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## PROJECT-BASED LEARNING IN EARLY CHILDHOOD EDUCATION: A BIBLIOMETRIC ANALYSIS OVER FIVE DECADES (1970–2023)

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### Abstract

*This study mapped the knowledge structure and thematic trends in research on project-based learning in early childhood education through a scientometric analysis of 100 publications from the Scopus database (1970–2023). The results showed a substantial increase in publication volume after 2014, with contributions originating predominantly from Western nations. A co-citation analysis identified three principal knowledge foundations: (1) the progressive educational philosophies of Dewey and Vygotsky; (2) the practical implementation of the 'Project Approach' articulated by Katz and Helm; and (3) contemporary integrations with STEM/STEAM education and robotics, as advanced by researchers such as Bers and Clements. Accordingly, research themes shifted from a focus on foundational pedagogical principles toward specific applications in STEM, robotics, and sustainable development. By delineating the relevant field's intellectual architecture and identifying research gaps, this investigation offers a valuable knowledge map. These findings establish a foundation for future inquiries and provide strategic directions for researchers, educators, and policymakers to support the theoretical and practical development of project-based learning at the early childhood level.*

**Keywords:** *Bibliometric analysis, early childhood education, knowledge structure, project-based learning, STEM.*

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# **HỌC TẬP THEO DỰ ÁN TRONG GIÁO DỤC MẦM NON: PHÂN TÍCH TRẮC LƯỢNG THƯ MỤC QUA NĂM THẬP KỶ (1970-2023)**

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## **Lịch sử bài báo**

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## **Tóm tắt**

*Bài báo này nhằm sơ đồ hóa cấu trúc tri thức và các xu hướng chủ đề trong nghiên cứu về học tập theo dự án trong giáo dục mầm non thông qua phân tích bản đồ khoa học 100 công trình từ cơ sở dữ liệu Scopus (1970–2023). Kết quả cho thấy sự gia tăng số lượng công bố đáng kể từ sau năm 2014, chủ yếu từ các quốc gia phương Tây. Phân tích đồng trích dẫn đã xác định ba nền tảng tri thức cốt lõi: (1) triết học giáo dục tiến bộ của Dewey và Vygotsky; (2) thực tiễn triển khai "Tiếp cận dự án" của Katz và Helm; và (3) các hướng tích hợp đương đại với giáo dục STEM/STEAM và robotics (Bers và Clements). Tương ứng, các chủ đề nghiên cứu cũng dịch chuyển từ việc tập trung vào nguyên tắc sư phạm nền tảng sang các lĩnh vực ứng dụng cụ thể như STEM, robotics và phát triển bền vững. Bằng việc phân tích bức tranh toàn cảnh và xác định các khoảng trống, nghiên cứu cung cấp một bản đồ tri thức hữu ích. Các kết quả này đặt nền móng cho những nghiên cứu tương lai, đồng thời đề xuất định hướng chiến lược cho các nhà nghiên cứu, nhà giáo dục và nhà hoạch định chính sách nhằm thúc đẩy lý luận và thực tiễn của học tập theo dự án ở cấp học mầm non.*

**Từ khóa:** *Cấu trúc tri thức, giáo dục mầm non, học tập theo dự án, trắc lượng thư mục, STEM.*

## **1. Introduction**

Project-based approaches, originating in the 1910s, were a central element of the progressive education movement. Dewey is recognized as a pioneer who advocated the "Learning by Doing" philosophy (Gijbels, 2011; Kilpatrick, 1918; Li, 2020; Williams, 2018). This methodology rests on the constructivist theories proposed by Piaget and Vygotsky (Van Geert, 2017). Previous investigations have examined the role of Project-Based Learning (PjBL) in Early Childhood Education (ECE) (Bell et al., 2009; Chien et al., 2020; Dahlberg & Moss, 2004; Yilmaz-Tuzun, 2018), assessed its geographical and cultural applications (Jennifer et al., 2017), offered implementation guidance (Helm & Katz, 2001, 2016; Katz & Chard, 2000), developed and evaluated STEM education programs through PjBL (Bers, 2012; Clements, 2007; Clements & Sarama, 2016), and explored teacher perceptions and competencies (Lam et al., 2023). Most studies conclude that PjBL integrates real-world projects and activities into the curriculum, enabling children to construct knowledge through hands-on experiences (Larmer et al., 2015). This approach fosters active engagement, critical thinking, and problem-solving skills (Chien et al., 2020; Yilmaz-Tuzun, 2018). These studies also revealed the beneficial effects of PjBL on cognitive, social, and emotional aspects of early childhood development (Hung & Huang, 2019; Krajcik & Berger, 2018) and indicated its contribution to sustained academic achievement (Clucas, 2018; Helm & Katz, 2016; Krajcik & Berger, 2018).

Although several literature reviews on PjBL in ECE have been conducted (Ferrero et al., 2021), few have addressed the detailed structure of research and scholarly collaborations in this field, primarily because of the constraints of traditional review methods. To address this gap and identify areas for future inquiry, the present study employed bibliometric methods to assess shifts in research emphasis, author interactions, and conceptual overlaps in PjBL research. This approach, which compensates for the limitations of a standard literature review, provides a broad overview of numerous academic works (Donthu et al., 2021; Ninkov et al., 2022). Accordingly, using a corpus of 100 scholarly articles and conference papers from the Scopus database, the analysis generated an overview of the scholarly output on PjBL in ECE. The study addressed the following primary research questions (RQ):

**RQ1:** What patterns emerge in the growth trajectory and geographical distribution of the PjBL in ECE literature?

**RQ2:** Which authors, documents, and intellectual clusters have been most influential in shaping the field?

**RQ3:** What are the predominant and emerging research themes, and what do they reveal about the field's evolution?

## **2. Data and research methods**

### **2.1. Data collection**

The Scopus Database served as the primary source of scholarly articles on PjBL in ECE for this study. Scopus, a recognized bibliographic database, encompassed a variety of scientific disciplines, including education (Falagaset et al., 2008). Its coverage of peer-reviewed journals, conference papers, and book chapters rendered it appropriate for a bibliometric analysis.

In terms of search strategy, our research focuses on the confluence of ECE and PjBL, requiring a search strategy that accurately reflects these dimensions. To achieve this precision, we painstakingly curated a list of keywords and phrases relevant to ECE, encompassing terms such as "early childhood", "young child\*", "early years", "preschool"... Simultaneously, we

incorporated keywords associated with PjBL such as “project based\*”, “project-based\*”, and adding keywords as “project approach”, “project-based approach”, “project method”, “project work\*”, “project curriculum”, “learning project”, “PjBL”. This thoughtful selection ensures that our search results exclusively encompass articles that encapsulate both critical aspects of our research.

On 26 June 2023, we conducted a Boolean search string on the Scopus database as follow: TITLE-ABS-KEY (( “project-based” OR “project based” OR “project approach” OR “project-based approach” OR “project method” OR “project work\*” OR “project curriculum” OR “learning project\*” OR “PjBL”) AND TITLE-ABS-KEY ( “early childhood” OR “young child\*” OR “early years” OR “preschool”OR “pre-school” OR “kindergarten” OR "pre-k\*” OR “infant education”OR “nursery school” OR “pre-primary” OR “pre-elementary”)).

The above search yielded a total of 551 publications. Following the PRISMA process, as used by (Moher et al., 2009), the authors eliminated 452 publications, including 257 unrelated fields articles; 77 book reviews, proceeding papers and other documents; and 117 articles unrelated to the topic of PjBL in ECE. Finally, the screening process follow the preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram came up with 100 articles (Figure 1).

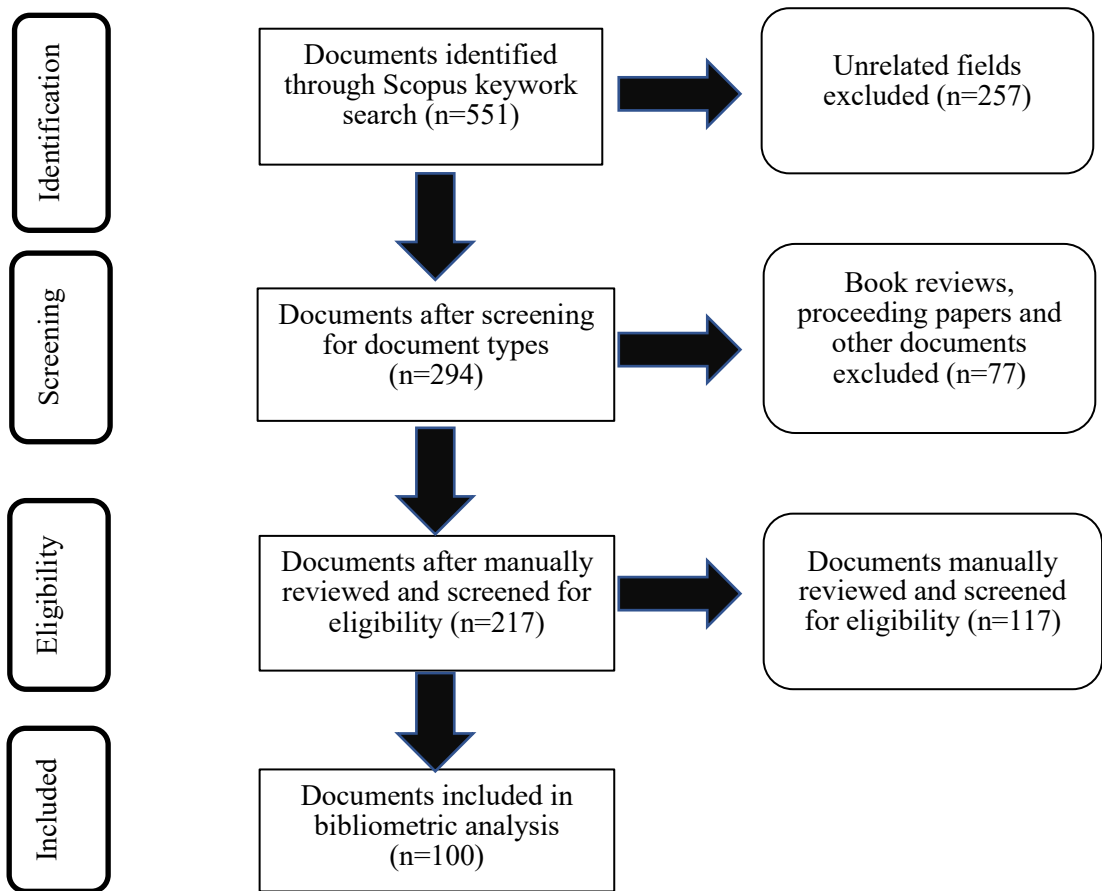


Figure 1. PRISMA Flow Diagram

(Moher et al., 2009)

## 2.2. Data analysis techniques

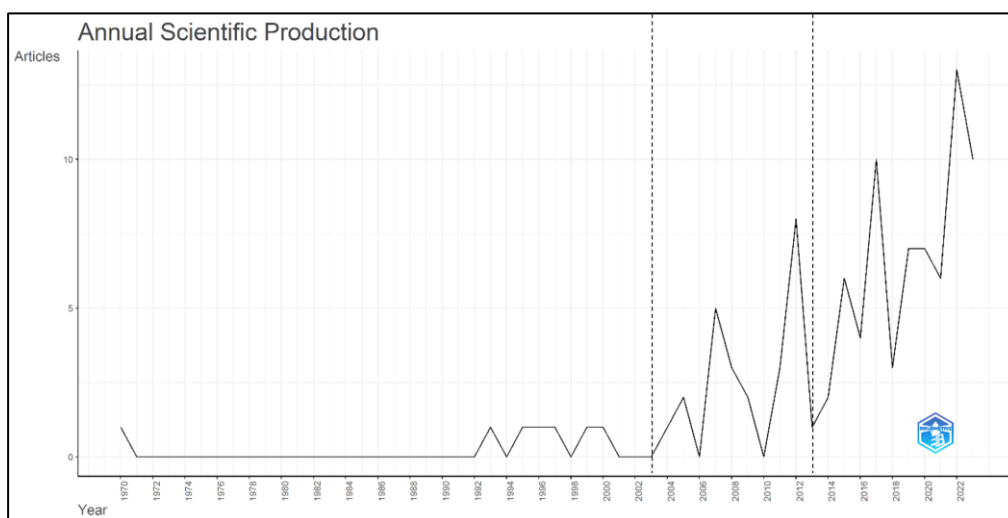
Bibliometric analysis was employed to investigate the evolution of scientific knowledge on PjBL in ECE. Metadata from 100 articles published between 1970 and 2023 on the Scopus database were gathered, including authors' names, affiliations, countries, article titles, journals, keywords, abstracts, citations, and references. The data were then processed with VOSviewer (version 1.6.19) and Biblioshiny, tools that enabled visualization (Van Eck & Waltman, 2014) and mapping of bibliometric data (Aria & Cuccurullo, 2021). The analysis identified principal trends, topics, and influential publications in the field of PjBL in ECE.

## 3. Results

### 3.1. The growth trajectory and geographical research distribution (research questions 1)

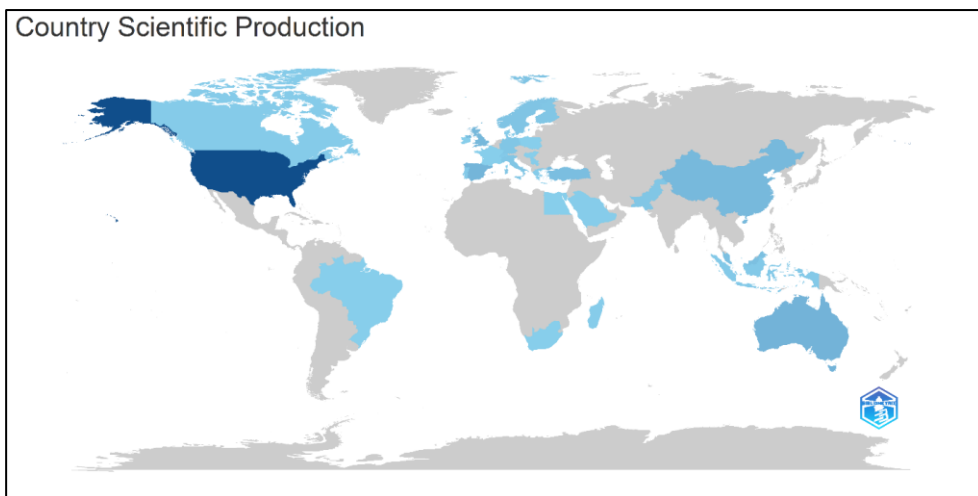
Over the 53 years since the first publication on PjBL in ECE, only 100 articles appeared in the Scopus database. The growth trends of scientific works on PjBL in ECE from 1970 to 2023, as illustrated in Figure 2, allowed the knowledge base on PjBL in ECE to be divided into three stages:

- *1970-2003*: The stage of limited attention, during which PjBL in ECE received minimal scholarly interest, with only seven works published (accounting for 7% of the total works published from 1970 to June 2023).
- *2004-2013*: The stage of early development, during which PjBL in ECE began to draw scholarly interest, with 25 studies published (accounting for 25% of the total works published during the entire period).
- *2014-6/2023*: The stage of substantial development, during which PjBL in ECE garnered considerable interest from scholars, with a total of 68 works published (accounting for 68% of the total publications from 1970 to June 2023). In the first six months of 2023 alone, publications accounted for 10% of the works at this stage and nearly matched the total number from 2022.



**Figure 2. Annual Scientific Production on Project-Based Learning in Early Childhood Education**

Figure 3 illustrates the distribution of publications by geographical regions and countries, revealing patterns in global PjBL research within ECE. Scientists from 36 countries contributed to the knowledge base of PjBL in ECE from 1970 to 2023 in the Scopus database.



**Figure 3. Top countries' contributions to Project-Based Learning in Early Childhood Education research**

Figure 3 shows that the United States leads this research area with 87 publications, followed by Australia (18) and Spain (17). The United Kingdom and China share fourth place, each with 14 publications. The other countries with more than five publications on PjBL in ECE research were Turkey, Malaysia, Norway, Sweden, and Finland. The data suggested that PjBL in ECE research occurred more frequently in Western countries than in Asian countries, except for China and Malaysia.

Table 1 ranks the top 10 most relevant countries using two indicators: total citations (TC) and average citations per article. TC denoted the cumulative citations received by all documents from a country, whereas average article citations represented the mean number of citations per document. The United States had the highest TC (441) and the second-highest average article citation rate (21.00), indicating that it was the most influential and productive country in the field. The United Kingdom followed with the second-highest TC (148) and the third-highest average article citation rate (18.50), suggesting a substantial and steady contribution. Although Chile had a relatively low total citation count (TC = 50), it achieved the highest average citations per article (50.00), indicating that its publications were highly influential. Other countries, including Italy, Pakistan, and Malta, also displayed high average article citations but low TC values, a pattern implying that a smaller set of highly influential documents originated from these nations.

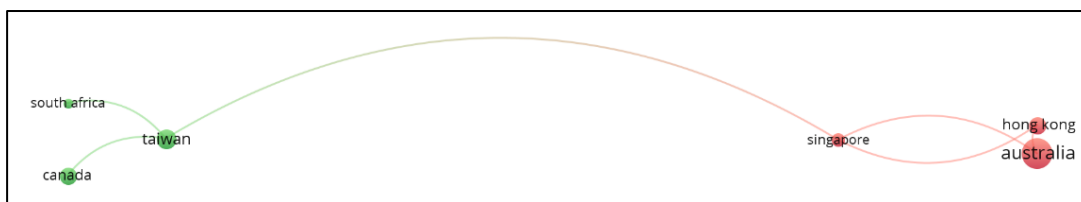
In contrast, countries such as Australia and China had low average citations per article but high total citation counts, reflecting a larger volume of research output with more moderate individual impact. This outcome reflected varied patterns of research production and influence across countries. Spain recorded the lowest average article citation rate (3.20) and one of the lowest TC values (13), signalling relatively limited scholarly influence and visibility in this field.

**Table 1. Top 10 most relevant countries related to Project-Based Learning in Early Childhood Education**

Country	TC	AV article citations
USA	441	21.00

Country	TC	AV article citations
United Kingdom	148	18.50
Chile	50	50.00
Australia	36	9.00
Italy	33	33.00
China	25	8.30
Malaysia	19	9.50
Pakistan	19	19.00
Malta	16	16.00
Spain	13	3.20

Figure 4 presents the international cooperation network in PjBL research in ECE, based on countries with at least one publication. Node size indicates the number of publications, while line thickness represents collaboration strength. The data show that authors from 36 countries have participated in research and publication in this field. The figure displays two clusters, each comprising countries/regions with the most substantial collaborative ties: Cluster 1 includes Taiwan, Canada, and South Africa, while Cluster 2 includes Australia, Hong Kong, and Singapore. Singapore and Taiwan emerged as the countries with the most collaborations, each with three link strengths (see Figure 4). Among the countries with the most collaborations, Australia contributed the highest number of papers on PjBL in ECE, with nine publications.



**Figure 4. Visualized the most collaborative countries in research on Project-Based Learning in Early Childhood Education**

### 3.2. Influential contributions and the field's intellectual structure (research questions 2)

In response to the second research question, this section identifies the most influential entities (including journals, authors, and documents) and subsequently analyzes the field's intellectual structure through its co-citation network.

#### 3.2.1. Top Journals

Table 2 ranked the top five journals according to their influence in the field of PjBL in ECE, using four indicators: h-index, TC, NP, and year of the first paper publication (PY\_start). These indicators assessed the research influence and visibility of the journals in the field of PjBL in ECE.

**Table 2. The top five greatest impact Journals related to the field of Project-Based Learning in Early Childhood Education**

Journals	h_index	TC	NP	PY_start
European Early Childhood Education Research Journal	5	145	5	2007
Early Childhood Education Journal	4	62	5	2005
Reading Teacher	2	14	2	2017
Journal of Early Childhood Research	2	13	2	2018
European Journal of Engineering Education	2	36	3	1996

The table showed that the European Early Childhood Education Research Journal attained the highest h-index of 5 and TC of 145, which marked it as the most influential and productive journal in the field of PjBL in ECE. It also achieved five publications, which indicated consistent publication, and a PY\_start in 2007, which reflected its active and current role in PjBL in ECE. The *Early Childhood Education Journal* ranked second, with an h-index of 4 and a total citation count (TC) of 62, underscoring its importance and productivity in PjBL research in ECE. This journal also recorded five publications (NP = 5), reflecting steady output since 2005 (PY\_start), and highlighting its established presence in the field. Other journals, such as the *European Journal of Engineering Education*, *Journal of Early Childhood Research*, and *Reading Teacher*, exhibited moderate h-indices (2) and TCs ranging from 13 to 36, indicating a certain level of influence and productivity in PjBL research in ECE. These journals also had lower NP values from 2 to 3 and PY\_starts from 1996 to 2017, which revealed diverse patterns of research output and activity in PjBL in ECE.

### 3.2.2. Top relevant authors

Table 3 presents the top five most relevant authors, ranked by both the number of articles and the fractionalized article count. The number of articles reflects each author's total publications in PjBL research in ECE, while the fractionalized count represents each author's proportional contribution relative to co-authors. For instance, a sole author received a score of 1, whereas one of two co-authors received 0.5. The fractionalized number of articles helped measure individual contributions.

**Table 3. Top five relevant authors**

Authors	Articles	Articles Fractionalized
Damjanovic, V.	2	0.75
Bers, M U.	2	0.64
Unahalekhaka, A.	2	0.64
Acker, A.	1	0.50
Aksela, M.	1	0.50
Akyol, Ak.	1	0.50

It is important to note that Damjanovic, V., ranked as the most relevant author, with two articles and a fractionalized score of 0.75, followed by Bers, M. U. and Unahalekhaka, A., with two articles and a fractionalized score of 0.64 each. The remaining authors produced one article each with a fractionalized score of 0.5. These data suggested that Damjanovic, V., Bers, M. U., and Unahalekhaka, A. emerged as the most influential and productive authors in the field of PjBL in ECE.

*3.2.3. Greatest impact documents*

Table 4 displays the 10 most influential documents from the 100-document dataset, ranked according to three indicators: total citations (TC), total citations per year (TC/Year), and normalized total citations (Normalized TC). TC represented the total number of citations a document received. TC/Year denotes the average number of citations received per year since publication. Normalized TC was the ratio of a document's TC/Year to the average TC/Year for all publications in the same field and year. These indicators were used to assess the research influence and visibility of each document.

**Table 4. Top ten greatest impact documents on Project-Based Learning in Early Childhood Education research**

<b>Author (year)</b>	<b>DOI</b>	<b>TC</b>	<b>TC/Year</b>	<b>Normalized TC</b>
Clements, D.H. (2011)	10.1007/s10857-011-9173-0	99	7.62	2.83
Vellutino, F.R. (2008)	10.1007/s11145-007-9098-2	97	6.06	2.31
Bagiati, A. (2015)	10.1080/1350293X.2014.991099	69	7.67	4.36
Merritt, J. (2017)	10.7771/1541-5015.1674	62	8.86	3.83
Morgan, A. (2007)	10.1080/13502930701320933	47	2.76	1.81
Moran, M.J. (2007)	10.1016/j.tate.2006.12.008	40	2.35	1.54
Mitchell, S. (2009)	10.1007/s10643-008-0295-7	38	2.53	1.07
Van Horne, K. (2017)	10.1080/10508406.2017.1330689	37	5.29	2.28
Edward, N.S. (2004)	10.1080/03043790410001716284	34	1.70	1.00
Chiazzese, G. (2019)	10.3390/informatics6040043	33	6.60	3.50

The table indicated that Clements, D. H. et al. (2011) ranked as the most influential document in PjBL in ECE, with the highest TC (99) and the second-highest Normalized TC (2.83). It also recorded a high TC per Year (7.62), which suggested consistent activity in PjBL in ECE. The article investigated how geometry and spatial thinking supported young learners and reviewed research on training early childhood teachers in this domain. It also described projects that applied learning trajectories to guide the teaching and learning of geometry and spatial reasoning.

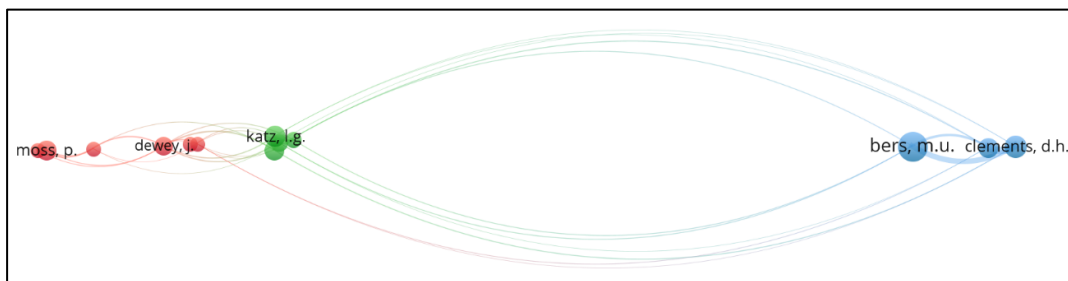
Vellutino, F. R. et al. (2008) ranked second in influence, with the second-highest TC (TC = 97) and a moderate normalized TC (2.31). It also achieved a moderate TC per year

(6.06), indicating a stable impact in PjBL research in ECE. This article focused on applying response to intervention (RTI) for identifying children at risk of persistent reading difficulties. The study tracked literacy development in children who received project-based interventions in kindergarten and/or first grade, compared to typical readers. The findings showed that RTI measures were more effective and consistent than psychometric measures in distinguishing between children who remained at risk and those who were no longer at risk.

Other documents, such as Bagiati, A. et al. (2015), Merritt, J. et al. (2017), Van Horne, K. et al. (2017), and Chiazzese, G. et al. (2019), recorded high TCs per Year (from 6.60 to 8.86) and high Normalized TCs (from 2.28 to 4.36), which reflected high quality and influence in PjBL in ECE. They also attained moderate to high TCs (from 33 to 69), which marked them as influential documents in PjBL in ECE. In addition, the table revealed that some documents had low TCs per Year, such as Edward, N. S. et al. (2004) (1.70) and Moran, M. J. et al. (2007) (2.35), which indicated limited quality and influence in PjBL in ECE. They also showed low Normalized TCs, such as Mitchell, S. et al. (2009) (1.07) and Edward, N. S. et al. (2004) (1.00), which suggested they did not stand out in PjBL in ECE.

#### 3.2.4. Co-citations analysis

Co-citation refers to the frequency with which two objects (such as authors, documents, or journals) are cited together in another article. This technique helps reveal research emphases in international PjBL in ECE by identifying interrelated papers (Hallinger & Kovačević, 2019). By using VOSviewer, 13 authors with at least 12 citations within this dataset were visualized in Figure 5, organized into three clusters. These clusters represent distinct perspectives within the literature, providing an overview of key research areas. Principal topics in each cluster were identified by examining the most prominent and distinctive documents (Cao et al., 2021).



**Figure 5. Co-citation map of 13 authors with at least 12 citations**

The red cluster contained four authors: Bell, P.; Moss, P.; Dahlberg, G.; Darling-Hammond, L.; Dewey, J.; and Vygotsky, L. S. These authors addressed the theoretical foundations and importance of PjBL in ECE. Vygotsky (1978, 1929) analyzed children's cultural development, emphasizing the acquisition of cultural tools and the relevance of socio-cultural theory to education and psychology. Dewey (1938) highlighted the importance of learning through experience. Building on these foundational works, authors in this cluster challenged dominant discourses and practices in early childhood services, proposing alternative approaches that give greater consideration to children's rights, diversity, and participation (Dahlberg et al., 2004), as well as to learning in informal environments (Bell et al., 2009). Among the authors, Moss, P. (20 citations, 47 total link strength) and Dewey, J. (18 citations, 43 total link strength) proved the most prominent.

The green cluster comprised four authors with comparable co-citation levels: L. Katz, J. H. Helm, and S. C. Chard. Their influential books focus on the application of project-based

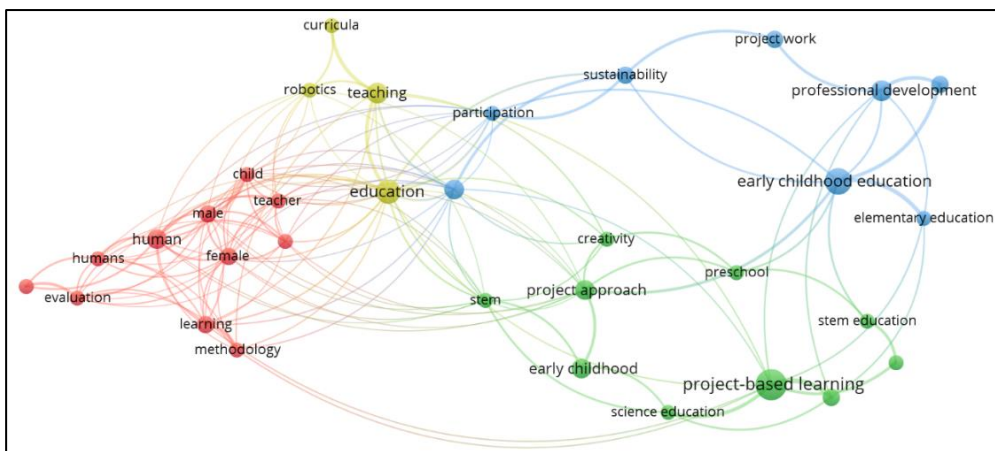
learning (PjBL) methods in early childhood education. *Young Investigators: The Project Approach in the Early Years* (Helm & Katz, 2001; 2016) and *Engaging Children's Minds: The Project Approach* (Katz & Chard, 2000) outline strategies for engaging young children in in-depth investigations. These works guide implementing projects from toddler to first-grade level, integrating standards and technology, and include classroom examples that address common challenges. They frame the project approach as a means to foster children's intellectual development and offer practical recommendations for planning, executing, and evaluating projects across subjects and settings. Both books also feature global project examples and adaptations for diverse learners and contexts (Katz & Chard, 2000; Helm & Katz, 2001, 2016). Katz stands out as the most prominent author in this group, with two documents receiving the highest citation counts (24 citations and 19 citations, with total link strengths of 62 and 54, respectively), followed by Helm and Chard.

The blue cluster comprised three authors: Bers, M. U.; Clements, D. H.; and Sarama, J., with Bers, M. U. recording the most citations (45 citations, 159 total link strength) but Clements, D. H. showing higher research collaboration with 369 total link strength, despite only 26 citations. These authors focused on PjBL in early STEM and robotics education. Clements (2007) and Clements & Sarama (2016) suggested a framework for research-based STEM curricula, with emphasis on goals, materials, activities, assessments, and pedagogy. Alignment, coherence, usability, and effects were advocated in curriculum research, with discussions of their use in development stages. The research also indicated positive outcomes from the Building Blocks curriculum for low-income preschoolers, which pointed to long-term advantages for math development and school readiness (Clements & Sarama, 2016). Bers (2012) examined how digital spaces supported positive youth development through the Positive Technological Development (PTD) model. Two technologies, ScratchJr and KIBO, were presented, with demonstrations of their integration into curricular areas and developmental stages. The approach yielded benefits, including computational thinking skills, problem-solving abilities, and positive attitudes toward computer science (Bers, 2019).

### **3.3. Predominant and emerging research themes and their evolution (research questions 3)**

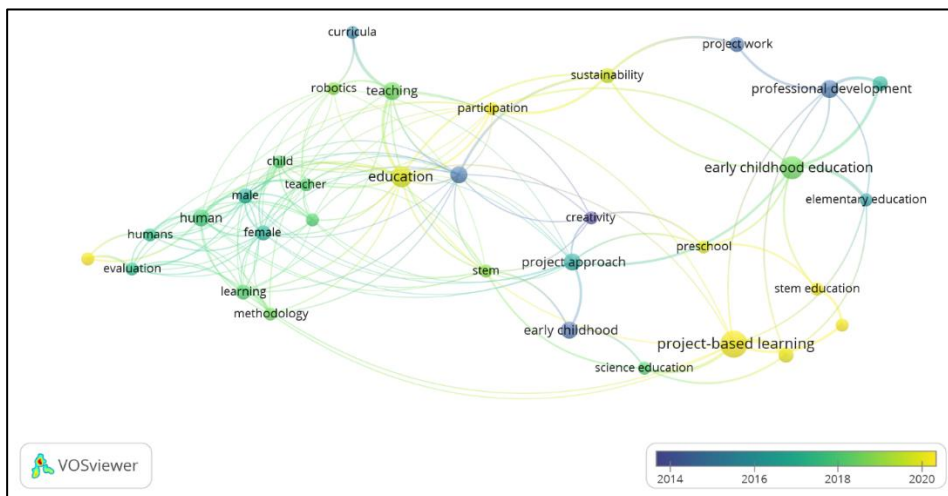
To address the third research question, co-occurrence analysis was used to identify the main publication topics in the field by examining relationships and overlaps among keywords (Xing et al., 2018). Keywords from authors and journals were incorporated. A threshold of three was set, requiring a keyword to appear at least three times in the database for inclusion in the co-occurrence network. The network organized the 33 most frequent keywords into four clusters, as illustrated in Figure 6.

The red cluster encompassed terms associated with gender differences in learning outcomes and teacher evaluations in kindergarten. Keywords frequently linked to this topic included "human", "male", "female", "learning", "child", "teacher", "methodology", and "evaluation". The green cluster pertained to children's creativity and computational thinking in STEM PjBL learning. Common keywords in this cluster were "Project-based learning", "STEM/ STEM education", "creativity", and "science education". The blue cluster focused on aspects related to curriculum, teachers' professional development, and sustainability. This cluster contained keywords such as "early childhood education", "professional development", "sustainability", and "project work". The yellow cluster is related to robotics education curriculum and teaching, with keywords including "education", "robotics", "curricula", and "teaching".



**Figure 6. Visualized co-occurrence of 33 popular keywords on Project-Based Learning in Early Childhood Education**

Figure 7 shows that research topics connected to curriculum, teacher competence development, and creativity in PjBL maintained enduring interest. In contrast, topics like STEM education, gender equality, and sustainable development attracted attention only in recent years.



**Figure 7. Overlay visualized the co-occurrence of 33 popular keywords on Project-Based Learning in Early Childhood Education**

#### 4. Discussion

This study employed bibliometric analysis to delineate the scholarly domain of PjBL in ECE over 53 years. The findings not only confirmed a growing academic interest in this pedagogical approach, particularly after 2014, but also illuminated the field's knowledge structure, influential contributors, and the evolution of research themes. The discussion that follows interprets the significance of these findings, reflects upon them in the Vietnamese context, and proposes directions for future inquiry.

The analysis of the growth trajectory and geographical distribution suggested a clear pattern. The pronounced dominance of Western countries, especially the United States, in both the volume and impact of publications was understandable. This dominance is not merely a

reflection of a well-established research and publishing ecosystem but also mirrors the historical origins of the approach, which is deeply rooted in the "Learning by Doing" philosophy of American educator John Dewey (1938). The legacy of progressive education cultivated a fertile academic ground for PjBL research. However, this dominance also poses an important question for other nations, including Vietnam: are educational models developed for Western socio-cultural contexts being passively imported? The pronounced scarcity of publications from Asia (with the exceptions of China and Malaysia), Africa, and Latin America indicated a substantial gap and, concurrently, an opportunity for researchers from these regions to contribute indigenous perspectives and enrich the global discourse.

Regarding the knowledge structure, the identification of three core co-citation clusters outlined the intellectual foundation of the field. The red cluster, with Dewey and Vygotsky at its core, represented the philosophical and cultural-historical psychological foundation, affirming PjBL as a method with a solid theoretical basis. The green cluster, which united the works of Katz, Helm, and Chard, provided a practical guide with the "Project Approach." This cluster is the most application-oriented, helping to translate theory into concrete classroom practices. The emergence of the blue cluster, focusing on the integration of PjBL with STEM/STEAM and robotics, led by Bers and Clements, was a logical evolution. It not only showed the natural progression of the method to meet contemporary societal demands for technology education from an early age but also opened an important academic dialogue: Does the integration of STEM, with its sometimes-specific objectives, create a tension with the spirit of open-ended, child-led inquiry that is the hallmark of PjBL? Or is it a synergy that enriches the learning environment? The works of Bers (2019) and Clements and Sarama (2016) demonstrated an effort to reconcile these aspects, but this remains a topic for further debate.

Applying this knowledge map to the Vietnamese context provided particularly valuable insights. In Vietnam, the PjBL approach was institutionalized in the national ECE curriculum, which emphasizes "child-centered" and "integration" approaches (MoET, 2021). Observations suggest that implementation efforts over the past decade have primarily focused on the green cluster, specifically applying the practical models of Katz and Helm (2016). Meanwhile, the blue cluster concerning STEM integration is an emerging trend, promoted by recent policies, but its systematic application is still in the nascent stages. The philosophical foundation of the red cluster appears to be underemphasized in teacher training and professional development programs in Vietnam. This gap may result in teachers applying PjBL superficially—"doing projects for the sake of it" without a deep understanding of its underlying philosophy. Therefore, awareness of these three clusters can help Vietnamese educational leaders identify priorities for development: not only enhancing practical skills (green cluster), but also strengthening the theoretical foundation (red cluster) and critically engaging with modern trends (blue cluster).

The thematic shift from foundational pedagogical concepts to applied areas such as STEM, robotics, and sustainability suggests potential directions for future research. Although this study had certain limitations, such as its reliance solely on the Scopus database and English-language publications, it pointed out apparent gaps. Future research should be expanded to other databases and languages for a more complete perspective. For Vietnam specifically, urgent research directions include: (1) qualitative studies to explore the process of how Vietnamese teachers interpret, adapt, and overcome challenges when applying PjBL in the specific context of large class sizes and limited resources; (2) experimental studies to compare the efficacy of traditional PjBL versus STEM-integrated models on the holistic development of Vietnamese children; and (3) analyses of policy-related and cultural factors that enable or hinder the sustainable, nationwide scaling of PjBL.

## 5. Conclusion

This study employed bibliometric analysis to map the evolution of PjBL in ECE, utilizing a dataset of 100 documents from the Scopus database spanning 1970 to 2023. The results reveal that the intellectual structure of PjBL comprises three main components: (1) the philosophical foundations of progressive and socio-cultural education, represented by scholars such as Dewey and Vygotsky; (2) practical frameworks for the Project Approach, pioneered by Katz and Helm; and (3) the contemporary integration of STEM, STEAM, and robotics, advanced by researchers like Bers and Clements. This tripartite structure underscores that effective implementation of PjBL requires balancing theoretical knowledge, pedagogical skills, and responsiveness to modern educational demands. These insights offer valuable guidance for educators and policymakers seeking to promote holistic practice and to move beyond a mechanistic, “doing projects” approach.

The study has several limitations. Its scope was confined to the Scopus database and English-language publications, which may exclude relevant scholarship from other sources or in different languages. Furthermore, while bibliometric methods are effective for identifying broad trends, they do not permit a qualitative assessment of the methodological rigor of individual studies.

The geographical concentration of research in Western nations highlights the need for more cross-cultural and indigenous studies. Consequently, a future challenge for the field is not simply to import PjBL models, but to thoughtfully adapt and enrich them within diverse socio-cultural contexts. Future inquiry from underrepresented regions, such as Asia, should therefore move beyond descriptive applications toward the development and evaluation of culturally responsive PjBL frameworks that are both globally informed and locally relevant.

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