscape on SSP in STEM Education. This overwhelming output suggests that the US has institutionalized collaborative STEM education practices and invested substantially in research infrastructure, funding, and policy development in this area. The prevalence of programs such as STEM Ecosystems, National Science Foundation (NSF) funded initiatives, and university outreach centers likely contribute to this leadership position. This reinforces the country's commitment to integrating scientists into K–12 education.

Following the US, countries like Australia (51), the United Kingdom (UK) (50), and Canada (47) present moderately high publication activity, reflecting their robust educational systems and policy frameworks that promote interdisciplinary STEM engagement. These countries often prioritize inquiry-based learning and have national strategies that encourage partnerships between academic researchers and schools. For instance, Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the UK's STEM Ambassador Program provide institutional models that support these collaborations. The relatively close figures among these three nations also indicate a shared commitment to STEM education reform through participatory and contextually relevant approaches.

In the broader global context, European nations such as Germany (30), the Netherlands (27), and Italy (19), along with New Zealand (18), Brazil (17), and the Russian Federation (17), represent a secondary cluster of active contributors. While their output is significantly lower than that of the US, these countries are still making vital contributions, often through localized or region-specific partnership models. The presence of countries from different continents suggests growing international interest and a diverse application of SSP frameworks. However, the stark contrast in publication volume also reveals an imbalance in global research representation. This highlights the need for increased capacity-building and collaborative networks in underrepresented regions.

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What Are The Popular Keywords Related To The Study?

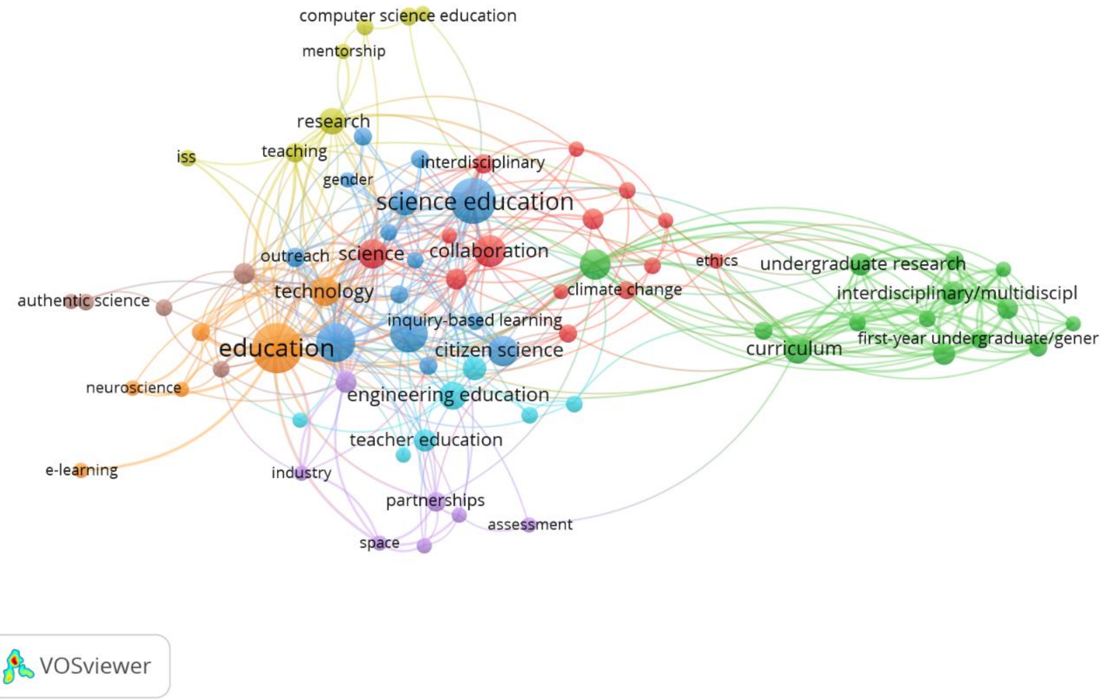

Figure 5: Network Visualization Map of Keywords' Co-Occurrence

Table 5: The Top 10 Popular Keywords Related to the Study

No.	Keyword	Occurrences	Total link strength
1	Education	51	70
2	Stem	30	47
3	Science	18	45
4	Technology	17	43
5	Interdisciplinary/multidisciplinary	11	39
6	Curriculum	16	37
7	Collaborative/cooperative learning	10	36
8	Collaboration	21	30
9	Public understanding/outreach	9	29
10	Science education	42	29

The keyword co-occurrence analysis from VOSviewer reveals several dominant themes within the literature on science and STEM education, indicating prevailing trends and interlinked research foci. Notably, the most frequently occurring keywords include "education" (51 occurrences, 70 total link strength), "science education" (42, 29), and "STEM" (30, 47). These indicate the centrality of educational themes and frameworks within the reviewed corpus. The high total link strength for "education" and "STEM" also suggests their strong associative presence across various subtopics. At the same time, terms like "collaboration" (21, 30), "curriculum" (16, 37), and "professional development" (19, 27) reflect a growing scholarly interest in pedagogical strategies, teacher capacity building, and instructional design as core elements in enhancing science learning environments.

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Another key trend involves interdisciplinary and student-centered approaches, as evidenced by terms such as "interdisciplinary/multidisciplinary" (11, 39), "inquiry" (12, 14), "project-based learning" (7, 7), "inquiry-based/discovery learning" (6, 24), and "student-centered learning" (6, 28). These keywords underscore a pedagogical shift toward engaging learners through active, experiential, and integrative methods that mirror real-world problem-solving. The presence of "authentic science" (6, 3) and "co-design" (6, 4) further suggests a move toward participatory learning models and closer alignment between academic science and school-based practices. Additionally, keywords such as "citizen science" (19, 15) and "public understanding/outreach" (9, 29) highlight the expanding focus on democratizing science through public engagement and community-based initiatives.

Finally, the data also underscore growing attention on inclusivity and contextual responsiveness in science education. For instance, the appearance of terms like "gender" (5, 6), "ethics" (5, 7), "sustainability" (7, 13), and "climate change" (7, 6) suggests an evolving discourse that integrates equity, ethical reflection, and socio-environmental relevance. Conversely, the inclusion of "covid-19" (7, 8) and "distance education" (5, 4) reflects the pandemic's influence in reshaping instructional modalities and priorities. Similarly, the consistent reference to "partnership/partnerships" (9/8 occurrences) implies recognition of multi-stakeholder collaboration, aligning well with the STSP model as a mechanism for systemic improvement in STEM education. Overall, the VOSviewer output demonstrates a multifaceted research landscape focused on innovation, interdisciplinarity, and social relevance in science and STEM pedagogy.

What Is The Co-Authorship Collaboration Between Countries?

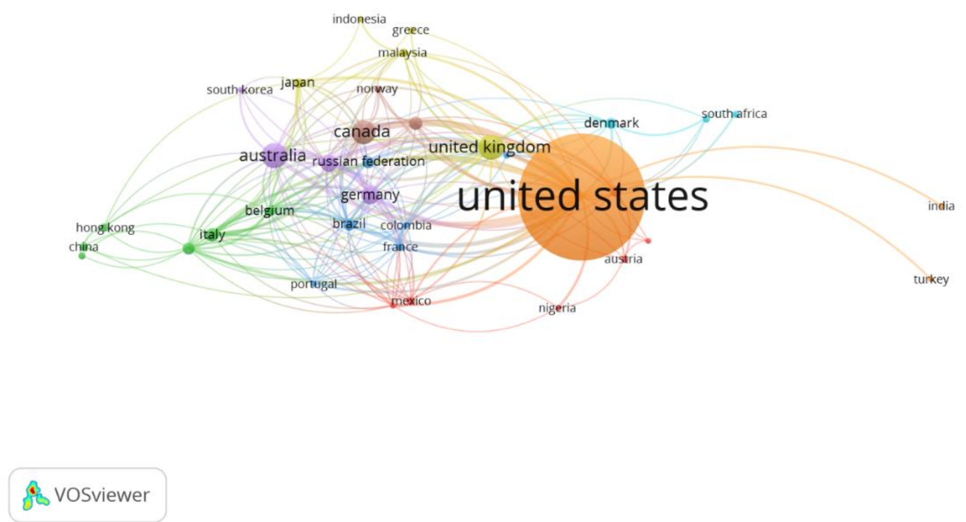

Figure 6: The Co-Authorship by Countries Collaboration

Table 6: The Top 10 Co-Authorships by Country Collaboration Related to the Study

No.	Country	Documents	Citations	Total Link Strength
1	United States	637	6708	126
2	Netherlands	27	145	53
3	United Kingdom	50	617	51
4	Germany	30	447	47

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5	Brazil	17	125	43
6	Australia	50	511	40
7	Canada	48	880	40
8	Belgium	11	37	34
9	Italy	19	123	34
10	Spain	17	164	28

The VOSviewer analysis reveals a highly uneven distribution of scholarly output and influence across countries in the context of the selected research domain, likely STEM education or science partnerships. The US overwhelmingly dominates with 637 documents, 6,708 citations, and a total link strength of 126, indicating both prolific productivity and substantial academic influence. The UK (50 documents, 617 citations, link strength 51) and Canada (48 documents, 880 citations, link strength 40) also emerge as prominent contributors. These countries are central hubs in the global research network, reflecting established infrastructures for STEM research, robust funding ecosystems, and strong international collaborations.

Several middle-power contributors demonstrate significant scholarly visibility relative to their output volume. For instance, Germany (30 documents, 447 citations, link strength 47) and Australia (50 documents, 511 citations, 40 link strength) rank high in both citations and connectivity, indicating their work is well-integrated into global discourse. Similarly, the Netherlands (27 documents, 145 citations, link strength 53) displays a high link strength compared to citation count. This suggests that Dutch research, while modest in volume, is extensively connected across research networks. Notably, Brazil (17 documents, 125 citations, link strength 43) and Italy (19 documents, 123 citations, 34 link strength) illustrate growing participation from Latin Europe and the Global South, with rising collaborative influence.

In contrast, countries like India (6 documents, 11 citations, link strength 2), Indonesia (6 documents, 28 citations, 3), and Nigeria (5 documents, 59 citations, 6) reflect underrepresentation in terms of both productivity and global integration. Although some nations, such as Malaysia (10 documents, 88 citations, link strength 19) and Colombia (6 documents, 43 citations, 21), exhibit relatively strong citation and network metrics per document, their overall global footprint remains limited. These patterns suggest opportunities to strengthen South-South and South-North research partnerships, especially through capacity-building, increased funding, and institutional support to ensure more equitable global contributions in STEM education research.

Conclusion

This bibliometric analysis was conducted to map the global research landscape on SSP in STEM education. The study seeks to examine key publication trends, the most influential articles, top contributing countries, prominent keywords, and patterns of international collaboration. Using a carefully constructed search strategy within the Scopus database and analytical tools including OpenRefine, Scopus Analyzer, and VOSviewer, a total of 1,054 articles were analyzed to uncover patterns and structures in this growing field.

The analysis revealed a steady increase in publication output, particularly from 2010 onwards, indicating rising scholarly interest in integrating scientists into school-based STEM education. The US emerged as the most dominant contributor in both output and citation impact, followed by the UK, Canada, and Australia. Thematic trends emphasized inquiry-based learning, science communication, professional development, and interdisciplinary integration. Keyword co-occurrence highlighted the central roles of education, science, and collaboration, underscoring a sustained interest in pedagogical innovation and institutional partnerships.

This study contributes to the literature by offering a macro-level perspective on developing SSP, identifying influential works, mapping collaborative networks, and highlighting underrepresented regions. The findings provide valuable insights for educators, researchers, and policymakers seeking to advance STEM education through authentic, interdisciplinary approaches. While the analysis offers a robust overview, it is limited by its reliance on a single database and exclusion of grey literature. Thus, future research may extend this work by incorporating qualitative reviews or exploring policy impacts and case studies across diverse educational settings. Overall, this bibliometric inquiry underscores the value of systematic evidence mapping in capturing the evolving dynamics of scientist-school collaboration. It also serves as a foundational reference for advancing inclusive and context-responsive STEM education practices.

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