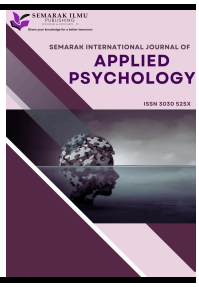
SEMARAK ILMU PUBLISHING

Semarak International Journal of Applied Psychology

Journal homepage:
https://semarakilmu.my/index.php/sijap/index
ISSN: 3030-525X



A Bibliometric Study on Gender Differences among Educators: Trends, Themes, and Global Collaborations

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ARTICLE INFO

Article history:
Received 26 November 2024
Received in revised form 3 December 2024
Accepted 25 December 2024
Available online 3 February 2025

Keywords:
Gender differences; educators; education

ABSTRACT

This bibliometric study explores the evolving research landscape on gender differences among educators through a comprehensive analysis, utilizing Scopus and VOSviewer to evaluate publication trends, key contributors, and collaboration networks. The research addresses the complexity of gender dynamics in education, encompassing themes such as teaching styles, biases, and equity in academic outcomes. Data collected from Scopus using advanced search strategies identified 1,273 relevant publications spanning from 2000 to 2024. VOSviewer was employed to visualize co-authorship, keyword co-occurrence, and country collaborations, revealing significant trends and intersections in the research. The results show a steady increase in scholarly output over the years, highlighting the growing recognition of gender issues in education. The United States and the United Kingdom emerge as dominant contributors, with extensive collaborations and high citation impacts, while other regions, including Asia and the Middle East, exhibit increasing but still underdeveloped participation. Key terms such as "gender differences," "inclusive education," and "mental health" underscore the interdisciplinary nature of this field, connecting sociology, psychology, and pedagogy. This study concludes that although the research community has made substantial strides in addressing gender disparities among educators, there remains a critical need to enhance international collaborations, especially with underrepresented regions, to ensure a more inclusive and globally representative understanding of the subject.

1. Introduction

Gender differences among teachers have been a subject of extensive research, revealing significant trends, themes, and global collaborations. Studies have shown that gender equity in academic institutions, including health research, remains a critical issue, with disparities evident in faculty representation, service obligations, recruitment, promotion opportunities, leadership roles, scholarly output, and collaboration activities [1]. For instance, a scoping review highlighted that most studies on gender equity in academia originate from North America, with limited consideration of genders beyond the binary categories and other social identities such as race and religion [1]. This

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https://doi.org/10.37934/sijap.5.1.1528b

underscores the need for more inclusive and intersectional approaches to understanding and addressing gender disparities in academic settings. Further research has explored the specific challenges faced by male and female teachers in different educational contexts. For example, a study on male primary school teachers in England, Sweden, and New Zealand found that societal emphasis on gender equity varied significantly across these countries, influencing teachers' pedagogical attitudes and actions [2]. Despite the growing body of literature on gender differences in education, there is a conspicuous lack of comprehensive studies that explore these issues from a global and intersectional perspective. Future research should aim to fill this gap by examining how various identities intersect with gender in educational settings worldwide, thereby fostering a more equitable and inclusive academic landscape.

2. Literature Review

The literature on gender differences among educators reveals a complex interplay of factors that influence teaching styles, biases in evaluations, and educational outcomes. A significant body of research indicates that gender biases exist not only in classroom dynamics but also in the broader educational context, affecting both educators and students. For instance, Aragón *et al*., [4] highlight that teaching evaluations often reflect gender biases that can adversely impact the career progression of female educators, suggesting that these biases are not merely anecdotal but are embedded in institutional practices. This assertion is further supported by Küçük-Demir and Deniz-Yılmaz [5], who discusses how learning styles, which can be influenced by gender, affect the educational experiences of teacher candidates, thereby contributing to broader gender disparities in educational outcomes.

In terms of teaching styles, studies by Hadjar and Backes [6] reveal that male and female educators may adopt different pedagogical approaches, with variations in formality and engagement strategies that can influence student learning experiences. This aligns with findings from Miletic *et al.*, [7] who emphasizes the importance of understanding how different teaching styles can affect learning, particularly in physical education contexts. Such dynamics underscore the importance of recognizing how gender differences in teaching styles can affect not only classroom interactions but also the broader educational environment.

Moreover, the implications of gender differences extend to academic achievement and student performance. Research by Stoet and Geary [8], indicates that gender disparities in subjects like mathematics and reading are inversely related to national gender equality indicators, suggesting that environments promoting gender equality can enhance educational outcomes for both genders [9]. Similarly, studies examining the performance of boys and girls in mathematics and science reveal that while girls may excel in verbal skills, boys often perform better in quantitative domains, highlighting the need for tailored educational strategies that address these differences [10].

However, the existing literature predominantly reflects studies from specific geographical regions, primarily North America and Western contexts. To provide a more holistic view of gender issues in education, it is essential to broaden the literature review to include studies from various geographical regions. For instance, research from diverse cultural contexts can illuminate how local norms and values shape gender dynamics in education. Studies such as those by Zhu [11], which explore gender differences in educational attainment across different regions, can contribute to a more comprehensive understanding of these issues.

Furthermore, incorporating global perspectives can highlight the universal nature of gender biases in education while also recognizing the unique challenges faced in different cultural settings. For example, research by Li and Yang [12] on gender equality in preschool education can provide

insights into how early educational environments influence gender perceptions across various cultures. By integrating these diverse studies, the literature can better address the complexities of gender differences among educators and students, ultimately fostering a more equitable educational landscape that supports the diverse needs of all learners.

In conclusion, while the existing literature provides valuable insights into gender differences in education, it is crucial to expand the scope of research to include a wider range of geographical perspectives. This approach will not only enhance our understanding of the global nature of gender issues in education but also inform more effective strategies for promoting equity in diverse educational contexts.

3. Research Question

1. What are the research trends in gender differences in education according to the year of publication?
2. Who and how much has been published in the area with regard to the authors?
3. Who is the top 10 authors based on citation by research?
4. What are the popular keywords related to the study?
5. What are co-authorship countries' collaboration?

4. Methodology

Bibliometrics is the merging, organizing, and analysis of bibliographic data from scientific publications [13-15]. It includes sophisticated methods like document co-citation analysis in addition to standard descriptive data like publishing journals, publication year, and major author classification [16]. To create a thorough bibliography and produce reliable results, a successful literature review requires an iterative process that includes selecting relevant keywords, doing a literature search, and conducting in-depth analysis [17]. Given this, the study aimed to concentrate on prestigious publications since they provide important insights into the theoretical stances influencing the development of the field of study. The study used the SCOPUS database to collect data in order to guarantee data dependability [18-20]. Interestingly, Elsevier's Scopus, which is renowned for its broad coverage, made it easier to gather papers from 2000 to December 2023 for further examination.

4.1 Data Search Strategy

Scopus' advanced search functionality is a strong tool that allows researchers to conduct targeted and exact searches, which are required for thorough bibliometric analysis. This advanced search engine improves the relevancy and quality of search results by allowing researchers to customize searches using advanced options such as field-specific codes, wildcards, and Boolean/proximity operators. The ability of using field-specific codes is very useful for focusing results on certain features of a publication, such as authorship, title, abstract, keywords, and source. This accuracy enables researchers to filter out unnecessary results, ensuring that their search queries target the most relevant material. Researchers might narrow their search to publications written by a certain researcher or published in specific journals or conferences, ensuring that the data retrieved is relevant to their study aims. Futhermore, one of the most useful aspects of Scopus for bibliometric study is its citation tracking capabilities. Scopus tracks citation patterns across a wide range of indexed journals, conference proceedings, books, and patents. Researchers may readily see which

articles have been most frequently cited, providing information about the effect and influence of certain studies. Citation analysis can also identify patterns in particular domains, such as new subjects, notable contributors, and influential research networks.

Table 1 displays a search string for the Scopus database, demonstrating various search keywords, operators, and filters are employed to get a highly concentrated search results. It increases the precision of search queries by combining keywords, Boolean operators, and field-specific codes.

Table 1
The search string

Scopus	(TITLE-ABS-KEY ("gender difference*" OR "gender gap*" OR "sex difference*" OR "gender inequality" OR "gender bias" OR "gender role*" OR "gender equity") AND ("teacher*" OR "educator*" OR "teaching" OR "instructor*" OR "school staff" OR "education professional*")) AND ("special education" OR "special needs") AND PUBYEAR > 1999 AND PUBYEAR < 2025 AND (LIMIT-TO (LANGUAGE , "English"))

Table 2 summarizes the inclusion and exclusion criteria used to select relevant studies. This phase is critical for ensuring that only the most relevant research is included in the bibliometric analysis, hence improving the quality and reliability of the generated data. It is important to set clear selection criteria to guarantee that only the most relevant and trustworthy sources are used. One such criterion concerns the language of the material. As the research is focused on English-language studies, only materials written in English are studied, ensuring a standardized interpretation and consistency in the content. Furthermore, the timeline constraint limits the scope to publications published between 2000 and 2024, emphasizing the importance of current and timely research. This time limit ensures that the material is relevant to current trends and advances, while older sources (published prior to 2000) are eliminated. The rationale for this is to eliminate outdated ideas and instead focus on current results, especially in sectors where knowledge and practices change frequently. Setting these inclusion and exclusion criteria keeps the research focused and ensures that the materials chosen are both current and accessible to the intended audience.

Table 2
The selection criterion is searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time line	2000 – 2024	< 2000

4.2 Data Analysis

VOSviewer, a widely-used bibliometric software developed by Nees Jan van Eck and Ludo Waltman at Leiden University in the Netherlands [21,22], is known for its user-friendly interface and powerful capabilities in visualizing and analyzing scientific literature. The tool excels in creating network visualizations, clustering related items, and generating density maps, allowing researchers to examine co-authorship, co-citation, and keyword co-occurrence networks comprehensively. With its interactive design and regular updates, VOSviewer supports efficient exploration of large datasets, offering customized visualizations and compatibility with various bibliometric data sources. Its ability to compute metrics and its adaptability make it an invaluable resource for scholars aiming to gain insights into complex research domains.

The software's strength lies in its capacity to convert complex bibliometric datasets into visually intuitive maps and charts. Through network visualization, VOSviewer clusters related items, analyzes keyword co-occurrence, and generates density maps, making it accessible to both novice and experienced researchers. For this study, datasets from Scopus, covering publications from 2014 to December 2024 and containing publication year, title, author, journal, citation, and keywords in PlainText format, were analyzed using VOSviewer version 1.6.19. VOS clustering and mapping techniques facilitated the creation of maps, offering an alternative to Multidimensional Scaling (MDS) by situating items within low-dimensional spaces to reflect their similarity and relatedness accurately [23,24]. While MDS primarily calculates similarity metrics like cosine and Jaccard indices, VOSviewer uses association strength (ASij) as a more suitable method for normalizing co-occurrence frequencies [25] :

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

Fig. 1. Association Strength Index (AS)

which is "proportional to the ratio between on the one hand the observed number of cooccurrences 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"[23].

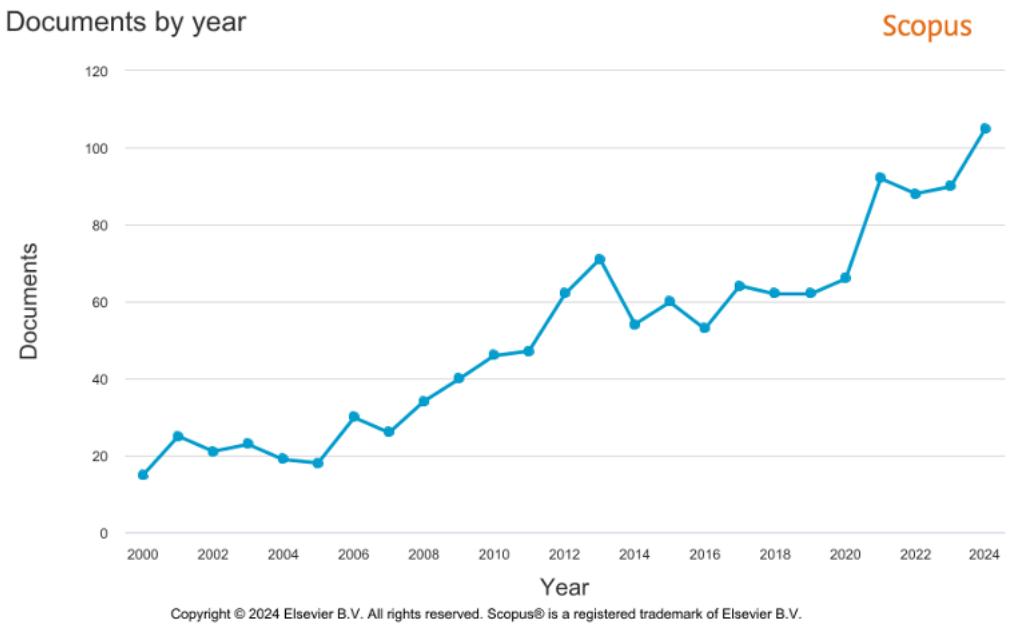

Fig. 2. Plotting document publication by years

According to the trend illustrated in the graph, the number of publications on gender inequalities among educators has increased dramatically between 2000 and 2024. The data show a steady but progressive increase in the early years (2000–2008), with annual publications averaging 20-40 documents. However, beginning in 2009, a clear rising trend is noted, with more pronounced rise between 2012 and 2014, reaching a peak of almost 80 publications. Despite modest fluctuations in some years (for example, slight falls after 2014), the overall trend is continuous upward,

demonstrating increased scholarly interest in this area. By 2024, the publishing count will have surpassed 100 documents, the greatest point in the previous 24 years.

This rise reflects the increasing recognition of gender issues in education and their consequences for teaching practices and policies. The high surge since 2012 may indicate global movements toward tackling gender inequity and diversity in educational settings, which are likely driven by governmental reforms, research funding initiatives, and increased societal awareness. This increased trend emphasizes the topic's importance and indicates that scholars and stakeholders are increasingly prioritizing study on how gender dynamics influence educators' experiences and outcomes in a variety of instructional settings.

5.2 Who and how much has been published in the area with regard to the authors?

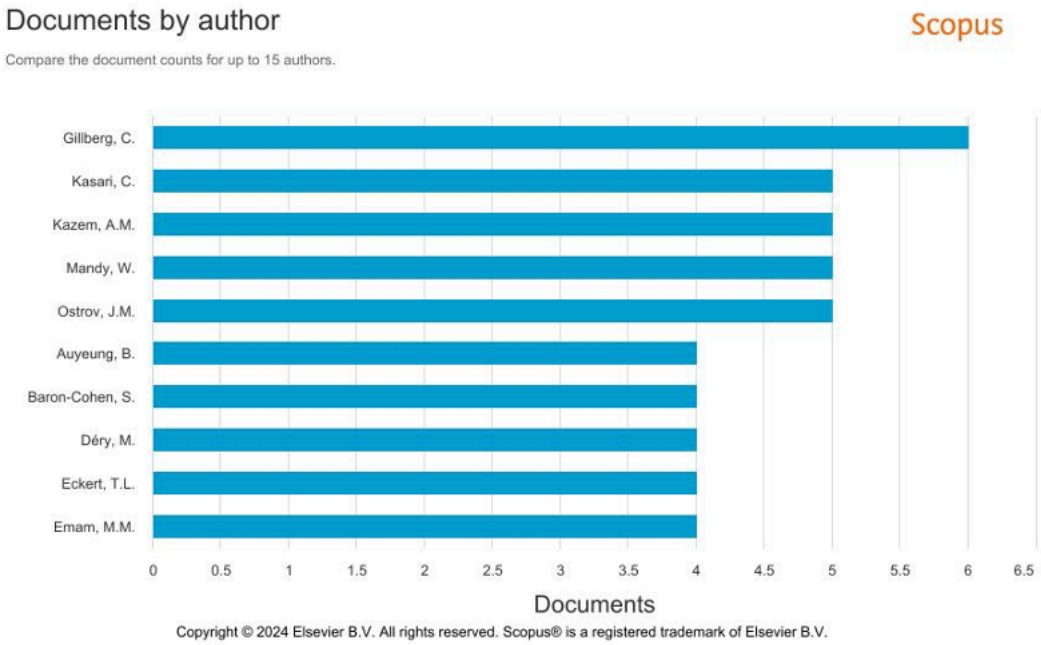

Fig. 3. Bar chart based on documents by author

The data on the top cited writers in growth mindset research highlights specific individuals who have made significant contributions to the subject. Carol S. Dweck leads with 12 publications that illustrate her groundbreaking efforts in inventing and popularizing the notion of growth mindset. Her findings serve as the foundation for many later studies in this field, particularly those investigating the impact of a growth mindset in educational settings. Lou, Tirri, and Yeager follow closely behind Dweck, each having 11 documents. These authors have most likely built on Dweck's basic theories, investigating a wide range of applications and situations, including implications for student motivation, academic resilience, and educational psychology. Their high citation count indicates that they are influential in furthering research on mindset interventions and their effects on both instructors and pupils.

The reasonably narrow range of publication counts among the authors indicates a collaborative and distributed authorship structure in this study area, with no single author dominating. This tendency shows an interdisciplinary and collaborative approach to addressing gender-related educational issues. The inclusion of multiple authors with varying degrees of productivity shows a variety of perspectives and research methodologies, which enriches the scholarly discussion on this

topic. These findings emphasize the significance of unique academics' contributions while also pointing to potential areas for future collaboration and in-depth investigation of gender inequalities among educators. Table 3 show top contributing authors by publication count.

Table 3
Top contributing authors by publication count

Author Name	Number Of Document	Percentage (%)
Gillberg, C.	6	0.471328
Kasari, C.	5	0.392773
Kazem, A.M.	5	0.392773
Mandy, W.	5	0.392773
Ostrov, J.M.	5	0.392773
Auyeung, B.	4	0.314218
Baron-Cohen, S.	4	0.314218
Déry, M.	4	0.314218
Eckert, T.L.	4	0.314218
Emam, M.M.	4	0.314218

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5.3 Who is the top 10 Authors based on Citation by Research?

Gender differences in educators have a significant effect on teaching practices, educational outcomes, and equity in learning environments, making it an important topic of scholarly research. The table lists the top ten most cited works on differences in gender among educators and other educational themes, demonstrating the importance and relevance of these research in the field. Hamre and Pianta [26] study on early teacher-child connections, published in Child Development, has received an outstanding 1,928 citations. This essential work stresses the long-term impact of teacher-student relationships on academic trajectories, revealing how gender and education intersect to shape student outcomes. Diamond *et al.,* [27] article in Science, with 1,425 citations, examines the cognitive effects of preschool programs. While not directly related to gender disparities among

educators, it emphasizes the importance of early childhood education, where gender dynamics can play a subtle but powerful impact in teacher-student interactions.The table also highlights key contributions to understanding gender gaps in schooling. Card *et al.* [28] conducted a meta-analytic review in Child Development (1,362 citations) that specifically examined gender variations in aggressiveness and its consequences for early development. Similarly, Skiba et al. [29] article in Urban Review (1,040 citations) examines racial and gender disparities in school discipline, highlighting structural biases in education. Both research provide strong evidence for the complex ways that gender and educator practices interact with larger socio-emotional and behavioral outcomes. Voyer and Voyer [30] meta-analysis in Psychological Bulletin (833 citations) adds another critical layer by looking at gender differences in scholastic achievement, providing a thorough understanding of how these dynamics manifest in classroom settings and are influenced by educators' gendered perceptions.

The remaining studies focus on a variety of themes with indirect but substantial connections to gender in education. Hong and Espelage [31] review on bullying (793 citations) and Archer and Coyne [32] work on aggression (730 citations) examine social dynamics in schools, where educators' responses frequently differ by gender. Lai *et al.,* [33] study on gender disparities in autism research (698 citations) and Wang and Degol [34] investigation of gendered motivational pathways in STEM occupations (559 citations) expand the discussion to include specialized educational disciplines. Collectively, these works show that, while gender inequalities among educators are not necessarily the primary emphasis, the topic overlaps with a wide range of crucial concerns, underscoring its diverse character and the importance of ongoing research through bibliometric analysis. Table 4 show the detail of primary data for top 10 highest citation.

Table 4

Detail the primary data for top 10 highest citation

Authors	Title	Year	Journal	Cited by
Hamre B.K.; Pianta R.C. [26]	Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade	2001	Child Development	1928
Diamond A.; Barnett W.S.; Thomas J.; Munro S.[27]	The early years: Preschool program improves cognitive control	2007	Science	1425
Card N.A.; Stucky B.D.; Sawalani G.M.; Little T.D. [28]	Direct and indirect aggression during childhood and adolescence: A meta-analytic review of gender differences, intercorrelations, and relations to maladjustment	2008	Child Development	1362
Skiba R.J.; Michael R.S.; Nardo A.C.; Peterson R.L. [29]	The color of discipline: Sources of racial and gender disproportionality in school punishment	2002	Urban Review	1040
Voyer D.; Voyer Susan D. S. [30]	Gender differences in scholastic achievement: A meta-analysis	2014	Psychological Bulletin	833
Hong J.S.; Espelage D.L. [31]	A review of research on bullying and peer victimization in school: An ecological system analysis	2012	Aggression and Violent Behavior	793
Archer J.; Coyne S.M. [32]	An integrated review of indirect, relational, and social aggression	2005	Personality and Social Psychology Review	730
Lai M.-C.; Lombardo M.V.; Auyeung B.; Chakrabarti B.; Baron-Cohen S. [33]	Sex/Gender Differences and Autism: Setting the Scene for Future Research	2015	Journal of the American Academy of Child and Adolescent Psychiatry	698
Rutter M.; Sroufe L.A. [35]	Developmental psychopathology: Concepts and challenges	2000	Development and Psychopathology	651
Wang M.-T.; Degol J. [34]	Motivational pathways to STEM career choices: Using expectancy-value perspective to understand individual and gender differences in STEM fields	2013	Developmental Review	559

5.4 What are the Popular Keywords Related to the Study?

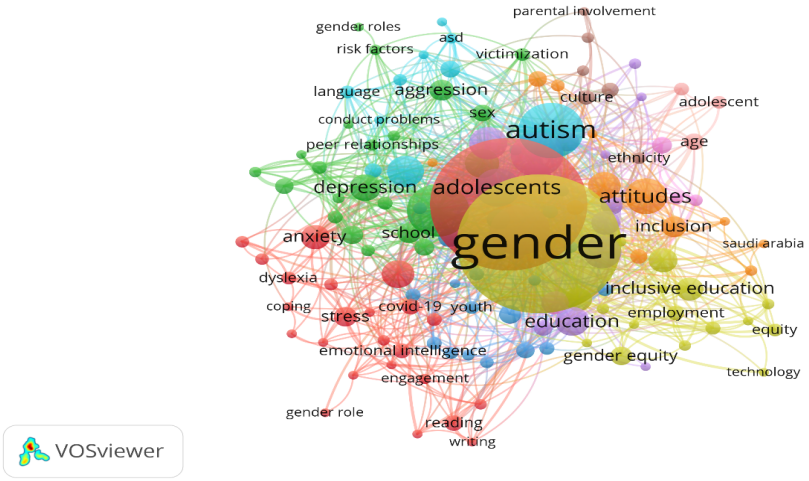

Fig. 4. Network visualization map of keywords' co-occurrence

The figure provides a comprehensive overview of the popular keywords associated with research on gender differences among educators, reflecting the breadth and diversity of this research field. The keyword "gender" appears as the most frequently used term, with 141 occurrences and a total link strength of 195, underscoring its centrality to the research. Closely related terms such as "gender differences" (133 occurrences) and "sex differences" (43 occurrences) highlight the predominant focus on understanding and analyzing variations between genders in educational contexts. Other high-frequency keywords, such as "children" (41 occurrences) and "autism" (46 occurrences), suggest a strong interest in how gender differences intersect with specific populations and conditions, particularly in areas like special education and developmental disorders. Keywords like "inclusive education" (16 occurrences) and "disability" (17 occurrences) further emphasize a growing focus on equity and diversity within the field.

In addition to these prominent themes, the table indicates additional key areas of investigation, such as mental health ("anxiety" - 17 occurrences, "depression" - 19 occurrences) and behavioral concerns ("aggression" - 14 occurrences, "inclusion" - 14 occurrences). These phrases indicate an interdisciplinary approach to understanding gender dynamics in education, which incorporates ideas from psychology, sociology, and pedagogy. The use of phrases such as "academic achievement" (13 instances) and "education" (21 occurrences) demonstrates a persistent emphasis on gender-related academic results. Furthermore, phrases such as "teachers" (16 occurrences) and "job satisfaction" (5 occurrences) indicate that gender-related issues are being investigated not only in pupils, but also in educators' professional experiences and workplace dynamics. Collectively, the findings reflect a broad and interrelated research landscape that is highly committed to understanding the multifaceted impact of gender in educational contexts.

5.5 What are Co-Authorship Countries' Collaboration?

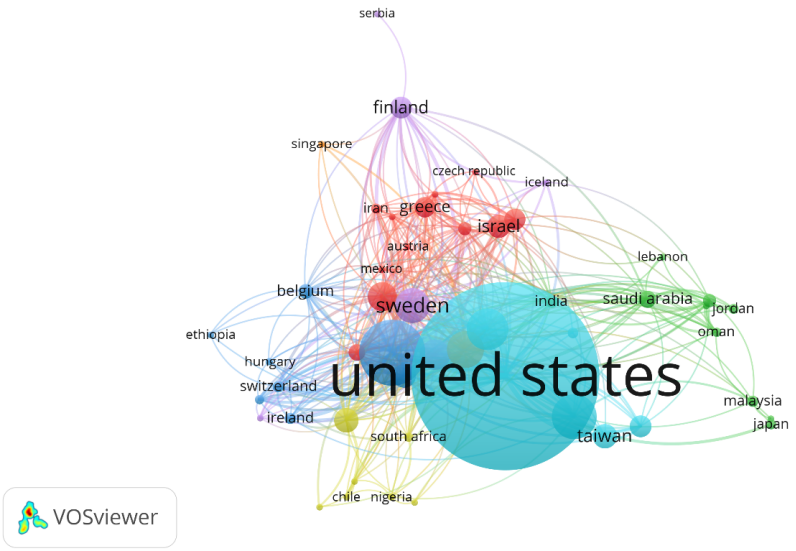

Fig. 5. Co-authorship countries' collaboration in gender diffrences among educators

The co-authorship study with Vosviewer software reveals global collaboration trends in research on gender diffrences among educators. The United States is substantially ahead, with 459 documents and 29,197 citations, as well as the greatest total link strength of 149, demonstrating its important involvement in the worldwide research network. The United Kingdom is second with 128 documents, 9,110 citations, and a total link strength of 119, demonstrating its high academic contribution and collaborative ties. Countries such as Germany (47 papers, 1,440 citations, 81 link strength) and Australia (64 documents, 3,001 citations, 80 link strength) are also active participants, demonstrating their emphasis on gender and education research. These strong overall connection strengths imply active collaborations and regular partnerships between these countries, which contribute to the knowledge pool and encourage multidisciplinary study.

Several smaller but significant contributors include Canada (73 documents, 6,524 citations, 70 link strength) and Sweden (60 documents, 1,883 citations, 73 link strength), demonstrating their expanding importance in the subject. Interestingly, countries such as China (81 documents, 1,070 citations, 41 link strength) and India (16 documents, 482 citations, 35 link strength) demonstrate emerging research interest but lower connection strengths, implying less international collaborations than Western equivalents. Countries such as the Netherlands (37 documents, 1,649 citations, 52 link strength) and Italy (24 documents, 1,098 citations, 45 link strength) also play important roles, consistently contributing to the conversation while maintaining moderate collaboration networks. The data also highlights the participation of a wide range of smaller countries, including Saudi Arabia (25 papers, 389 citations, 38 link strength), Finland (34 documents, 900 citations, 43 link strength), and Belgium (21 documents, 785 citations, 38 link strength). These countries may have lower research outputs, but they exhibit substantial collaborative strength inside their networks. Countries with low citations and link strengths, such as Ethiopia (6 documents, 9 citations, 5 link strength) and Indonesia (7 documents, 31 citations, 3 link strength), offer potential for growth through increasing international collaboration. Overall, the report emphasizes Western nations' dominance in this subject while emphasizing the opportunity for emerging regions to strengthen their collaboration networks and contributions to the research landscape.

6. Conclusion

The findings of this bibliometric examination of research on gender differences in education highlight significant trends and patterns that reflect the evolving landscape of educational research. The consistent increase in publications from 2000 to 2024 underscores a growing recognition of the critical role that gender plays in educational settings. This upward trajectory is likely influenced by a global emphasis on diversity and equity in education, as well as heightened awareness among both the public and institutional stakeholders regarding the implications of gender disparities. The analysis reveals a substantial corpus of research focusing on interconnected themes such as teaching styles, evaluation biases, and gender-specific academic outcomes. The prominence of keywords related to interdisciplinary themes, including mental health, inclusiveness, and special education, indicates a broader understanding of gender dynamics across various educational contexts. This interdisciplinary approach is essential for addressing the complexities of gender differences and their implications for educational practice and policy.

Utilizing VOSviewer software provided a nuanced representation of the dataset, illustrating co-authorship networks, keyword co-occurrence, and international collaborations. The visual maps generated from this analysis reveal strong connections among Western countries, highlighting their active engagement in international research collaborations. The frequent occurrence of phrases such as "gender differences," "education," and "inclusion" points to the intersections of research across disciplines such as psychology, sociology, and pedagogy. While these findings indicate a well-connected research community in dominant regions, they also underscore the need for enhanced international collaboration, particularly with countries that are less represented in the current literature.

However, this study is not without its limitations. The focus on publications primarily from Western contexts may overlook valuable insights and perspectives from underrepresented regions. Additionally, the reliance on bibliometric data may not capture the full spectrum of qualitative research that explores the lived experiences of individuals affected by gender disparities in education. Future research should aim to address these gaps by incorporating studies from diverse geographical locations and exploring qualitative dimensions of gender dynamics in educational settings. Moreover, there is a pressing need for more comprehensive investigations into the specific challenges faced by marginalized groups within the gender spectrum, as well as those from various cultural and socioeconomic backgrounds. The impact of race, religion, and socio-economic status on gender issues in education is particularly critical, as these intersecting identities can significantly influence educational experiences and outcomes. Expanding research networks to include these perspectives will contribute to a more inclusive and holistic understanding of gender dynamics in education.

In conclusion, this study emphasizes the importance of fostering global connections and encourages further exploration of underrepresented regions to enrich the research landscape on gender differences in education. By broadening the scope of inquiry to include the impact of race, religion, and socio-economic status, alongside enhancing international collaborations, researchers can develop a more nuanced understanding of the multifaceted nature of gender dynamics. Ultimately, this will lead to more equitable educational practices and policies that address the diverse needs of all learners.

Acknowledgement
This research was not funded by any grant.

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