Environment and Social Psychology (2025) Volume 10 Issue 2
doi: 10.59429/esp.v10i2.3325
ISSN: 2424-8975 (O)
2424-7979 (P)

RESEARCH ARTICLE

Parental belief, home literacy environment and children's English learning attitudes: A bibliometric analysis

Qingyun Li[1], Kimberley Kong[2], Huan Ding[3*], Yichen Shang[4], Miaoling Zhang[5], Qian Wang[6]

[1] *School of Educational Studies, Universiti Sains Malaysia, Penang, 50480, Malaysia, liqingyun1010jolly@student.usm.my*

[2] *School of Educational Studies, Universiti Sains Malaysia, Penang, 50480, Malaysia, kimberley.kong@usm.my*

[3] *College of International Education of Sichuan lnternational Studies University, Chong Qing, 400031, China, 13983603737@163.com*

[4] *College of Education, University of Massachusetts Amherst, 01003-0001, United States, yshang@umass.edu*

[5] *School of Physical Education, Fuyang Normal University, 236037, China, zhangmiaoling@student.usm.my*

[6] *Institutefor Advanced Studies, Universiti Malaya, Kuala Lumpur, 50603, Malaysia, wenheng20230107@163.com*

*** Corresponding author:** Huan Ding, 13983603737@163.com

ABSTRACT

Early English exposure has a big impact on children's language development and future learning, especially as English becomes more and more important as an international language. Children's attitudes (CA) and behaviors toward learning English can be influenced by their parents. This study aims to give a thorough examination of the relationship between CA about learning English, parental beliefs (PB), and the home literacy environment (HLE). In this study, the authors performed a bibliometric analysis from the Web of Science (WoS) database on PB, HLE, and CA towards learning English, covering from January 2000 to February 2024. Using VOSviewer and Citespace software for keyword clustering, timeline and burst analysis, the authors explored the interdisciplinary nature and collaborative characteristics of the research. A comprehensive search of the WoS databases yielded 1,102 studies, of which 109 met the inclusion criteria for analysis. The findings advance the understanding of key themes and hotspots in children's English learning development. The results highlight how important family learning contexts, PB, and literacy variety are in influencing CA toward learning English. These insights are invaluable for educators and parents working to support children's English language learning and foster positive educational attitudes.

Keywords: parental belief; home literacy environment; children's attitudes; English learning; bibliometric analysis

1. Introduction

With the growing the importance of English as an international language [1-3], early exposure to English significantly impacts children's language development and future learning[4]. The family environment, particularly parental beliefs (PB) and the literacy atmosphere, plays a crucial role in this process[5,6]. PB can shape their children's attitudes (CA) and behaviors towards English learning, while the home literacy

ARTICLE INFO
Received: 24 December 2024 | Accepted: 03 January 2025 | Available online: 23 February 2025

CITATION
Li QY, Kong K, Ding H.et al. Parental belief, home literacy environment and children's English learning attitudes: A bibliometric analysis. *Environment and Social Psychology* 2025; 10(2): 3325. doi:10.59429/esp.v10i2.3325

environment (HLE) provides abundant resources for English acquisition[7,8]. This study investigates the intersection between PB, HLE, and CA towards learning English, utilizing bibliometric tools to provide a comprehensive analysis.

To elucidate the hotspots and key themes in this field, we performed keyword clustering, timeline, and burst analyses were performed using VOSviewer and Citespace software. These analyses identified PB, the HLE, and CA towards learning English as primary research topics. Researchers mainly focus on parental attitudes and behaviors towards children's English learning, as well as the influence of the HLE on young learners' English acquisition[9,10]. Some studies also explore the relationship between PB and the HLE, as well as their mutual interaction in children's English learning[11-13]. However, previous studies have largely overlooked the complementarity of different modern bibliometric tools, such as performance analysis and science mapping[14].

This study aims to complement previous work by providing a comprehensive quantitative and qualitative analysis of children's English as a Foreign Language (EFL) research. We focus on organizational aspects using primary bibliometric procedures, including performance analysis and science mapping[15]. To achieve this,we obtained abroad set of references from the Web of Science (WoS), and applied bibliometric procedures to various units of analysis, including authors, journals, universities, and countries. The performance analysis utilized basic bibliometric indicators such as the number of publications and citations received. These analyses were complemented by the development of a science mapping analysis, constructed using different techniques such as bibliographic coupling, co-citation analysis and co-occurrence of keywords analysis[14]. The co-occurrence of keywords allowed us to quantify and visualize the thematic evolution of the children's EFL field within a longitudinal framework, aligning with its different stages of development. By implementing these bibliometric procedures, we provide a comprehensive overview of research focusing on PB, HLE, and CA towards English learning.

This work is organized as follows. Section 2 describes the methodology and data resources. Section 3 presents the results, including bibliometric analyses of annual publication output and trends, national cooperation relations, author collaboration, institutional analysis, journal analysis, and discipline analysis. Section 4 discusses research hotspots and trend evolution. Finally, Section 5 outlines the main conclusions of this work.

2. Method

2.1. Data collection and search strategies

We selected the Web of Science (WoS) Core Collection for its comprehensive coverage of peer-reviewed journals. Managed by Clarivate Analytics, WoS is a primary tool for searching and evaluating various types of publications and journals[16]. It provides essential metadata for analysis, including abstracts, references, number of citations, lists of authors, institutions, countries, and journal impact factors[17]. WoS contains more than 15,000 journals and 50,000,000 classified documents across 251 categories and 150 thematic research areas.

We used the WoS Core Collection as our literature source, combining performance analysis and science mapping[18]. Techniques such as word frequency analysis, citation analysis, and publication counts by country, university, research group, or author were employed[16]. The search term "Topic" was used to search the database[19], covering the period from 2000 to 2024. The final search term was: TS = (parental belief OR home literacy environment) AND (parental belief OR children English learning attitude) AND (home literacy environment OR children English learning attitude). Data collection on May 8, 2024, yielded 1102

studies, with 109 articles meeting the criteria of being in English and classified as "Article" or "Review." No ethical approval or informed consent was required as data were from public databases. **Table 1** presents the search strategy.

Table 1. Data Source and retrieval strategy process.

Content	Web of Science Core Collection
Publication date	2000.1.1-2024.5.8
Languages	English AND Chinese
Document type	Article AND Review
Search strategy	TS = (parents belief OR home literacy environment) AND (parents belief OR children English learning attitude) AND (home literacy environment OR children English learning attitude)

2.2. Article inclusion criteria

The authors evaluated the quality of retrieved literature by scrutinizing the title and abstract of each article. Full texts were downloaded if they met the inclusion criteria of being published in peer-reviewed journals or conference proceedings. Articles that did not meet these criteria or only mentioned the topic's significance without further analysis were excluded. The process adhered to the PRISMA statement[20,21], with all co-authors reaching a consensus on contentious studies.

The present systematic review is guided by PRISMA (2020) framework. Based on the PRISMA framework the process of article selection was developed. It included four major steps – identification, screening, eligibility, and inclusion. In identification step, keywords were generated that were relevant to this bibliometric analysis and would potentially generate maximum articles within the scope of this study. The keywords used for article retrieval arepresented in **Table 1**.

The subsequent step involved a thorough screening process. The authors selected peer-reviewed journal articles published in English, covering the period from 2000 to 2024. This stringent criterion aimed to guarantee a collection of high-calibre literature. The focus was on empirical research and literature review. This selection procedure was enacted through the application of two distinct classification criteria: the inclusion and exclusion criteria. To enhance clarity, these terms were augmented with detailed definitions and specifications, as elucidated in **Table 2**.

Table 2. Inclusion and exclusion criteria.

Inclusion Criteria	Exclusion Criteria
Studies published between 2000-2024	Studies published before 2000
Empirical studies and literature review	Concept papers, editorials, or grey literature
Studies focusing on preschoolers (4–6-year-old)	Studies focusing on any age above or below preschoolers (4-6 years old)
Studies focusing on English language learning	Studies focusing on learning languages other than English
Text available in English and/or Chinese language	Text available in languages other than English and/or Chinese

Following the inclusion and exclusion criteria, two coders conducted the screening. At first, all the duplicates were removed from the total retrieved articles. 116 were found to be duplicated and 207 articles remained for further screening. Then articles that were published before 2000 were removed. Further, 186 articles were removed during the first screening where only abstracts were analyzed.

During the third step of eligibility check, 307 articles were removed after full-text analysis. The articles were then screened to match the suitability to the inclusion and exclusion criteria. When the two codes did not reach on consensus for including/excluding any articles, the third codes was invited to review and decide.

This helped to avoid bias and maintain the rigorous nature of the bibliometric analysis. Finally, 109 articles of parental beliefs, home literacy environment, and children's attitudes towards learning English, published between 2000-2024 were selected for this bibliometric analysis. **Figure 1** illustrates this process based on PRISMA.

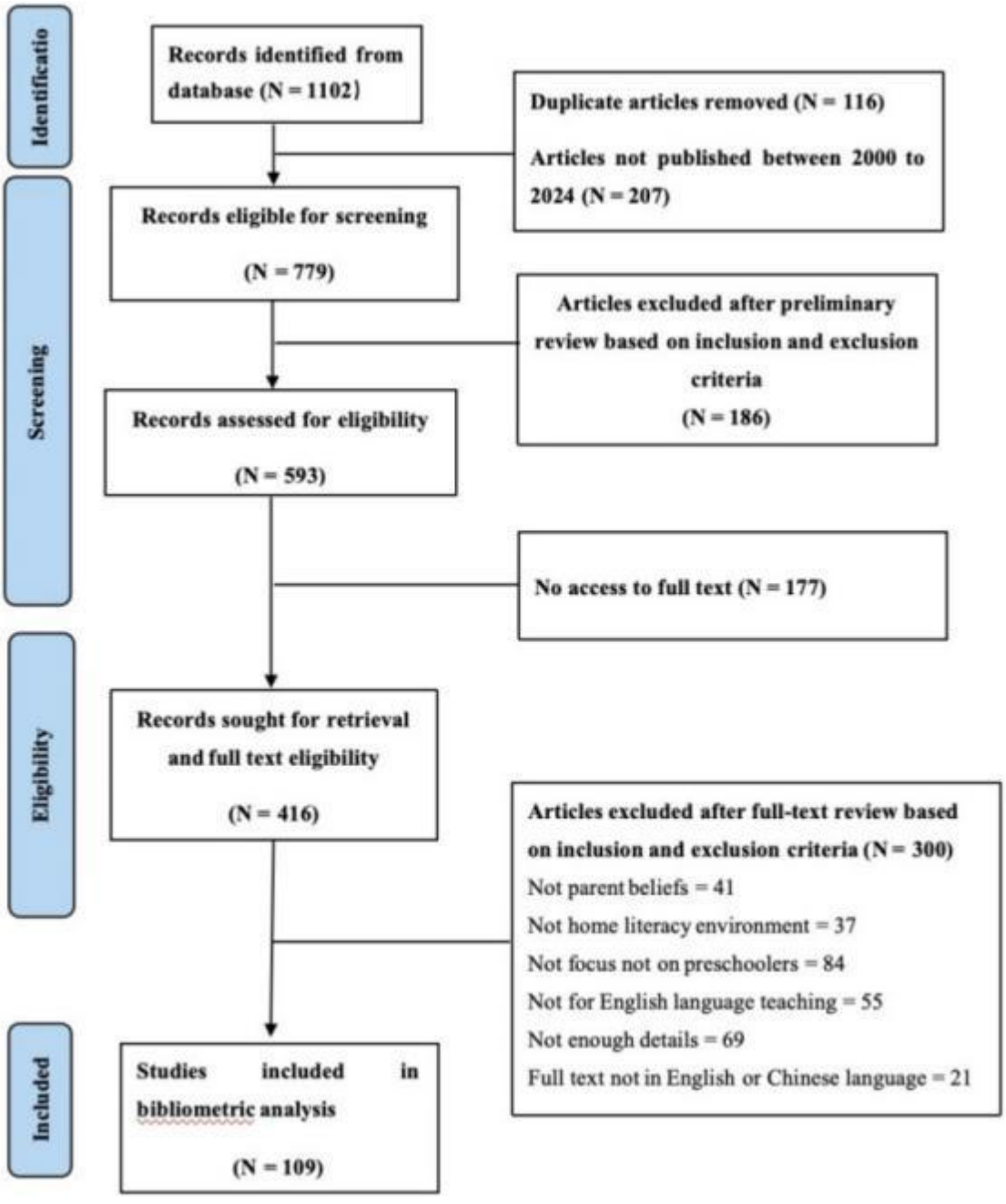

Figure 1. Article selection process based on PRISMA.

2.3. Software parameters

VOSviewer and CiteSpace were used for the analysis. VOSviewer automatically identifies collaborative relationships, enabling co-authorship and co-occurrence analysis. CiteSpace is comprehensive for keyword clustering and temporal evolution analysis. VOSviewer 1.6.18 software was selected, and both Chinese and English literature data were batch imported. Parameters were adjusted for optimal display effects. In the

Method function area, Association Strength was used, with adjustments in the Clustering function area for Resolution and Min. cluster size set to 1.00 and 1,respectively.

For CiteSpace 6.2R7, "All references and citations" were selected. Data from the WoS were exported as "plaintext" files and imported. Annual time slices, and the cosine algorithm for network strength calculation were used, extracting the top 10% of nodes in each time slice[22]. Node types were selected, and the keyword threshold (Top N) was set to 50, with node extraction threshold using the g-index (k=25), while other parameters remained at default values[23]. Keyword clustering used the Latent Semantic Indexing (LSI) algorithm to identify top-ranking terms as cluster labels[24]. **Figure 2** illustrates this process based on VOSviewer and CiteSpace.

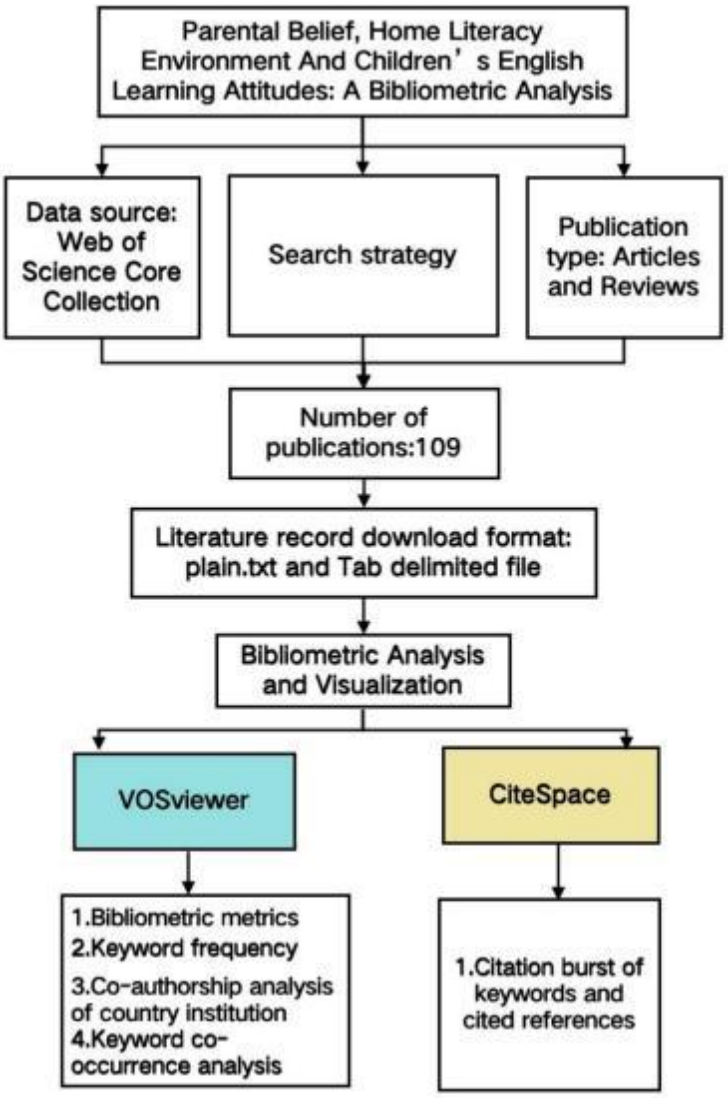

Figure 2. Article selection based on VOSviewer and CiteSpace.

3. Bibliometric analysis

3.1. Annual publication output and trends

As depicted in **Figure 3**, the provided literature data reveals discernible trends and variations in annual publication output and citation frequency. Although the search began in 2000, no documents were available until 2009. From 2009 to 2012, both publication volume and citation frequency were relatively low,

indicating insufficient attention and recognition in the field. However, starting from 2013, the number of publications gradually increased, accompanied by a rise in citation frequency, suggesting a growing interest and recognition, possibly due to increased research funding and academic focus. A notable growth trend in both metrics is observed from 2015 onwards, with significant increases in 2017 and 2018, reflecting rapid development and widespread attention in the field.

Data from 2019 and 2020 indicate a continued growth, with 12 publications and 178 citations in 2020. In 2021 and 2022, publication output reached 17 and 18 respectively, with citation frequencies of 247 and 329, illustrating vigorous development and significant research outcomes. In 2023, publication output increased to 19, although citation frequency slightly decreased to 338, possibly due to intensified competition. Data from 2024 show a significant decrease in publication output to 2, while citation frequency remains relatively high at 76. This decrease may be attributed to the partial availability of data for the year, requiring further observation and analysis.

Overall, the analysis provided a rapid growth trend in research output and recognition in this field over recent years[25,26]. The increase in publication output and citation frequency reflects the active research and impact of scientific achievements in this field. However, future trends require further observation and research, especially considering the intensifying competition.

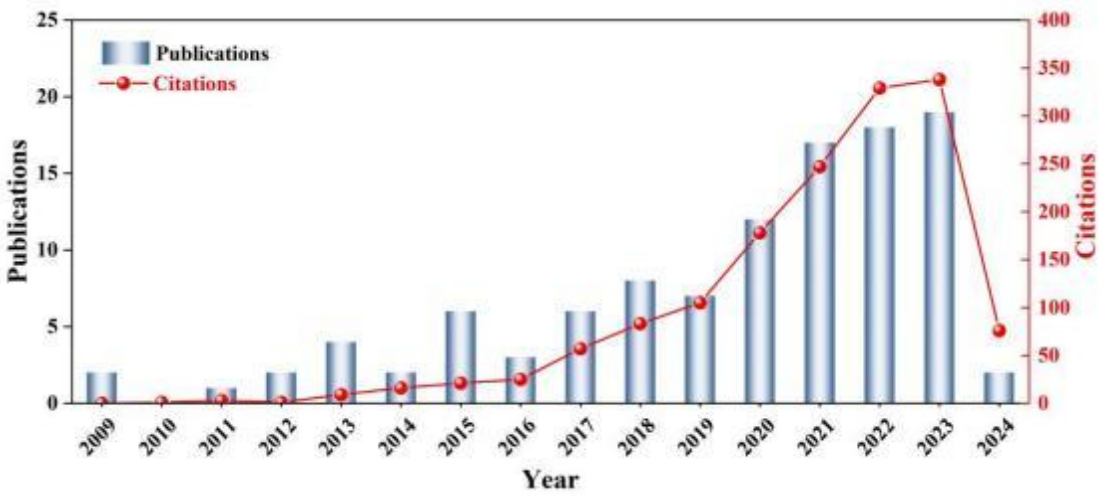

Figure 3. Number of publications and citation trends.

3.2. Analysis of national cooperation relations

As illustrated in **Figure 4**, the United States ranks first publication output with 55 publications, followed by China with 16 and Canada with 9. This indicates that the United States has the most active research output in this field, demonstrating high research capabilities and influence. China's significance in the research domain is gradually increasing, and Canada has made notable contributions as well.

In terms of citation frequency, the United States leads with 1061 citations, followed by Germany with 117 and China with 97. This reflects the high academic influence of U.S. research, with Germany and China, also showing substantial academic contributions.

Regarding link strength, the United States ranks first with a score of 14, followed by China and Canada, both with scores of 8. This suggests strong research collaboration and exchange, particularly for the United States. China and Canada also demonstrate significant influence in international research collaboration.

Overall, the United States stands out in publication output, citation frequency, and link strength, highlighting its prominent research contributions and importance in the field. China, as an emerging research country, exhibits increasing publication output and citation frequency, showcasing its potential and development. Other countries, such as Germany, Canada, the United Kingdom, and Australia, also have significant research capabilities and influence.

Further observation and research are needed to fully assess the contributions and importance of these countries. Additionally, collaboration relationships among countries and the quality of research outcomes are also important factors in evaluating national contributions.

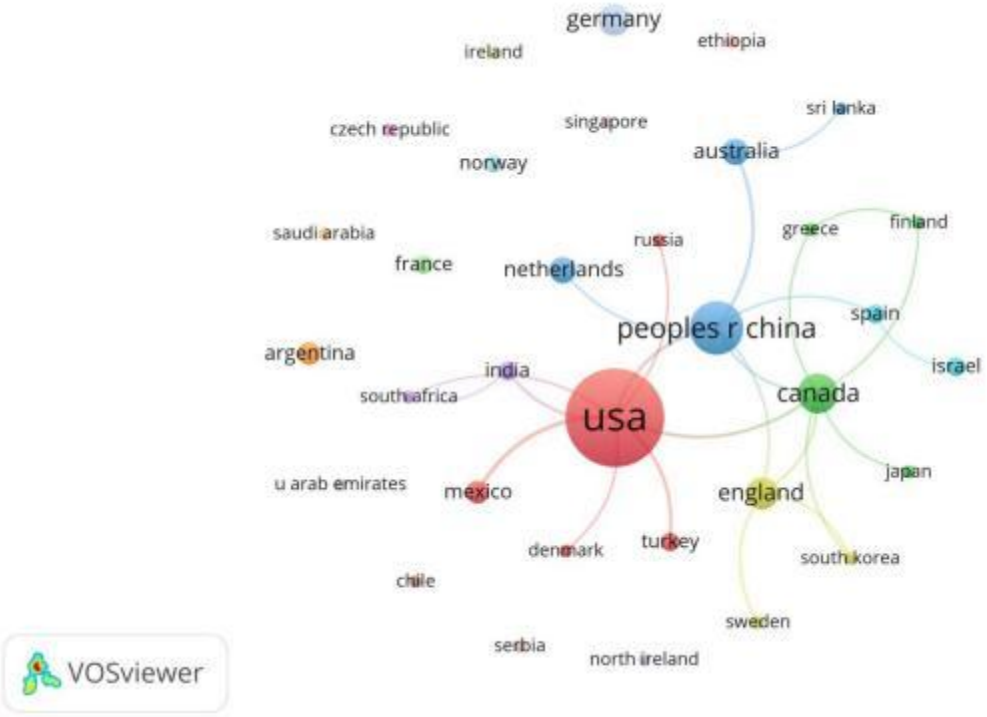

Figure 4. National cooperative co-occurrence network.

3.3. Author collaboration analysis

VOSviewer's co-authorship collaboration network, as shown in **Figure 5**, analyzes the contributions and research importance of authors. Below are discussions on the top five authors in terms of publication output, citation frequency, and link strength, respectively.

In terms of publication output ranking, the author with the highest number of publications is Laura M. Justice, ranked first with five publications (e.g.,[27-31]). She is followed by Jorge E. Gonzalez, ranked second with four publications (e.g.,[29,32-34]), and Leanne Elliott, also with four publications (e.g.,[35-38]). These authors exhibit active research output in this field, highlighting their significant contributions and ongoing commitment to the domain..

In terms of citation frequency ranking, the author with the highest citation frequency is Froilandet al.[39], accumulating 112 citations. They are followed by Missallet al.[40], who have garnered 107 citations, and then DeFlorio and Beliakoff[41], with 106 citations. The research outcomes of these authors have received widespread citation and recognition, demonstrating their substantial academic influence and pivotal contributions to the field.

Regarding link strength ranking, the author with the highest link strength is Gonzalez, Jorge E. (1st, 18), followed by Justice, Laura M. (2nd, 12), and Cheung, Sum Kwing (3rd, 12). Link strength reflects the level of collaboration and research exchange among authors. These authors exhibit close research collaboration in this field, demonstrating their importance and influence in international research cooperation.

Based on publication output, citation frequency, and link strength, Leanne Elliott, Jorge E. Gonzalez, and Laura M. Justice demonstrate prominent research contributions and importance in this field. Other notable authors include Sum Kwing Cheung, Katharina Kluczniok, and Melissa E. Libertus, who also possess significant research capabilities and influence.

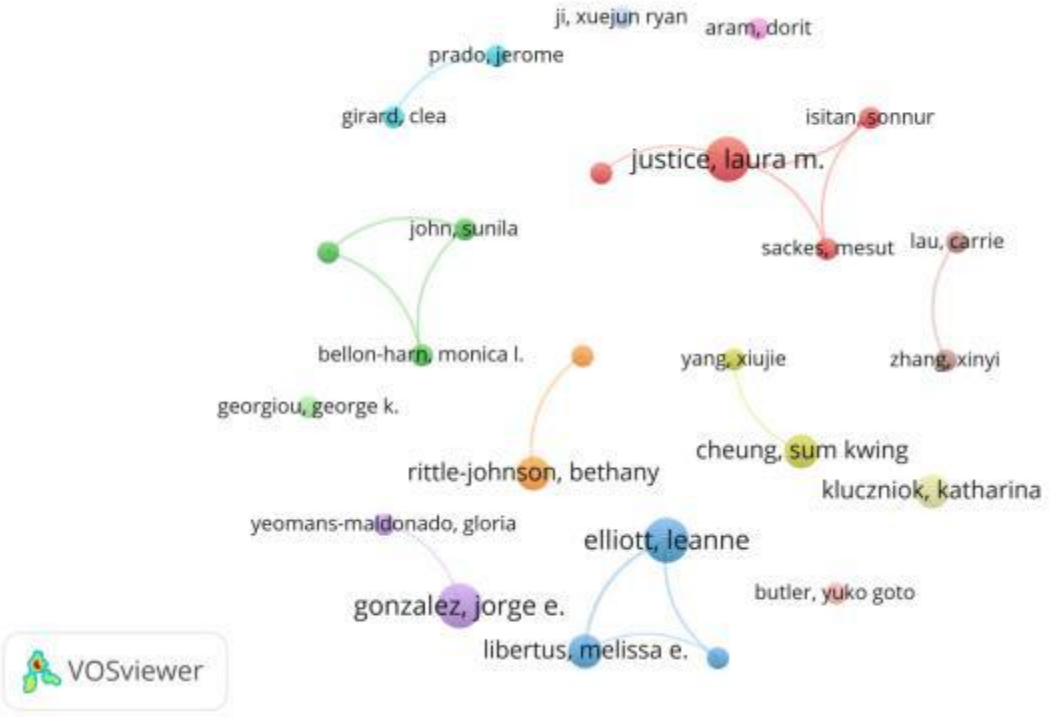

Figure 5. Author collaboration co-occurrence network.

3.4. Institutional analysis

According to the institution co-occurrence collaboration network shown in **Figure 6**, an analysis of the top institutions in terms of publication output, citation frequency, and link strength is presented below.

Publication Output: Ohio State University leads in publication output with 6 publications, followed by The Education University of Hong Kong with 5 publications, and The University of Hong Kong, also with 5 publications but ranked third due to other factors such as citation impact or alphabetical precedence. These institutions demonstrate active research output in the field, underscoring their robust engagement and contributions.

Citation Frequency: University of Nevada, leads with 141 citations, followed by Lehigh University with 138 citations, and University of Minnesota with 136 citations. The research outcomes of these institutions have received widespread citation and recognition, solidifying their academic stature and influential contributions to the field.

Link Strength: Ohio State University, again leads with a score of 5, followed by Education University of Hong Kong, equally scoring 5, and Texas A&M University with a score of 4. Link strength reflects the

level of collaboration and research exchange among institutions. These institutions demonstrate significant collaboration, indicating their critical roles in fostering international research cooperation.

Overall, Ohio State University, Education University of Hong Kong, and University of Nevada stand out for their prominent research contributions and pivotal roles in this field. Their high publication output and citation frequency underscore their influential positions within the research community. Additionally, institutions like Lehigh University, University of Hong Kong, and The University of Minnesota also showcase notable research capabilities and influence.

In summary, Ohio State University, The Education University of Hong Kong, and University of Nevada are the top institutions in terms of publication output, citation frequency, and link strength in this field. Their research output and academic influence highlight their pivotal contributions and stature within the academic community. Moreover, other institutions such as Lehigh University, University of Hong Kong, and University of Minnesota also exhibit considerable research capabilities and influence, enhancing the landscape of research in this domain.

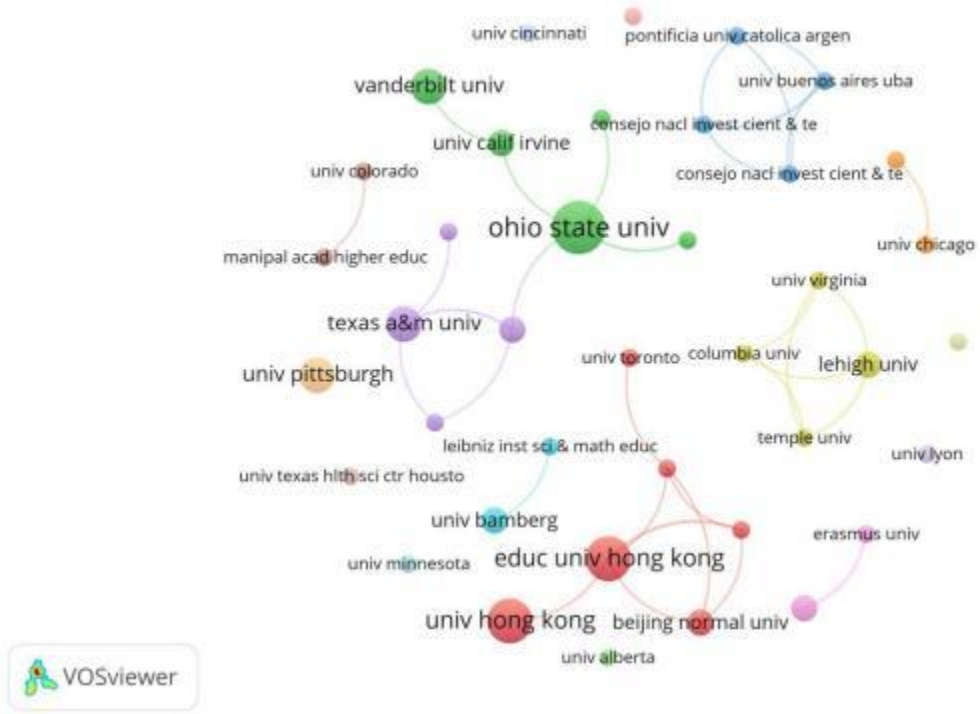

Figure 6. Institutional co-occurrence cooperation network.

3.5. Journal analysis

According to the journal co-occurrence collaboration network and the dual-map overlay network depicted in **Figures 7** and **8** respectively, this analysis evaluates the top journals based on publication output, citation frequency, and link strength.

Publication Output: Early Childhood Research Quarterly leads with 14 publications, ranked first, closely followed by Early Education and Development, which also boasts 14 publications but is ranked second based on additional factors such as impact or issue frequency. Early Childhood Education Journal, with 9 publications, is ranked third, reflecting substantial engagement within the research community.

Citation Frequency: In terms of citation metrics, Early Education and Development stands out with 387 citations, securing the top position. This is followed by Early Childhood Research Quarterly with 275 citations, and the European Early Childhood Education Research Journal with 116 citations, each reflecting significant academic impact and scholarly recognition.

Link Strength: Regarding collaborative dynamics, Early Education and Development exhibits the highest link strength with a score of 2157, indicating extensive inter-journal collaboration. Early Childhood Research Quarterly follows with a score of 1774, and Early Childhood Education Journal with 747, showcasing their pivotal roles in fostering scholarly networks.

Overall, Early Childhood Research Quarterly, Early Education and Development, and Early Childhood Education Journal are central to the domain based on their high publication output, citation frequency, and strong collaborative links. These journals significantly influence the research landscape within early childhood education. Additionally, other publications such as the European Early Childhood Education Research Journal, Journal of Early Childhood Literacy, and International Journal of Bilingual Education and Bilingualism also demonstrate notable research capabilities and influence, enriching the field's diversity and depth.

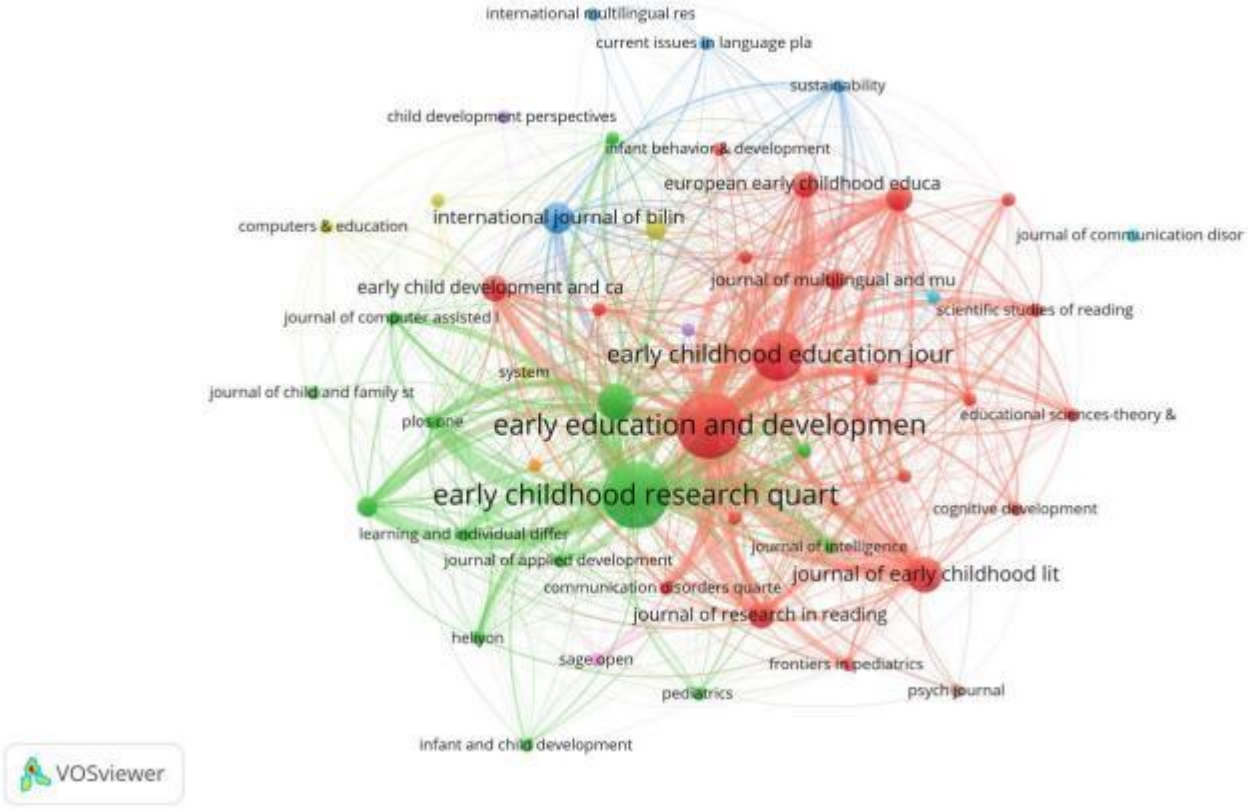

Figure 7. The co-occurrence and cooperation network of journals.

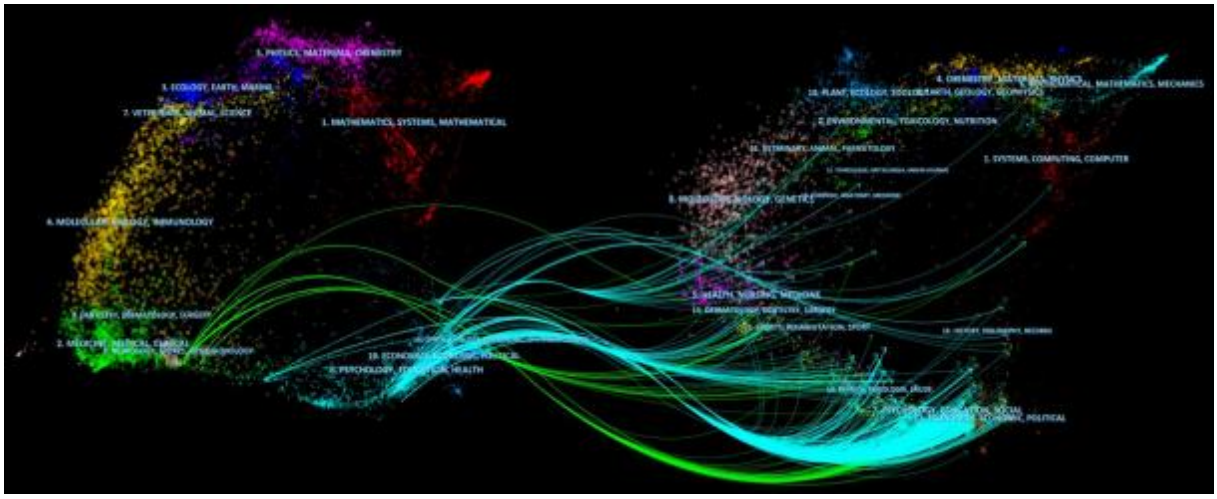

Figure 8. The double graph overlay network ofjournals.

3.6. Discipline analysis

Based on the disciplinary information obtained from CiteSpace, Education and Educational Research are the most prominent disciplines in the field of investigating PB, HLE, and CA towards English learning. Additionally, Developmental Psychology, Linguistics, and Educational Psychology also exhibit considerable research activity and academic influence. Other disciplines such as Family Studies, Rehabilitation Science, Social Work, Pediatrics, Multidisciplinary Science, and Experimental Psychology show relatively less research activity, indicating a need for further development and expansion. Analyzing the trend of disciplinary development over time, Education and Educational Research have consistently maintained high research activity, while Developmental Psychology has shown a recent upward trend in research activity. Therefore, these disciplines hold significant research value and application prospects in the study of PB, HLE, and CA towards English learning.

Figure 9 illustrate that, Education and Educational Research dominate the research domain, marked by a high frequency of 68 occurrences and significant centrality of 0.32. This underscores their central role and dynamic engagement in the field. Developmental Psychology, significant with 39 occurrences and a centrality of 0.28, plays a crucial role in exploring parental beliefs and the psychological development of families, shaping children's attitudes towards English learning.

The contributions of Linguistics and Educational Psychology are notable, with frequencies of 11 and 25 occurrences respectively. Linguistics, important for understanding the linguistic aspects of children's English learning, and Educational Psychology, despite its potential not yet fully realized, suggest areas ripe for deeper exploration.

Family Studies, Rehabilitation Science, and Social Work provide diverse perspectives on the family cultural environment's influence, supported by their activities in the field, although less frequent than the primary disciplines.

Pediatrics, Multidisciplinary Science, and Experimental Psychology contribute empirical studies and experimental data crucial for a holistic understanding of the educational impacts on children.

In recent years, Education and Educational Research have consistently been at the forefront, with Developmental Psychology also gaining prominence. This trend underscores the evolving importance of these disciplines in addressing complex educational and psychological issues in children's English learning.

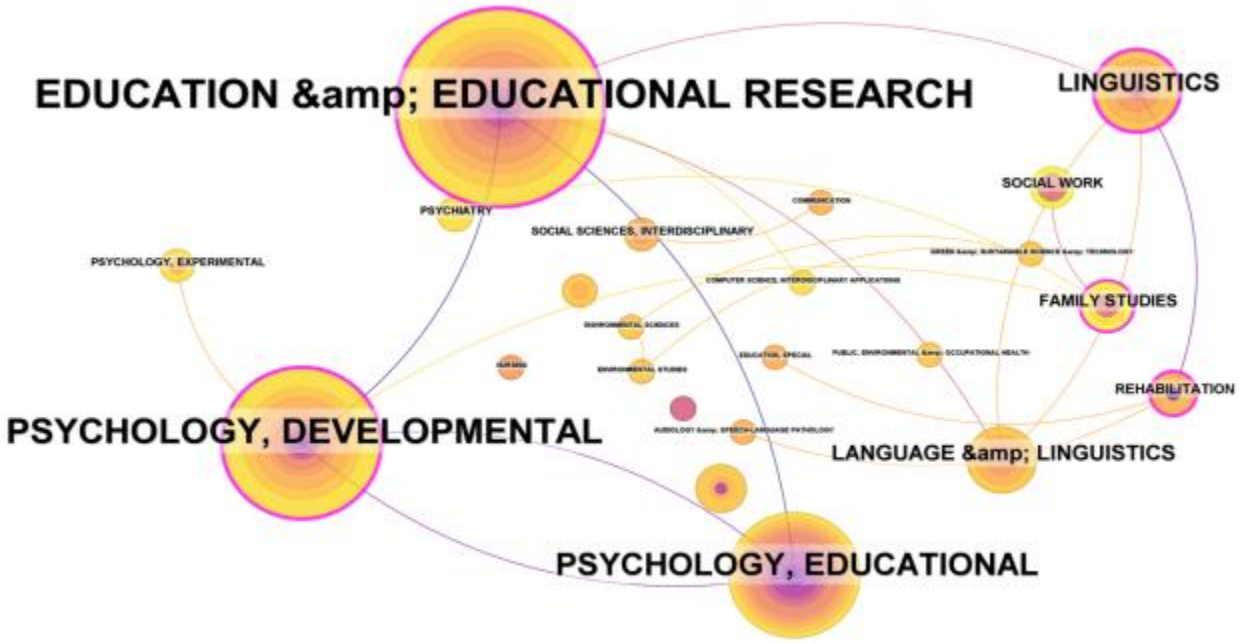

Figure 9. Citespace discipline co-occurrence.

4. Discussion on research hotspots and trend evolution

4.1. Keyword co-occurrence analysis

Keyword co-occurrence analysis provides scholars with a comprehensive understanding of the relationships between keywords and the various topics in a research field. This type of analysis helps in-depth examination of research progress and trends[42,43]. The keyword co-occurrence analysis network obtained from VOSviewer is depicted in **Figures 10** and **11**.

In the study of parental belief (PB), home literacy environment (HLE), and children's attitudes (CA) towards English learning, several keywords show high frequencies and significant centrality. The keyword "belief" appears most frequently (34 occurrences), suggesting a strong focus on PB and attitudes towards the HLE and their impact on children's English learning attitudes. This high occurrence indicates the critical role of PB in shaping children's learning and development. The co-occurrence of "belief" with keywords such as "environment," "achievement," and "literacy" highlights the interrelated nature of these concepts, suggesting that PB influence the family environment, academic achievement, and literacy development.

The keyword "environment" is the second most frequent (27 occurrences), underscoring its importance in studying the influence of the HLE on children's English learning attitudes. The term encompasses influences from family, school, and social environments. Its co-occurrence with keywords like "skill," "language," "achievement," and "literacy" indicates that these factors are interlinked, with the environment playing a crucial role in the development of children's skills, language abilities, academic achievements, and literacy.

"Home literacy environment," occurring 20 times, is another significant keyword, associated with the cultural atmosphere and literacy activities within the family. This keyword's association with "belief," "achievement," "literacy," and "parental involvement" underscores the multifaceted impact of the home literacy environment on children's English learning attitudes. It suggests that a rich HLE, supported by positive PB and involvement, significantly enhances children's learning outcomes.

Other keywords such as "education," "involvement," "children," and "parental belief" also have high frequencies. These terms are closely related to research on parental involvement in children's education and their overall learning and development. Their co-occurrence with keywords like "belief," "environment," and "achievement" highlights their importance in understanding how PB and the HLE shape children's educational experiences.

According to CiteSpace analysis, keywords such as "belief," "environment," "achievement," "literacy," "home literacy environment," and "parental involvement" are particularly important in this research field. These keywords' co-occurrence relationships reflect their mutual influence and correlation in research. The presence of keywords like "education," "children," and "parental belief" further underscores their significance and research value.

Research on these keywords provides valuable insights into the relationships between PB, the HLE, and CA towards English learning. This understanding offers theoretical and practical support for improving children's English learning attitudes and promoting the development of a supportive family cultural environment.

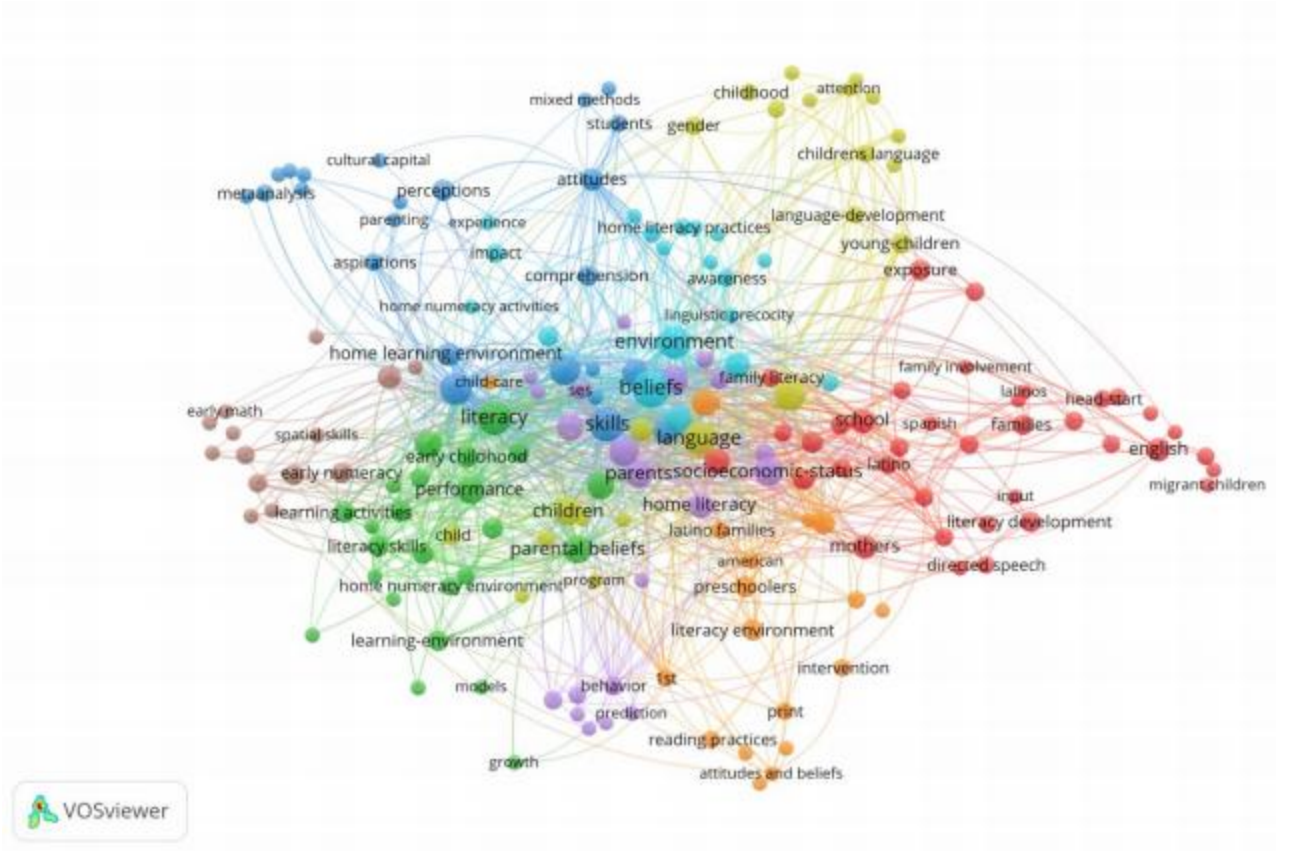

Figure 10. Keyword co-occurrence time network (frequency greater than 2).

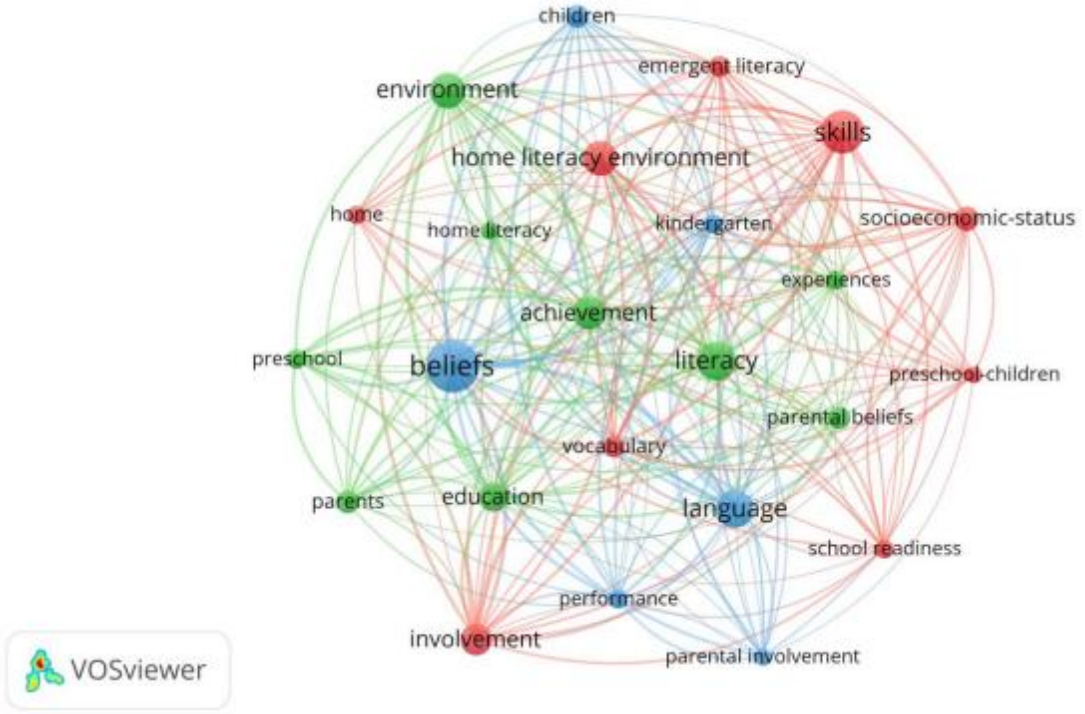

Figure 11. Co-occurrence time network for keywords with frequency greater than 10.

4.2. Keyword clustering analysis

CiteSpace's clustering analysis organizes a large amount of literature data based on keywords, authors, institutions, and citation relationships, creating a structured knowledge map[44]. It primarily uses spectral clustering to form clusters based on co-occurrence relationships. After clustering, a representative keyword, known as a cluster label, is identified[14]. By forming clusters based on these relationships, researchers can identify key research areas and emerging trends. This visualization technique allows researchers to gain a clearer understanding of the relationships between documents and research hotspots, thereby helping them better grasp the development trends and knowledge structure of the academic field[45]. The clustering analysis results in this study highlight the relevance and collaborative relationships between different topics, as illustrated in **Figure 12**.

According to the clustering results calculated by Citespace, there are a total of 10 clusters, and the analysis for each cluster is as follows:

Cluster 0: This cluster contains 37 keywords with a silhouette score of 0.878 and a year of 2016. The keywords in this cluster include "home literacy environment," "sibling dynamics," "bilingual vocabulary," and "language beliefs," all related to family cultural environment, sibling relationships, bilingual vocabulary, and language beliefs. The co-occurrence of these keywords may indicate researchers' focus on the influence of the family cultural environment on children's language abilities and cognitive development, as well as the interactions among siblings within the family.

Cluster 1: This cluster contains 35 keywords with a silhouette score of 0.769 and a year of 2016. Keywords such as "environment," "home literacy," "education," and "model" are included in this cluster, all related to the family cultural environment, education, and modeling. The co-occurrence of these keywords may reflect researchers' attention to the influence of the family cultural environment on children's education

and learning environment, as well as the modeling of the impact of the family cultural environment on children's language and cognitive abilities.

Cluster 2: This cluster contains 30 keywords with a silhouette score of 0.927 and a year of 2016. Keywords such as "emergent literacy," "home," and "low income" are included in this cluster, all related to the family cultural environment, low-income families, and children's acquisition. The co-occurrence of these keywords may indicate researchers' focus on the impact of the HLE on the language and reading abilities of children from low-income families.

Cluster 3: This cluster contains 27 keywords with a silhouette score of 0.851 and a year of 2017. Keywords such as "parent math support," "home math environment," "repeating patterning knowledge," and "parent math beliefs" are included in this cluster, all related to parental support for mathematics, the home math environment, and parental beliefs about mathematics. The co-occurrence of these keywords may reflect researchers' attention to the influence of the home math environment and parental attitudes towards mathematics education on children's mathematical learning.

Cluster 4: This cluster contains 25 keywords with a silhouette score of 0.845 and a year of 2016. Keywords such as "early childhood literacy," "home literacy environment," "cultural diversity," and "home practices" are included in this cluster, all related to early childhood literacy, the home cultural environment, and family practices. The co-occurrence of these keywords may indicate researchers' focus on the influence of the HLE on children's early literacy development and cultural diversity.

Cluster 5: This cluster contains 25 keywords with a silhouette score of 0.891 and a year of 2017. Keywords related to family experiences, children's development, and school readiness are included in this cluster. The co-occurrence of these keywords may reflect researchers' attention to the influence of family experiences on children's school readiness and development.

Cluster 6: This cluster contains 24 keywords with a silhouette score of 0.983 and a year of 2020. Keywords such as "low-income child development," "scale development," "parental beliefs," and "visiting outcomes" are included in this cluster, all related to the development of children from low-income families, scale development, and PB. The co-occurrence of these keywords may indicate researchers' focus on the development of children from low-income families and the influence of PB on their development.

Cluster 7: This cluster contains 24 keywords with a silhouette score of 0.922 and a year of 2017. Keywords such as "academic achievement," "educational attainment," "structural equation models," and "student expectations" are included in this cluster, all related to academic achievement, educational expectations, and structural equation models. The co-occurrence of these keywords may reflect researchers' attention to the influence of academic achievement and educational expectations on student development.

Cluster 8: This cluster contains 11 keywords with a silhouette score of 0.892 and a year of 2017. Keywords such as "parental beliefs," "home numeracy," "math abilities," "early childhood," and "math anxiety" are included in this cluster, all related to PB, family numeracy, and children's math anxiety. The co-occurrence of these keywords may indicate researchers' focus on the influence of PB and family math environment on children's math abilities and math anxiety.

Cluster 9: This cluster contains 10 keywords with a silhouette score of 0.983 and a year of 2014. Keywords such as "socio-economic status," "primary schools," "foreign language education," and "parental factors" are included in this cluster, all related to socio-economic status, primary schools, and foreign language education. The co-occurrence of these keywords may indicate researchers' focus on the influence of socio-economic status and parental factors on children's schooling and foreign language education.

Based on the clustering results calculated by Citespace, it can be observed that different clusters in the field of studying PB, HLE, and children's English learning attitudes focus on different keywords and research topics. The co-occurrence of these keywords reflects researchers' attention to factors such as the HLE, sibling relationships, low-income families, and family math environment, and their impact on children's language abilities, cognitive development, and academic achievement. Moreover, these clusters provide researchers with reference points for research focus and directions in this field.

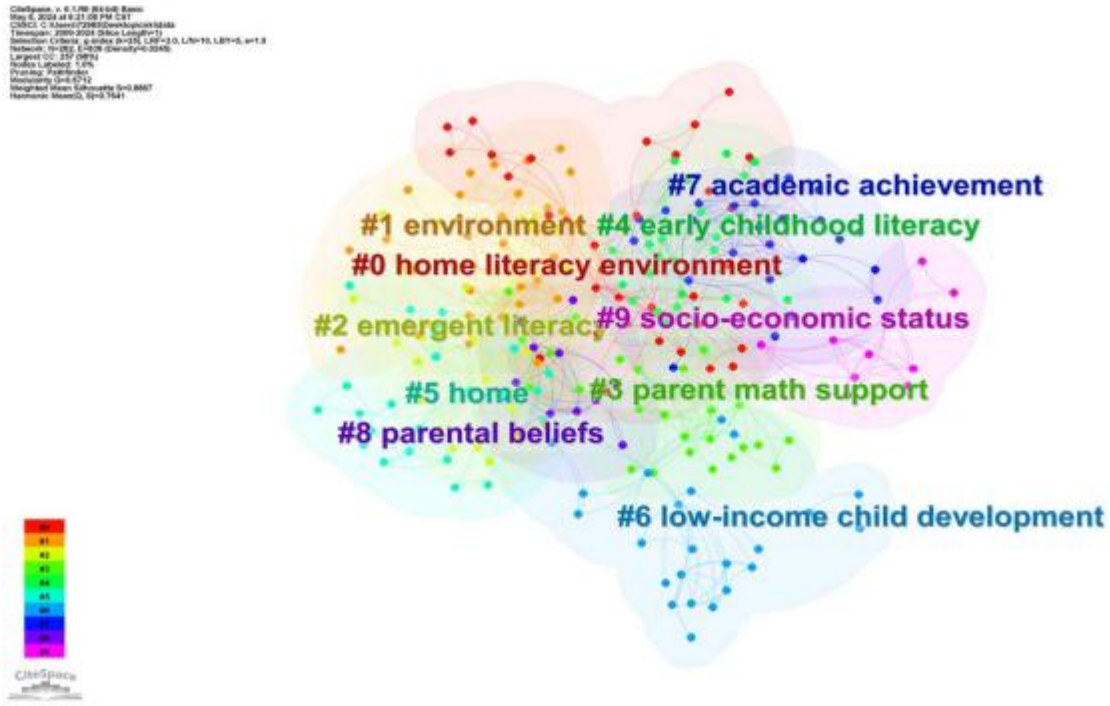

Figure 12. Keyword clustering diagram.

4.3. Time evolution trend of keywords

The keyword timeline visualization map primarily focuses on depicting the relationships between clusters and the historical span of keywords within each cluster[46]. The timeline, as shown in **Figure 13**, arranges nodes within the same cluster in chronological order along the same horizontal line, with time positioned at the top of the view. Nodes moving towards the right indicate proximity to the present time. Through analysis of the keyword timeline visualization map, a clear understanding of the research history can be obtained[17]. The visualization map mainly emphasizes describing the relationships between clusters and the historical span of keywords within each cluster[14,47]. Nodes within the same cluster are arranged in chronological order along the same horizontal line, with time placed at the top of the view. Nodes positioned further towards the right indicate closer proximity to the current time. Analysis of the keyword timeline visualization map allows for a clear understanding of the temporal trends in the research field[48].

Based on the results from Citespace, the developmental trends of keywords in different years can be observed. The following is a summarized analysis of the developmental trends of keywords in different years: **Table 3** presents a chronological trend of high-frequency keywords and the associated research focus for each period.

Table 3. Chronological trend of high-frequency keywords.

Period	High-frequency Keywords	Research Focus
2009-2010	Belief, Environment, Literacy, Socioeconomic Status, Education, Skill, Achievement, Children	Influence of parental beliefs, family cultural environment, education, and socioeconomic status on children's attitudes towards English learning. Focus on language and cognitive development, and academic achievements.
2011-2012	Belief, Language, Home Literacy Environment, Involvement, Parental Belief, Experience, Emergent Literacy, Early Childhood	Focus on parental beliefs, language environment, family cultural environment, and parental involvement. Attention to early reading abilities and language development in children.
2013-2014	Achievement, Family, Performance, Vocabulary, Early Literacy, Academic Achievement, Knowledge, Attitude	Influence of family cultural environment on academic achievements, vocabulary, and early reading abilities. Focus on academic achievements, knowledge, and attitudes.
2015-2016	Skill, Home Literacy Environment, Preschool Children, Home, Emergent Literacy, Literacy Environment, Exposure, Comprehension	Continued focus on language and cognitive development, influence of family cultural environment. Attention to children's literacy environment and comprehension.
2017-2021	Performance, Parental Involvement, Academic Achievement, Knowledge, Mathematics,	Focus on development of parental involvement, academic achievements, knowledge, and mathematical abilities.
	Learning Environment, Learning Activity, Early Numeracy	Attention to learning environments, learning activities, and early mathematical abilities.

According to the keyword development analysis conducted by Citespace, it can be observed that the development of keywords in the research field of PB, HLE, and CA towards English learning exhibits a certain temporal pattern. Over different time periods, researchers' focus has undergone certain changes. Starting from 2009, keywords such as "belief," "environment," "literacy," and "socioeconomic status" have consistently received attention from researchers. Over time, keywords like "language," "home literacy environment," "involvement," "parental belief," and "achievement" gradually became research hotspots. Researchers also focused on the influence of HLE on children's academic achievements, vocabulary, early reading abilities, as well as parental involvement and learning environments.

The development of these keywords reflects researchers' attention to family cultural environment, parental involvement, and children's learning development, providing a theoretical and practical foundation for further research.

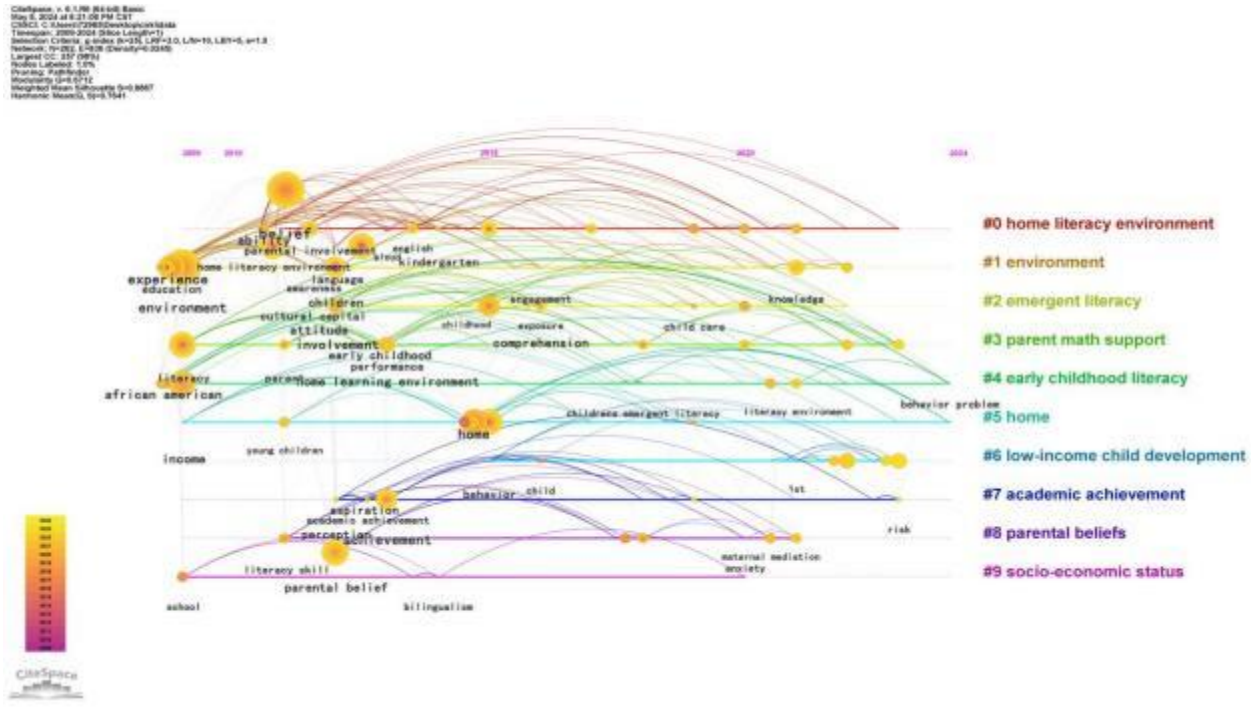

Figure 13. Keyword timeline chart.

4.4. Emerging hotspots and highly cited literature

In **Figure 14**, The keyword burst analysis conducted through Citespace serves as a methodological tool to discern the frequency and correlation of terms within the scholarly literature[49]. This analytic approach facilitates the identification of frequently occurring keywords, thereby delineating the principal research hotspots and emergent trends within the discipline[50]. The analysis of data generated by Citespace reveals that certain keywords within the domain of PB, HLE, and CA towards English learning have manifested prominently in particular years.

The key findings from the keyword burst analysis highlight several trends in scholarly interest over the years. In 2009 and 2018, the terms "school" and "education" showed significant bursts, indicating concentrated scholarly interest in the influence of familial literacy environments on children's readiness for school and broader educational development. The keyword "environment" was notably recurrent in 2009, 2019, and 2020, suggesting a sustained focus on the role of the family environment in influencing children's educational outcomes. In 2015 and 2021, the term "skill" featured prominently, pointing to a research emphasis on the development of children's language and cognitive skills.

"Emergent literacy" appeared as a focal topic in 2013 and 2015, reflecting scholarly attention to the foundational reading and writing capabilities of children. The keywords "child" and "preschool children" surged in 2016, 2019, and 2021, highlighting the critical study of developmental stages, particularly in preschool education. The term "experience" had bursts in 2009, 2019, and 2021,underscoring investigations into the experiential aspects of children's learning. "Performance" was a significant focus in 2013 and 2021, associated with research on academic achievements, particularly in language and cognitive domains. Finally, "knowledge" emerged in 2021 and 2024, pointing to a growing interest in the cognitive and knowledge-based outcomes of educational processes.

These temporal keyword bursts elucidate shifts in scholarly focus and priorities over time, demonstrating the dynamic nature of research concerning the impacts of family and educational environments on children's learning trajectories.

The keyword co-occurrence analysis conducted through CiteSpace offers valuable insights into the interrelationships among key research themes. Notably, the concurrent appearance of "environment," "performance," and "knowledge" in the years 2019 and 2021 underscores the pivotal role that family and educational settings play in shaping children's educational outcomes and knowledge acquisition. This interaction highlights the integral role of environmental factors in educational development.

Additionally, the association of "experience" with "preschool children" during the same timeframe emphasizes the critical importance of experiential learning within early childhood education frameworks. This connection reinforces the value of hands-on experiences in shaping foundational educational attitudes and skills in young learners.

Overall, this analysis through CiteSpace not only highlights the significance and evolution of key research themes but also elucidates the collaborative interactions among them, enhancing our understanding of the complex dynamics between PB, HLE, and children's educational attitudes. This enriched perspective provides a robust foundation for advancing theoretical constructs and practical applications in the field, fostering a deeper understanding of how environmental and experiential factors influence early childhood education.

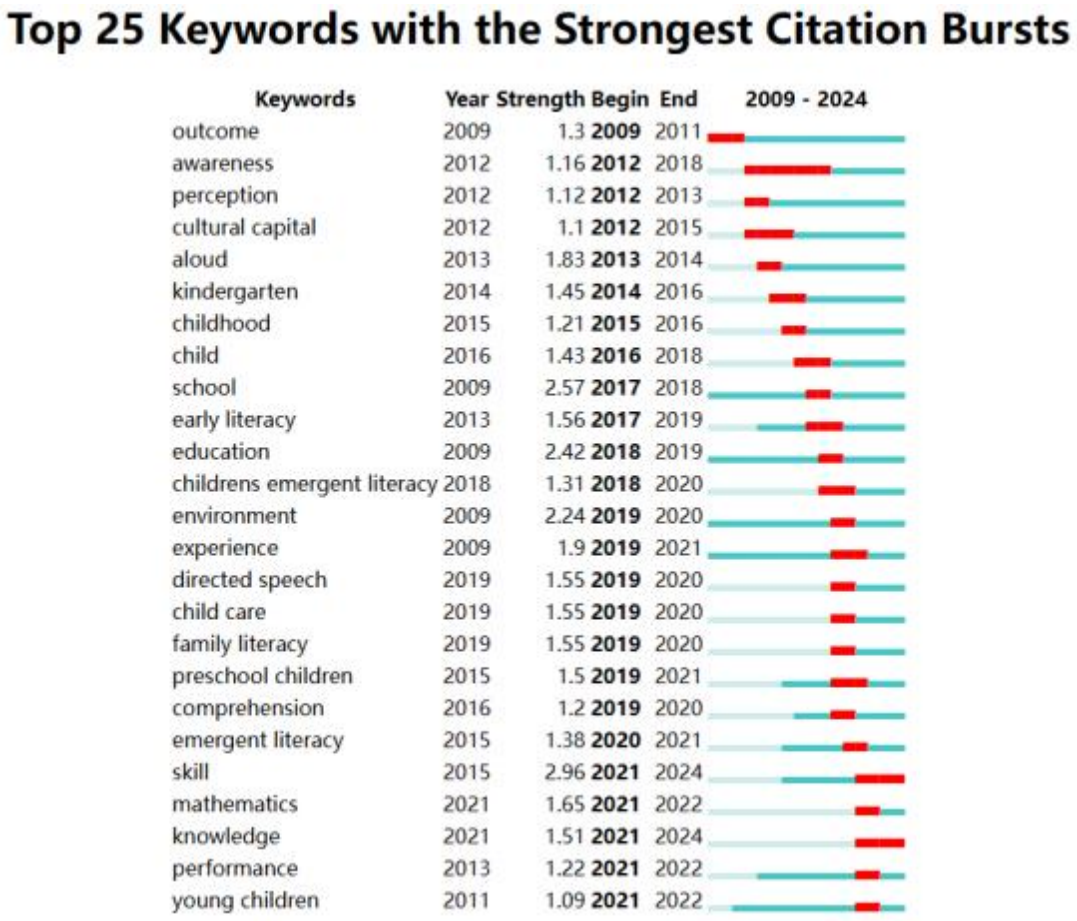

Figure 14. Keyword hotspot emergence chart.

In **Figure 15**, the primary works of these referenced articles span from 2009 to 2024, concentrating on PB, HLE, and CA towards English learning. These articles examine various factors including language and speech development, family cultural diversity, and parental involvement, which are crucial in shaping children's English learning outcomes.

The earliest group of highly cited articles (from 2009 to 2012) features studies by Hammer et al.[51] and Duncan et al.[52], which delve into children's language and speech development. These studies investigate the effects of early language experiences and PB on children's language acquisition, finding that enriched family reading environments and positive PB about language development are strongly linked to enhanced language abilities in children. This body of work underscores the critical role of parental involvement in fostering early childhood language development.

The second group of highly cited articles (from 2012 to 2015) includes research by Curenton et al.[53], Wu and Honig[54], and Anders et al.[55], which assess the impact of family reading environments on early education. Their findings indicate that aresource-rich reading environment, characterized by access to books and regular reading activities, correlates positively with improved literacy skills and preschool readiness. These studies highlight the essential role of parental involvement in nurturing early literacy skills and cultivating positive reading habits.

The third group of highly cited articles (from 2015 to 2024) comprises studies by Bridgeset al.[56], Aram et al.[57], DeFlorio and Beliakoff[41], and Bojczyk et al.[58], focusing on the influence of cultural diversity and socioeconomic factors on early childhood development. These studies emphasize the necessity of fostering

inclusive and culturally responsive learning environments to support the development of diverse language and literacy skills, highlighting the importance of mitigating socioeconomic disparities and enhancing access to quality early childhood education and resources.

The findings of these articles indicate that PB, HLE, and cultural diversity play significant roles in CA towards English learning. The research suggests that a rich family reading environment, positive PB, and inclusive educational practices are crucial for promoting children's language and literacy development. These findings provide important insights for educators and parents in supporting children's English language learning and fostering positive learning attitudes. By understanding and applying the results of these studies, educators and parents can create supportive and enriching environments to enhance children's English language development.

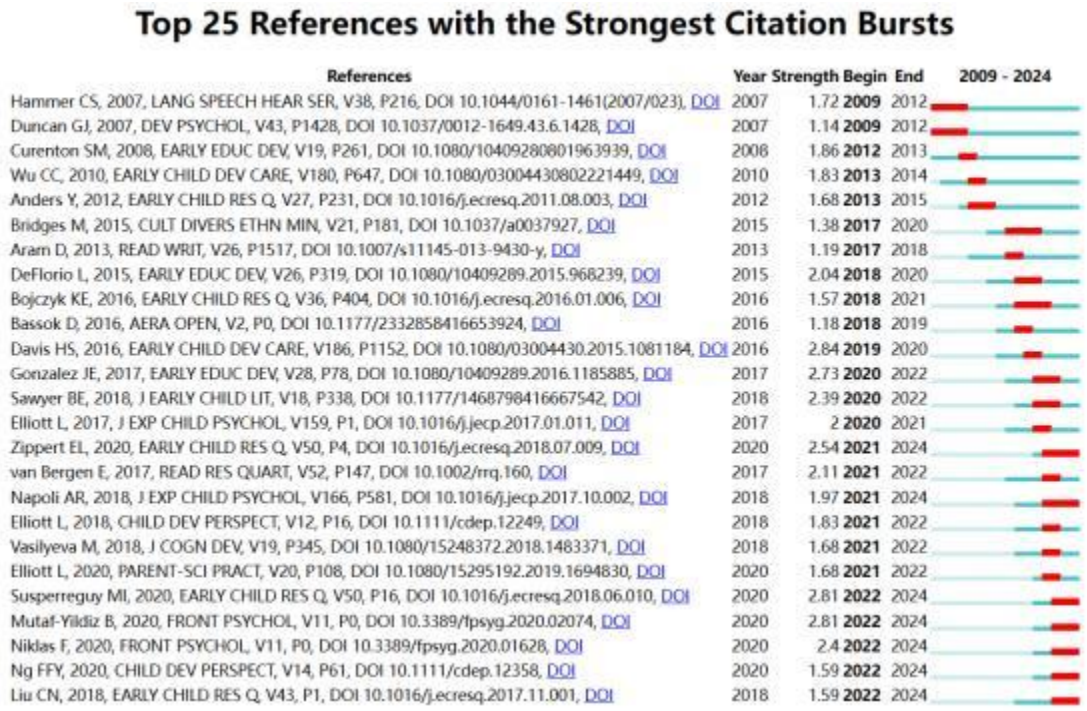

Figure 15. Highlights of highly cited references.

5. Conclusion

The findings underscore the critical role of parental beliefs (PB), home literacy environments (HLE), and literacy diversity in shaping children's attitudes (CA) towards English learning[3,2,1]. The research strongly supports the importance of a robust family reading environment, positive parental perspectives, and inclusive educational practices for enhancing children's language and literacy development[2,4]. These insights are invaluable for educators and parents working to support children's English language learning and foster positive educational attitudes.

However, the current research primarily focuses on socioeconomic factors, expectations, practices, involvement, and children's enjoyment, which presents certain limitations. With changes in educational policy affecting early childhood English learning, the impact of English learning is poised to expand into areas including learners' personality, gender, age, siblings, and peers, potentially affecting learners' outcomes. Future research should integrate community factors, children's individual characteristics, and learning development into their research[2,3,9]. Specifically, further investigation is needed in the following

areas: (1) the role of digital literacy and technology in early English learning, particularly how digital tools and online resources influence children's engagement and outcomes; (2) the long-term effects of bilingual or multilingual environments on children's cognitive and linguistic development; (3) the intersection of cultural diversity and language learning, particularly how cultural backgrounds shape CA and motivations towards English learning; and (4) the impact of parent training and professional development on the implementation of inclusive educational practices in diverse classroom settings.

This study analyzed 109 publications from the Web of Science, ensuring a high level of scientific rigor. However, reliance on a single database might yield somewhat biased results. Future research should incorporate multiple sources and diverse datasets, such as Scopus, ERIC, or regional databases, to achieve a more comprehensive and balanced exploration of the field. Additionally, mixed-methods approaches combining quantitative and qualitative data could provide deeper insights into the complex dynamics of early childhood English learning.

Author Contributions:

Q_YL: collecting data, analysis and interpretation of data, and first draft for the work. **K_K**: supervision and revising the work critically. **H_D**: collecting data, analysis and interpretation of data, and revising the work. **Y_CS:** revising the work critically and format the manuscript to be published. **M_L Z**: revising the work critically for important intellectual content. Q_W: revising the work critically for important intellectual content.

Funding

Not applicable.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Data are available from the the corresponding author.

Acknowledgments

We express our gratitude to the authors of the included papers for their contributions to this Bibliometric Analysis.

Conflicts of Interest

The authors declare no conflicts of interest.

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