

# ***Global Trends in Peer Effects Research: A Bibliometric Analysis Based on the Web of Science Database from 1992 to 2022***

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**Abstract:** While Peer Effects in the education field have been extensively studied worldwide, the development of research topics in this area remains insufficient and unclear. This study employs bibliometric analysis to explore research trends regarding Peer Effects. Publications output data were gathered from research articles in the Web of Science database from 1992 to 2022. Using VOS viewer, this study aims to answer questions related to the number of Peer Effects publications, countries, and regions engaged in research, highly cited scholars and works, as well as hot topics and development trends. This study suggests that Peer Effects research has gone through three stages of development over the past 30 years, with the United States dominating the field discourse. The study also identifies the core academic research group of the Peer Effects research field, and highlights the need to focus on sub-classroom levels. These findings have policy implications, as adjusting peer composition at different levels can improve resource allocation in education.

**Keywords:** Peer Effects, bibliometrics, Web of Science, VOS viewer

## **1. Introduction**

Since Coleman et al. introduced the concept of Peer Effects, it has been widely regarded as a beneficial factor in the field of education [1]. Parents compete to enroll their children in academically superior institutions, and ambitious students strive for admission to exclusive schools, believing that the presence of high-performing peers will lead to greater academic achievement. However, despite this long-standing research, there is no consensus on the viewpoints and research levels of this phenomenon. On the contrary, it is a controversial topic in the field of education [2]. Therefore, understanding Peer Effects has become crucial in estimating the effectiveness of various peer redistribution policies to improve educational outcomes.

“Journal articles are a barometer of research trends” [3]. Research results published in journals indexed in the Web of Science represent a world-class standard of basic social science research. Analyzing and studying the core English literature collected in the Web of Science can reveal the trajectory, characteristics, and laws of the Peer Effects theory and disciplinary development, enabling education scholars to better grasp the latest research dynamics and development trends in this field. However, previous literature reviews on Peer Effects have largely been based on qualitative analysis, which is relatively subjective and does not provide comprehensive coverage of the literature. This

highlights the need for a bibliometric analysis of the current state, which will contribute to a deeper understanding of this important topic.

To provide a clearer picture of the academic trends in Peer Effects research over the past 30 years, the author selected core English literature collected in the Web of Science Core Collection from 1998 to 2022 as the research sample. Using the VOS viewer software and bibliometric methods, the author proposed future directions for Peer Effects research based on the co-occurrence analysis. This study aims to answer the following questions: 1) What are the trends in the number of publications? 2) Which countries and regions are mainly engaged in Peer Effects research? 3) What are the highly cited international scholars and representative works? 4) What are the hot topics and development trends of international Peer Effects research? This research objectively reveals the basic development trends of Peer Effects in the field of education from both a quantitative and qualitative perspective. It aims to provide a reference for educational research and the formulation of peer redistribution policies.

## **2. Research Methodology**

### **2.1. Data Collection**

Research on Peer Effects is interdisciplinary and involves both humanities and social sciences. This study searched for papers in the English language in the Web of Science core collection databases, including the Social Science Citation Index (SSCI), Science Citation Index Expanded (SCIE), and Arts & Humanities Citation Index (A&HCI), with topics containing “peer effect” or “peer influence” or “peer contagion” and the articles had to belong to the education category. The literature screening time was from January 1, 1992 to December 31, 2022, resulting in 46,678 relevant articles. The actual time span of the literature obtained was from January 1, 1998 to December 31, 2022, and no literature that met the search criteria was found from January 1, 1992 to December 31, 1997. This study extracted information such as the countries/regions, authors, publication years, affiliations, keywords, and citation frequency of each paper to analyze research hotspots and development trends.

### **2.2. Data Screening**

This study conducted data screening of literature based on the “Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)” methodology [4], following the four steps of “Identification-Screening-Eligibility-Included”. A total of 140 types of literature, including proceeding paper, editorial material, correction, reprint, retracted publication, early access, and 3 unrelated to the topic, were excluded. Finally, 3199 articles and reviews related to the topic were obtained.

### **2.3. Data Processing**

Bibliometrics constitutes a quantitative approach to analyzing publication data, which rests on the systematic collection, processing, and interpretation of bibliographic information contained in academic literature [5]. By gathering data from the Web of Science database, bibliometrics can track the publication output of scholars, institutions, and countries and identify influential works and authors. One of the primary strengths of bibliometrics lies in its objectivity, which enables researchers to measure and assess research quality and impact based on empirical data. Furthermore, bibliometrics can be used to identify research gaps, emerging areas of scholarly inquiry, and fruitful avenues for future research [6].

In this study, bibliometrics was utilized as the primary method of analysis, with the aim of examining the peer effect research in educational studies. Specifically, this paper drew upon the Web of Science database to collect publication and citation data, which analyzed using the VOS viewer

software to create visualizations of the results. The author aimed to provide a comprehensive and nuanced understanding of the research trends, patterns, and impact in peer effect studies.

### 3. Results and Discussion

Since World War II, numerous countries have undergone a de-tracking trend. The common belief is that the act of tracking or streaming in education creates a balance between fairness and quality learning. The integration of diverse students in classrooms can guarantee that all learners receive comparable education, decreasing differentiation. Separating students based on their abilities can also enhance the education system's efficiency, as each student can be taught according to their aptitude [7]. However, this view is oversimplified, and it is vital to develop a more nuanced understanding.

Through the utilization of an advanced search in the Web of Science database employing the set of criteria presented in Section 2, a total of 3119 English documents were gathered spanning the period of 1992-2022. This study provides a comprehensive and multi-dimensional review of the development and current trends of the Peer Effects research field in the past 30 years, from the perspectives of the distribution of literature over time, country, highly cited documents, institutions, and research hotspots.

#### 3.1. Distribution of Publications over the Years

Figure 1 illustrates the publication trend of research on Peer Effects from 1992 to 2022. The distribution of publications and citations over the studied period can provide researchers with an overview of the progress made within the field. Based on the time distribution of English literature, it can be seen that the study of Peer Effects has gone through three stages: stable development stage (1992-2006), fluctuating growth stage (2007-2018), and rapid growth stage (2019-2022).

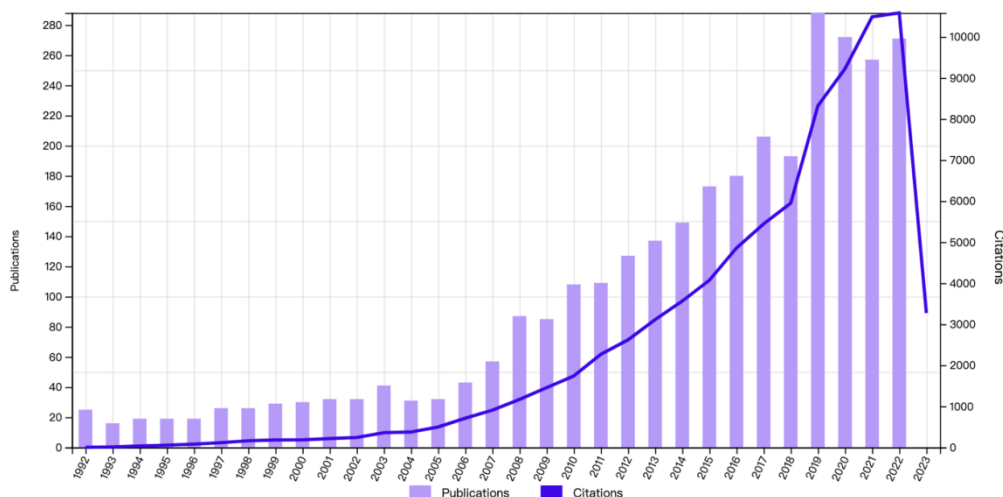


Figure 1: The annual publication on Peer Effects in the Web of Science.

Since Gamoran proposed that ability-based tracking could have positive externalities on other students or schools within the same system, and could motivate students to work harder at their studies in 1992 [8], education scholars began to focus on the influence of peer relationships on students' academic achievement and school performance. In particular, the number of publications rapidly increased to 288 in 2009, almost double that of 2014. This indicates that international attention to the research field of Peer Effects is continuously growing and has become a research hotspot.

### 3.2. Contributing Countries Analysis

The most contributing countries in the publication of English literature related to Peer Effects were achieved from the analysis of the Web of Science database. As exhibited in Figure 2, the United States has the highest number of publications with 1455 documents. Over the last few decades, the US has implemented various policies to redistribute resources among peers as a means of enhancing academic accomplishments at all education levels. These policies aim to support schools in delivering education tailored to individual aptitudes, as documented by Ansalone [9]. Historically, educational institutions worldwide have commonly followed the practice of separating students based on perceived academic performance or ability.

Following the US, China and England were the next highest contributing countries with significant differences in their publication outputs, producing 424 and 220 documents, respectively. A randomized experiment conducted in China revealed that grouping students with varying levels of academic performance did not impact the average performance of high-performing students. Conversely, their peer's average scores were improved by almost 20% standard deviation, as documented by Rozelle et al. [10]. Conversely, there were no significant differences in the publication outputs of the upcoming countries, including Australia (187 documents), Netherlands (144 documents), and Canada (143 documents), concerning their research on Peer Effects.

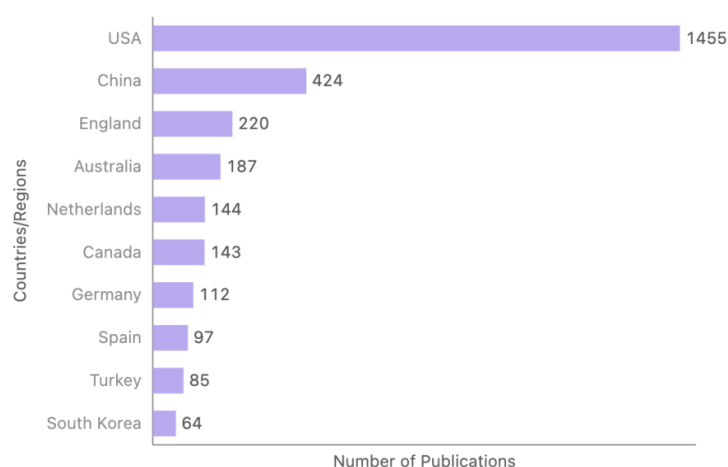


Figure 2: Contributions of countries worldwide in the production of documents on Peer Effects.

### 3.3. Citation Analysis

Citation analysis is taken as a valuable tool in identifying the most contributing documents within a research field. Highly cited papers are indicative of a substantial impact on a particular topic in comparison to lesser cited papers [11]. In the current study, a total of 3119 output publications were cited 82,259 times and 79,836 without self-citations, with an average of 26.37 citations per article. Statistically ranked by total citations, the top 10 most cited research articles in Peer Effects are shown in Table 1.

The article entitled “The Influence of Affective Teacher-Student Relationships on Students’ School Engagement and Achievement”, written by Roorda et al. from the Netherlands, is the most cited paper on Peer Effects with 1005 citations from 2011 to 2022 and an average of 77.3 citations per year. This meta-analytic study explores the relationship between the emotional aspects of teacher-student relationships and academic performance [12]. The second most cited article is “Diversity and higher education: Theory and impact on educational outcomes” by Gurin et al. from the USA, which addresses legal challenges to affirmative action and race-related factors in college admissions [13].

Rounding out the top three is “When smart groups fail” by Barron from Stanford University. This study examines how collaborative interactions influence problem-solving outcomes among 6th-grade triads [14]. These three seminal papers have played an innovative role in advancing and developing Peer Effects research, with far-reaching influence in the field of education.

Table 1: List of the most cited documents on Peer Effects obtained from Web of Science.

Rating	Title	First Author	Year	Citations(No.)
1	The Influence of Affective Teacher-Student Relationships on Students' School Engagement and Achievement: A Meta-Analytic Approach	Roorda, D.L.	2011	1005
2	Diversity and higher education: Theory and impact on educational outcomes	Gurin, P.	2002	910
3	When smart groups fail	Barron, B.	2003	714
4	Understanding participation in sport and physical activity among children and adults: a review of qualitative studies	Allender, S.	2006	665
5	The use of self-, peer and co-assessment in higher education: a review	Dochy, F.	1999	620
6	Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review	Broadbent, J.	2015	594
7	Academic Dishonesty - Honor Codes And Other Contextual Influences	Mccabe, D.L.	1993	511
8	Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK)	Angeli, C.	2009	507
9	Individual and contextual influences on academic dishonesty: A multicampus investigation	Mccabe, D.L.	1997	448
10	Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning	Cheung, Ronnie	2013	416

Utilizing the visualization tool VOS viewer, the author analyzed highly cited institutions in the field of Peer Effects. “Citation” was selected as the analysis type and “Organizations” were chosen as the analysis unit. The minimum publication number was set to 15, with a default minimum citation of 0. Of the 2162 institutions analyzed, 57 met the set criteria. Based on bibliometrics principles and citation relationships, citation networks can form various document clusters according to a specific co-citation frequency. The central cluster in the knowledge map represents the core academic group in the Peer Effects field, reflecting the strongest academic lineup and research strength in this research area.

According to the overlay visualization map presented by VOS viewer (Figure 3), the color depth represents the average publication year of the institution, with darker colors indicating earlier publication years. It is evident that certain American institutions were among the earliest research institutions in Peer Effects, while Chinese research affiliations entered this field relatively late. The

size of the nodes indicates the total link strength. Institutions with a bigger node have highlighted more cooperation with other institutions in Peer Effects research. Figure 3 indicates that institutions in Hong Kong and Taiwan exhibit a greater tendency to collaborate with a diverse range of institutes.

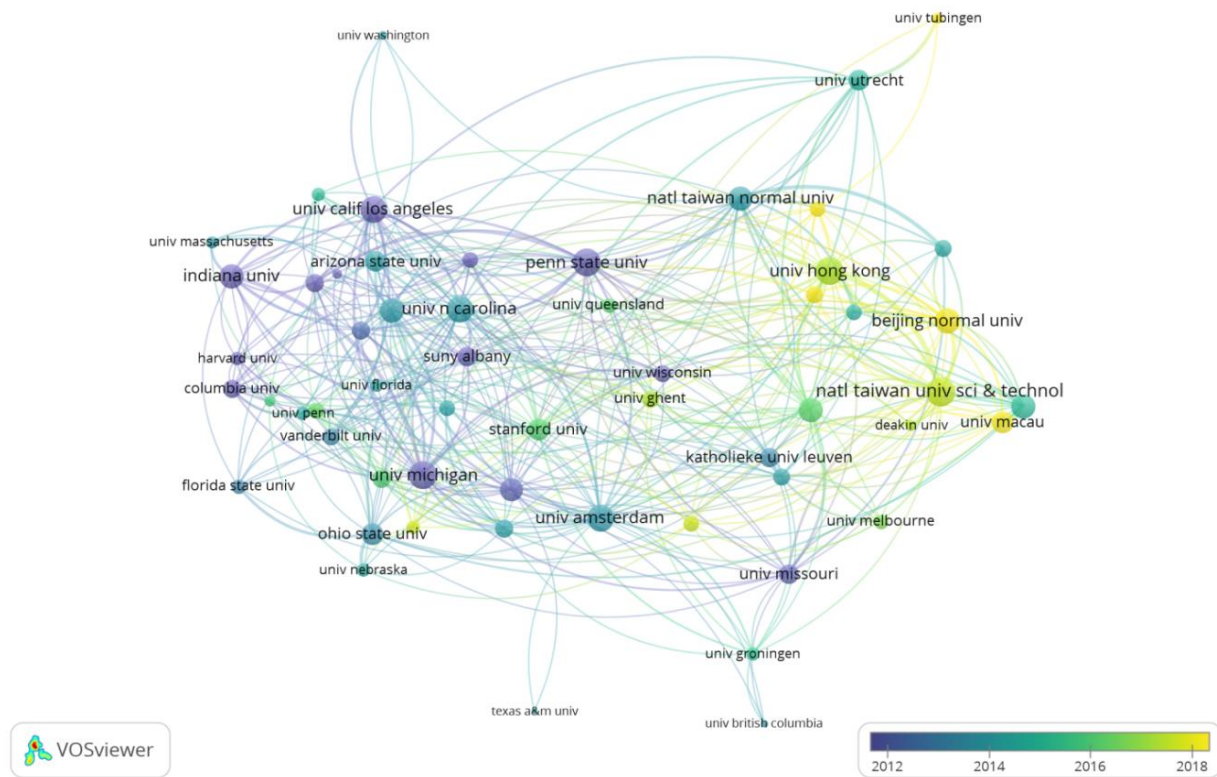


Figure 3: Citation relationship among author institutions.

According to the statistical data presented in Table 2, all of the top 10 cited research institutions, except for the University of Amsterdam in the Netherlands, University of Hong Kong, and National Taiwan University of Science and Technology in China, are American universities. This trend has contributed to the gradual formation of a core Peer Effects research group, with universities such as Pennsylvania State University, University of Michigan, and University of California, Los Angeles serving as the main pillars of this research area.

Table 2: List of the most cited institutions on Peer Effects obtained from Web of Science.

Rating	Institutions	Country	Citations (No.)	Publications (No.)	Total Link Strength
1	Pennsylvania State University	USA	2704	37	50
2	University Of Michigan	USA	2593	35	52
3	University Of Amsterdam	Netherlands	1622	21	48
4	University Of Hong Kong	China	1551	54.	52
5	University Of California Los Angeles	USA	1344	32	45



Table 2: (continued).

6	Stanford University	USA	1240	22	30
7	University Of North Carolina	USA	1171	52	45
8	National Taiwan University of Science and Technology	China	1124	32	53
9	Ohio State University	USA	1046	28	30
10	University Of Pittsburgh	USA	945	23	37

### 3.4. The Research Hotspots and Emerging Trends Based on Keywords Co-occurrence

In social science research publications, keywords play a critical role in understanding research patterns and focus directions, and can help identify research gaps. Keywords with high frequencies can indicate research hotspots [15]. Using VOS viewer, the co-occurrence of collected keywords appearing in documents was analyzed. The results of the keyword analysis show that the conceptual evolution of the research topic, represented by clusters comprising nodes of related keywords, is interconnected (as seen in Figure 4).

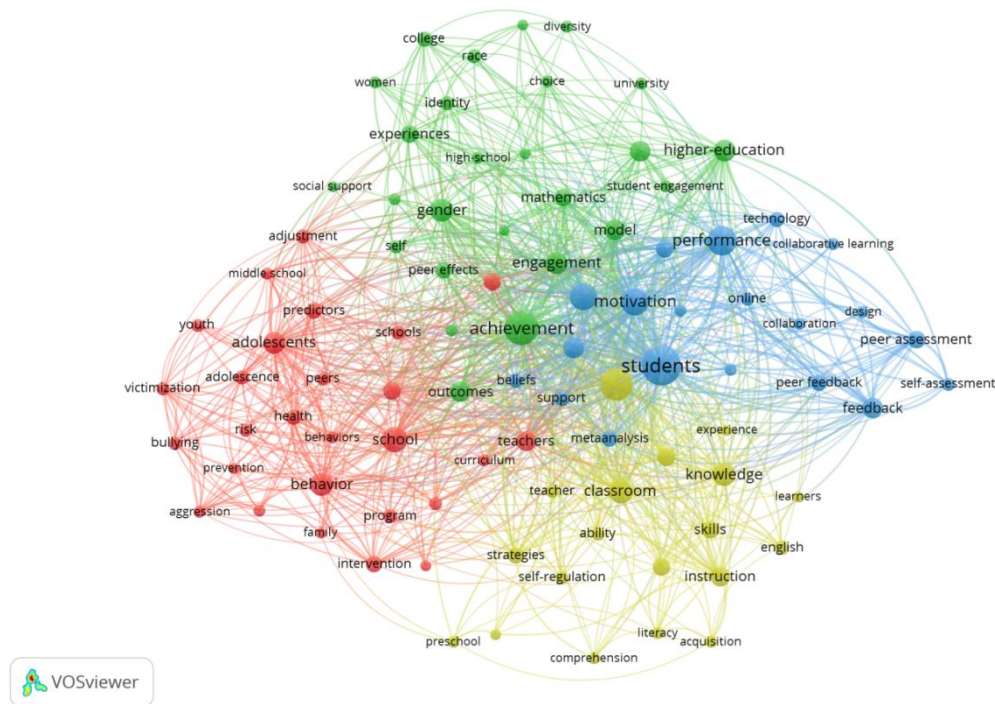


Figure 4: Co-occurring analysis of keywords appeared in documents published on Peer Effects.

Among 3119 analyzed articles, 9565 keywords were identified. The author set a minimum frequency of 40 occurrences for keywords, resulting in the selection of 92 keywords, and calculated the strength of their co-occurrence. Based on a co-occurrence analysis of keywords in international Peer Effects research (as shown in Table 1), this study identified four main research hotspots: school-level, dormitory-level, classroom-level, and group-level research.

Table 3 presents the co-occurrence of keywords, total link strength per cluster, and links. These keywords are frequently used to represent documents previously published on Peer Effects research. Co-occurrence of keywords is crucial in enhancing the visibility of articles in both current and past research issues. A thick connection line between two items indicates a close relationship, whereas a larger node size indicates the high frequency of occurrence of the items.

Table 3: Output of keywords co-occurring analysis.

Cluster	Count	Keyword	Contribution (%)
Cluster1 (Red)	27	school, teachers, program, adolescents...	29
Cluster2 (Green)	26	college, university, higher-education, dormitory...	28
Cluster3 (Yellow)	20	classroom, knowledge, pre-school, self-regulation...	22
Cluster4 (Blue)	19	perceptions, online, technology, collaboration, group...	21

Cluster 1 (in red) contains 27 keywords, accounting for 29% of the total keyword types. Notably, “school” had a total link strength of 601 with 87 links, while “teachers” had a total link strength of 375 with 76 links, and both were directly linked to each other. This direct connectivity suggests that one of the mechanisms underlying Peer Effects research focuses on the school level. Numerous studies have highlighted the impact of peer redistribution policies on students’ academic achievements in a school setting [16].

Cluster 2 (in green) contains 26 keywords, accounting for 28% of the total keyword types. The main keywords in Cluster 2 include “college” (52 links, 183 total link strength) and “university” (52 links, 146 total link strength). Peer redistribution policies in dormitory settings are commonly conducted among higher education or college students [17].

Cluster 3 (in yellow) contains 20 keywords, accounting for 22% of the total keyword types. In Cluster 3, “classroom” (83 links, 597 total link strength) is one of the popular keywords and has close connections with other clusters. Among the various channels of peer interactions, the impact of peer redistribution policy in the classroom setting on students’ academic performance has been the subject of debate. Scholars argue that peer redistribution policies, such as dividing students into high-performing, average, and below-average classes, could affect students’ academic achievements [18].

Cluster 4 (in blue) contains 19 keywords, accounting for 21% of the total keyword types. Another strand of channels underlying Peer Effects on educational reform is sub-classroom groups via online technology. In Cluster 4, “Perception” is one of the main keywords and has close connections with other keywords such as “online” and “technology” (occurrence=230, total link strength=822). In recent years, online educational games have gained popularity in the field of group instruction. However, little literature currently uses random assignment to study Peer Effects on sub-classroom groups. Therefore, future studies need to fill this gap by investigating peer redistribution policies conducted among sub-classroom groups [19].

#### 4. Conclusion

This study utilizes the Web of Science core database from 1992 to 2022 as the primary data source to examine Peer Effects research papers. Employing VOS viewer software, a bibliographic analysis was conducted to investigate the significant countries or regions, prominent scholars, their representative work, and research hotspots, as well as emerging trends in the Peer Effects field in education over the past 30 years. Both quantitative and qualitative perspectives were used to reveal the basic development of the Peer Effects research domain.

The research results show that: (a) Peer Effects research has gone through three stages over the past 30 years: stable development stage, fluctuating growth stage, and rapid growth stage; (b) the United States still dominates the discourse status of the Peer Effects research field with absolute advantages. However, in recent years, the international influence of countries and regions such as China, the United Kingdom, and Australia in the Peer Effects research field has gradually increased;



(c) high-cited authors represented by Dutch scholar Roorda, D. L., American scholar Gurin, P., and their important literature to a certain extent constitute the core academic research group and important knowledge foundation of the Peer Effects research field; (d) corresponding to a stage of multi-disciplinary and multi-perspective development, the research on Peer Effects has become a type of diverse discourse research across disciplines. Based on the co-occurrence analysis of keywords, it indicates that the existing studies are primarily focused on the school, dormitory, and classroom levels, and little attention has been paid to the Peer Effects within the sub-classroom level (seating assignment, gender composition, etc.). This suggests a number of implications for policy. Drawing on Peer Effects, the government can enhance the effectiveness of resource allocation in education by adjusting the composition of peers at different levels.

Due to the limited scope and quantity of the literature data included in the Web of Science core database, it is acknowledged that there may be some discrepancies and biases in the retrieval, processing, and statistical aspects of the literature data in this study. Its conclusions may not necessarily represent the overall current situation and progress of the core research papers on Peer Effects. Further verification may be needed through interviews with contemporary education scholars and experts. In addition, given that this study is limited to the contemporary English literature field based on the Web of Science, further analysis of the literature data in China's local Peer Effects research field can be conducted, and comparative analysis of contemporary Western and Eastern Peer Effects research and disciplinary development characteristics can be carried out. In the era of explosive knowledge today, these are educational issues that are worth further in-depth research and resolution.

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