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Mapping the Global Landscape of Project-Based Learning in Higher Education: A Bibliometric Analysis (2015-2025)

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ABSTRACT

This study maps the global research landscape of Project-Based Learning (PjBL) in higher education from 2015 to 2025 using bibliometric analysis of 318 articles from 198 journals indexed in Scopus. The findings indicate steady publication growth (1,06% annually), with Spain, Indonesia, and the United States as the leading contributors. Core journals include Sustainability, Education Sciences, and Frontiers in Education, reflecting strong connections between PjBL, sustainability, pedagogy, and digital innovation. Thematic analysis reveals PjBL is primarily implemented in social sciences, STEM, and engineering disciplines, while its application in entrepreneurship and the arts remains limited. Although the topic has reached bibliometric maturity, implementation challenges persist especially in developing countries due to infrastructural and pedagogical constraints.

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INTRODUCTION

The last few decades have seen a change in the dynamics of higher education. The paradigm that used to focus only on achieving knowledge transfer from lecturers to students is now changing to student-centered learning (Aldino et al., 2025; Velu et al., 2025). This means that students carry out the learning process actively.

The demands of learning in higher education today have shifted from transferring knowledge that makes students from "the transition from a state of ignorance to one of knowledge" to "doing and being". Students do not just know "what" and "why" but are able to "how" and "who" they are as part of a global society. This transformation must be balanced with transformation in all fields in order to create overall synergy.

The transition from traditional learning to more innovative learning is increasingly being studied in several studies. The change is based on the lack of synchronization between theory and real conditions. Learning in the classroom is only limited to providing knowledge understanding without any cases that match the real conditions in the field (Sanchez-Romero et al., 2019). Changes that can be adopted to overcome these problems are changing traditional learning to project-based learning (PjBL) (Aránguiz et al., 2020; Cheah & Li, 2020).

PjBL is a student-centered learning model where they learn by developing knowledge and skills through meaningful project work with a certain duration of time (Al-Busaidi & Al-Seyabi, 2021; Mohammed, 2017; Unzueta & Eguren, 2023). PjBL encourages active student participation (Ng et al., 2016; Pérez-Rodríguez et al., 2022), promotes collaboration (Mayar et al., 2023; Okello et al., 2024), and facilitates the development of students' social competencies. Despite the many benefits of PjBL for higher education, many experts question the implementation of PjBL in higher education because not all disciplines can apply it.

This study aims to look at the dynamics of PjBL in higher education based on scientific articles published from 2015-2025 through a bibliometric approach. The existence of this research is expected to provide a broad view for future researchers related to the topic of PjBL in higher education and provide identification of areas that need further attention. This implies the emergence of four research questions that will be discussed in this study.

RQ1: How has the number of publications on project-based learning in higher education grown?

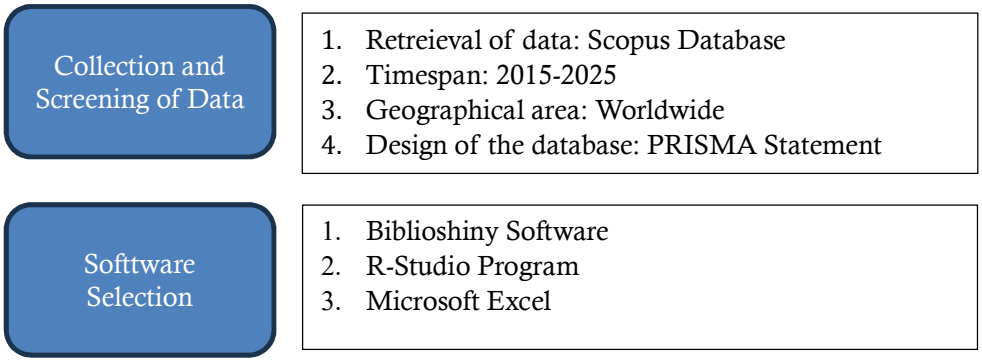
RQ2: What is the distribution of journals on the topic of project-based learning in higher education?

RQ3: What are the main themes and research domains that often appear in the topic of project-based learning in higher education?

RQ4: What disciplines are project-based learning often applied in higher education?

METHODS

This research combines bibliometric analysis and systematic literature review approaches. Bibliometrics is used to look at research trends by identifying publication patterns, research trends, and scientific collaboration networks (Ram & Paliwal, 2014; Zupic & Čater, 2015) while systematic literature review is useful in clarifying studies related to the topic of project-based learning in higher education. The study used data from the Scopus database from 2015-2025.



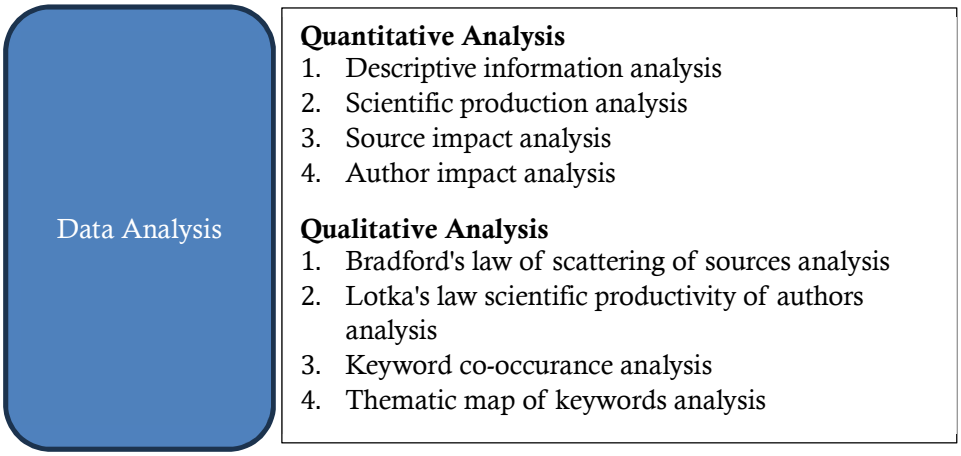


Figure 1 . Research flow

Data collection and screening

The data collection process in this study used reporting guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The initial process of bibliometric research is the establishment of research objectives. The data used in this study came from the Scopus journal database. The comprehensive strategy in this study used the search keywords TITLE-ABS-KEY ("project-based learning") OR TITLE-ABS-KEY ("project-based learning") OR TITLE-ABS-KEY ("project-based") AND TITLE-ABS-KEY ("higher education"). The search was conducted within the time span of 2015-2025 to ensure the novelty of the retrieved articles which resulted in 1280 articles.

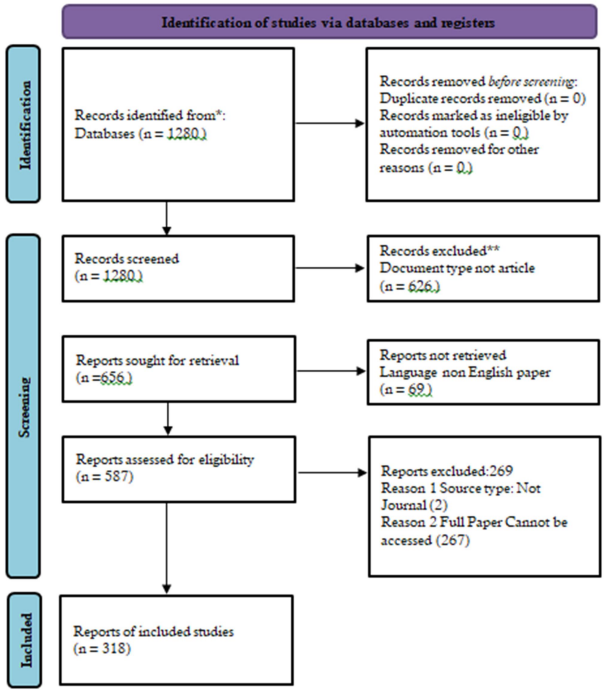


Figure 2. PRISMA Statement

RESULTS AND DISCUSSION

RQ1: Publication development of project-based learning model in higher education

The development of publications on project-based learning in higher education during 2015-2025 shows a steady growth rate and is widely distributed in the global scientific community. A total of 318 documents spread across 198 journal sources worldwide (table 1). This figure is an indication that the topic of project-based learning in higher education is still a research interest and concern for the global scientific community.

Although the document growth rate is 1,06% and is a small growth. It shows that research on this topic shows a level of maturity which means that research on this topic does not experience a significant surge but shows a positive level of continuity in the scientific landscape (Aria & Cuccurullo, 2017). The average document age of 3,42 years signals that publications on project-based learning in higher education are still relatively new and relevant in the development of learning in the 21st century.

Interesting findings emerged from the distribution of keywords. There are 640 keywords plus and 1.144 keywords from the author used in this publication corpus (table 1). This high level of keywords indicates that the discussion on this topic is very diverse in terms of methodology, contextual or thematic.

Table 1. Description of retrieved data information

Description	Result
Main information about data	
Timespan	2015:2025
Sources (Journal)	198
Documents	318
Annual Growth Rate%	1,06
Document Aveerage Age	3,42
References	144.442
Document Contents	
Keyword Plus	640
Author's Keywords	1.144
Author	
Authors	1.041
Authors of single-authored docs	50
Co-Authors per doc	3,36
International co-authorships%	18,87
Document Types	
Article	318

In terms of authorship, 1.041 authors were identified in the dataset with an average of 3,36 collaborators per article. This shows that research on PjBL topics is often developed collaboratively rather than individually. Only 50 articles were written by only one author. Furthermore, international collaboration of 18,87 (table 1) is a positive indicator even though it is not fully optimized. The existence of this international network enriches the perspective of PjBL topics in various countries.

Temporal analysis of scientific publications on PjBL during the period 2015-2025 shows the dynamics of development every year. Early publications in 2015 were still relatively low with only 9 articles, 2016 with 6 articles, and 2017 with 7 articles (table 2). This early year is an indication that the topic of PjBL is only at the embryonic or exploratory stage as is typical of emerging topics in the early phases of scientific development.

Table 2. Number of publications per year

Year	Number of articles
2015	9
2016	6
2017	7
2018	13
2019	15
2020	37
2021	45
2022	52
2023	61
2024	63
2025	10

However, in 2018 there was a significant spike of 13 articles, 2019 of 15 articles, 2020 of 37 articles, 2021 of 45 articles, 2022 of 52 articles, 2023 of 61 articles and reached the highest point in 2024 of 63 articles (table 2). These years show that the topic of PjBL is experiencing the stage of growing to maturity because this topic has begun to attract a lot of attention for scientists. However, it is interesting to note that in 2025 there was a decrease in the number of scientific articles from 63 to only 10 articles in 2025. The initial presumption of this decline is likely to be artifactual because 2025 is still running.

RQ2 distribution of PjBL journals in higher education

Analysis of the distribution of the number of sources of scientific publications divided into the top 10 sources shows diverse and dynamic results. *Sustainability (Switzerland)* produced the most articles as many as 37 articles (table 3). This shows that PjBL learning is a popular topic and has a correlation with sustainability issues, considering that PjBL is learning that can improve 21st century skills that are relevant in the context of sustainable development and transformative education (Brundiers & Wiek, 2017; Ospankulova et al., 2025).

Table 3. Number of articles based on journal sources

Sources	Number of Articles
Sustainability (Switzerland)	37
Education Sciences	14
Frontiers In Education	13
Cogent Education	5
European Journal Of Educational Research	5
Ieee Transactions On Education	5
International Journal Of Emerging Technologies In Learning	5

International Journal Of Learning, Teaching And Educational Research	5
Journal Of Engineering Education Transformations	5
International Journal Of Sustainability In Higher Education	4

The next positions at rank 3 and 4 are filled by *education science* and *frontiers in education* which contribute 14 and 13 articles respectively (table 3). Both journals are known to have a broad scope of pedagogical innovation and educational technology. The existence of PjBL topics in these journals is an indication that the topic of PjBL has received considerable attention in the discourse of formal education and the transformation of the curriculum which was originally limited to knowledge into a curriculum based on skills.

Interestingly, 7 journal sources (*Cogent Education, European Journal of Education Research, Ieee Transaction on Education, International Journal of Emerging Technologies in Learning, International Journal of Learning, Teaching and Educational Research, Journal of Engineering Education Transformations*) contributed 5 articles and the *international journal of sustainability in higher education* contributed 4 articles. This shows that PjBL is a learning that can be applied in various interdisciplinary fields such as engineering, digital technology and higher education in general.

Most sources that impact the topic of PjBL in higher education

Bradford's law used to see the distribution of articles and is divided into 3 main zones namely: core group, allied group and peripheral group (Alabi, n.d.; Alvarado, n.d.). There are 12 journal sources that fall into the core group of PjBL research in higher education (figure 3), which means that these 12 sources produce articles that are most relevant to this topic.

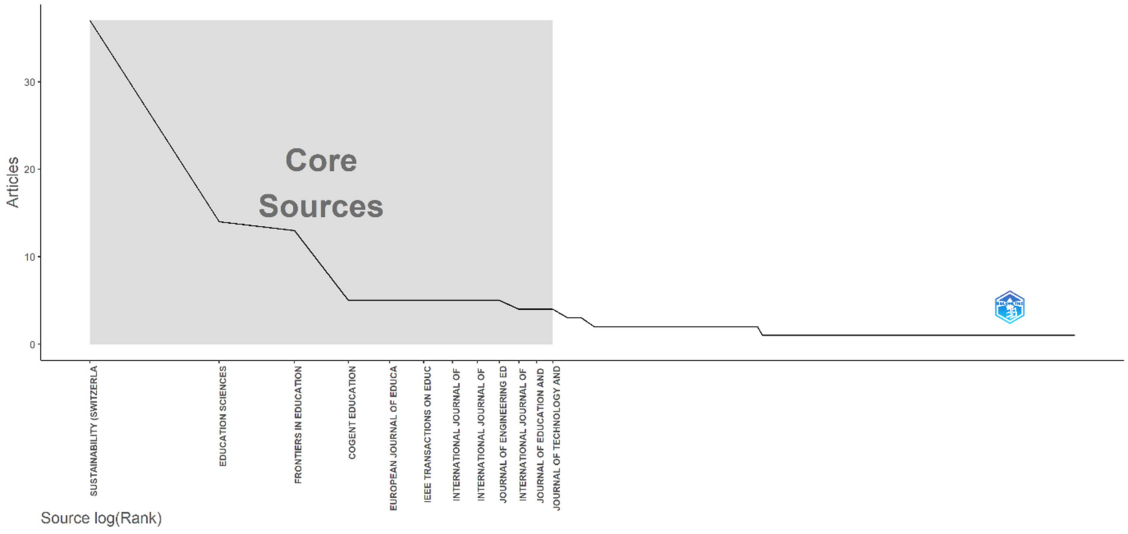


Figure 3. Bradford's law zone distribution

The distribution of articles on the topic of PjBL in education consists of 12 sources (106 articles) into the core group (Zone 1), 82 sources (108 articles) into the allied group (zone 2) and the remaining 104 sources (104 articles) into the peripheral group (zone 3) (table 4). These findings suggest that zone 1 contains a small number of highly productive sources that frequently

publish in journals on the topic of PjBL, while zone 2 contains a larger number of sources than zone 1 but each source contributes fewer articles. Zone 3 contains an even larger number of article sources with each publishing only a few articles relevant to the topic of PjBL in higher education.

Table 4. Total distribution of articles based on bradford's law zones

Type of Group	Total number of articles	Sources
Core Group - Most Productive Zone (Zone 1)	106	12
Allied Group - Moderately Productive Zone (Zone 2)	108	82
Peripheral Group - Least Productive Zone (Zone 3)	104	104
Total	318	198

Author productivity level in producing articles

Author productivity in writing articles can be seen by using Lotka's law (table 5). Most of the authors only wrote 1 article, namely a total of 1017 authors. Meanwhile, 22 authors wrote 2 articles and only 2 authors wrote 3 articles.

Table 5. Author productivity overtime

Documents written	N. of Authors	Proportion of Authors
1	1017	0,977
2	22	0,021
3	2	0,002

Authors who have a major impact on the topic of PjBL in higher education are based on the analysis of h_index, g_index, m_index, total citation (TC), number of publications (NP), and year of first publication (PY_Start) (table 6). PERTEGAL-FELICES ML has the highest impact on the development of publications in this topic because it has a total of 129 citations even though it only has an m_index of 0,286 even though the first scientific paper in this topic was published in 2019, this is an indication that the articles that have been published have generated a lot of interest from others. BERTEL LB is next in line with a total of 57 citations with an m_index value of 0,75 since 2022 in its first article. Similarly, BRAßLER M contributes with a total of 49 citations with an m_index of 0,4 since 2021 in its first article, indicating the high productivity of the authors in contributing articles on this topic.

Table 6. Authors who make an impact on the topic of PjBL in higher education

Author	h_index	g_index	m_index	TC	NP	PY_start
BERTEL LB	3	3	0,75	57	3	2022
BRAßLER M	2	2	0,4	49	2	2021
DU X	2	2	0,5	13	2	2022
GUERRA A	2	2	0,5	13	2	2022
HILTON M	2	2	0,333	27	2	2020
INIESTO F	2	2	0,667	6	2	2023
KANDIMALLA SR	2	2	0,333	27	2	2020
LYNGDORF NER	2	2	0,667	28	2	2023
PERTEGAL-FELICES ML	2	2	0,286	129	2	2019
RIENTIES B	2	2	0,667	6	2	2023

Some authors such as DU X and GUERRA A also show important contributions, with two publications and 13 citations respectively (table 6), and an m-index value of 0,5. These authors appear to be gaining significance in the PBL research community, especially as their works were published in a relatively recent timeframe (2022). In addition, INIETO F, LYNGDORF NER, and RIENTIES B stand out with an m-index of 0.667, indicating that although their publication productivity is still limited (two articles), their impact is quite high in relation to the very recent timing of their work (2023).

In general, these results show that PBL studies are dominated by new authors with a trend of rapid citation growth. This reflects the emerging nature of the PBL topic, which has begun to attract widespread attention in recent years and opens up opportunities for collaboration and exploration of further themes in the development of project-based pedagogy.

Most countries producing research on the topic of PjBL in higher education

An analysis of 318 articles on the topic of PjBL in higher education reveals the geographical distribution and global research focus on this topic. Spain contributed 158 articles and became the country with the most articles on this topic, followed by Indonesia with 134 articles and the USA with 112 articles.

The achievement of Spain to be the most article producer is an indication of the strong commitment of higher education institutions in the country as a developer and implement this PjBL learning for the advancement of their higher education. While Indonesia as a developing country shows the growth of higher education at the national level which is currently in line with the goals of the Indonesian state in producing education not only memorizing but practice-based and collaborative.

Other countries that stand out in publications related to the topic of PjBL in higher education include Portugal (53 articles), Finland (39 articles), and the UK (39 articles). These three countries are developed countries in the field of education and are known as countries that have progressive higher education systems and are open to contemporary approaches. Furthermore, Mexico (36 articles), Australia (34 articles), China (24 articles) and Denmark (24 articles) complete the countries producing research on the topic of PjBL in higher education.

Table 7. Countries producing research on project-based learning in higher education

Country	Frequency
Spain	158
Indonesia	134
USA	112
Portugal	53
Finland	39
Uk	39
Mexico	36
Australia	34
China	24
Denmark	24

These findings show that this topic is of great concern to countries around the world including both developed and developing countries. However, there is still a disparity of countries that have not done any research on this topic at all (figure 4). The darker the blue color on the

map, the more articles there are in that country. Meanwhile, if there is no blue color at all in a country, it shows that there is no research on the topic of PjBL in higher education.

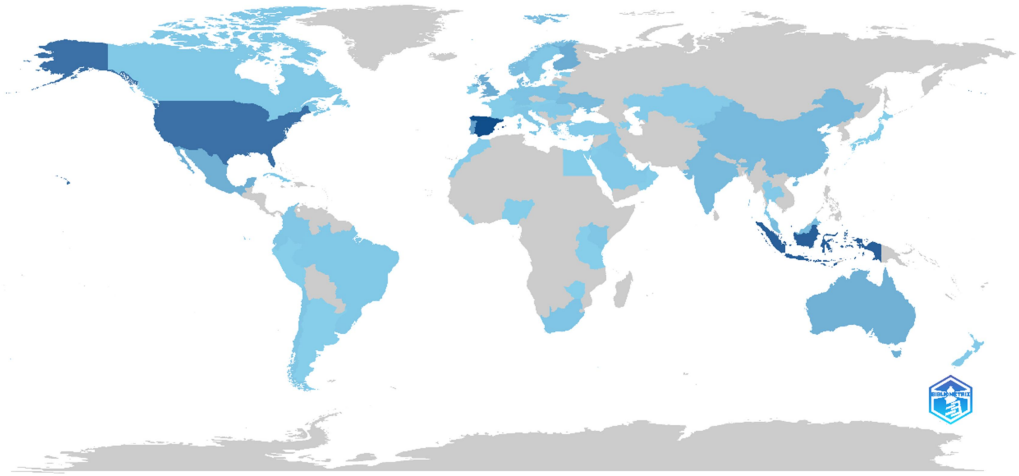


Figure 4. Distribution of countries producing articles on the topic of PjBL in higher education

RQ3: Major themes and research domains that often appear in PjBL topics in higher education

The distribution of research themes is divided into 4 main theme quadrants, namely motor themes, niche themes, emerging themes, and basic themes (figure 5). The four theme quadrants represent the level of development or density of a topic and the centrality or level of relevance of PjBL topics in higher education.

The motor theme is the quadrant located in the upper right corner which indicates that the themes in this quadrant are developed and have a strong influence on the topic under study. The themes "education", "human", and "software" are included in the motor theme quadrant in the topic of PjBL in higher education which indicates that the application of PjBL learning is not only relevant to the field of education but also has to do with the use of technology and humanistic contexts.

Basic theme is a quadrant located in the bottom right corner which indicates that themes in this quadrant have a high degree of centrality but low density. Themes in this quadrant still require further exploration. The themes "project based learning", "students", and "engineering education" fall into the basic theme quadrant which makes them basic themes as a foundation in researching PjBL topics in higher education.

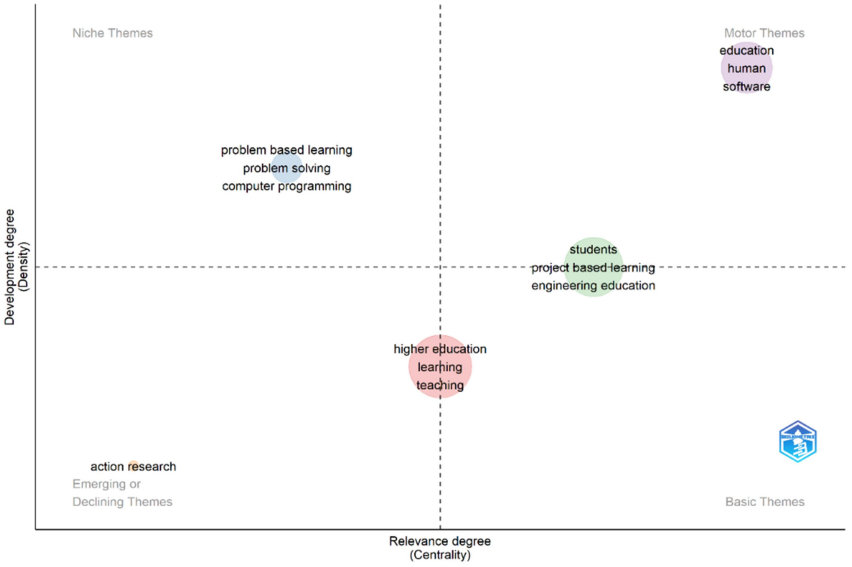


Figure 5. The main themes in the topic of PjBL in higher education

Niche themes are themes that have high density but low centrality. Themes in this area develop within a narrow or specific community. "Problem-based learning", "problem solving", and "computer programming" fall into these niche themes, indicating that there is strong theoretical and methodological development in these areas. Meanwhile, "action research" falls into the emerging or declining themes which have low centrality and density. This means that the theme of "action research" is a new theme and has not been widely developed in PjBL topics in higher education.

Keywords such as "Higher education", "Learning", and "Teaching" are at the center of the map, showing a central role as a link between basic, niche, and motor themes. This position reflects that these themes remain key contexts for PjBL development and application, but do not yet demonstrate specific thematic strengths as motors or niches.

Visualization of the keyword co-occurrence network (figure 6) revealed the main conceptual structures in the literature related to Project-Based Learning (PjBL) in higher education. Three dominant clusters are formed, each representing a different thematic orientation but conceptually interconnected.

The green cluster represents the dominance of keywords such as "higher education", "learning", and "sustainability". This cluster indicates that PjBL has been widely integrated in the context of higher education with a focus on sustainable development goals. This is in line with global demands for education that not only emphasize academic competence, but also strengthen awareness of social and environmental responsibility. The connection with keywords such as "academic research", "educational development", and "sustainable development" signifies a paradigm shift in higher education that emphasizes project-based transformative learning.

The blue cluster features keywords such as "students", "project-based learning", "curricula", "engineering", and "collaborative learning". The primary focus on student engagement in active and collaborative learning processes reinforces the position of PjBL as an effective pedagogical approach in building 21st century skills, including critical thinking, teamwork, and problem solving. Keywords such as software, internet of things, and artificial

intelligence indicate that PjBL is also widely applied in technology and engineering contexts, reinforcing the integration between digital innovation and experiential learning approaches.

Meanwhile, the red cluster, which includes keywords such as "education", "humans", "male", "female", and "peer review", reflects the socio-demographic and methodological dimensions of PjBL research. This suggests that some studies also consider humanistic variables, such as gender and age, as well as quality assurance practices through peer review in the development and evaluation of PjBL implementation.

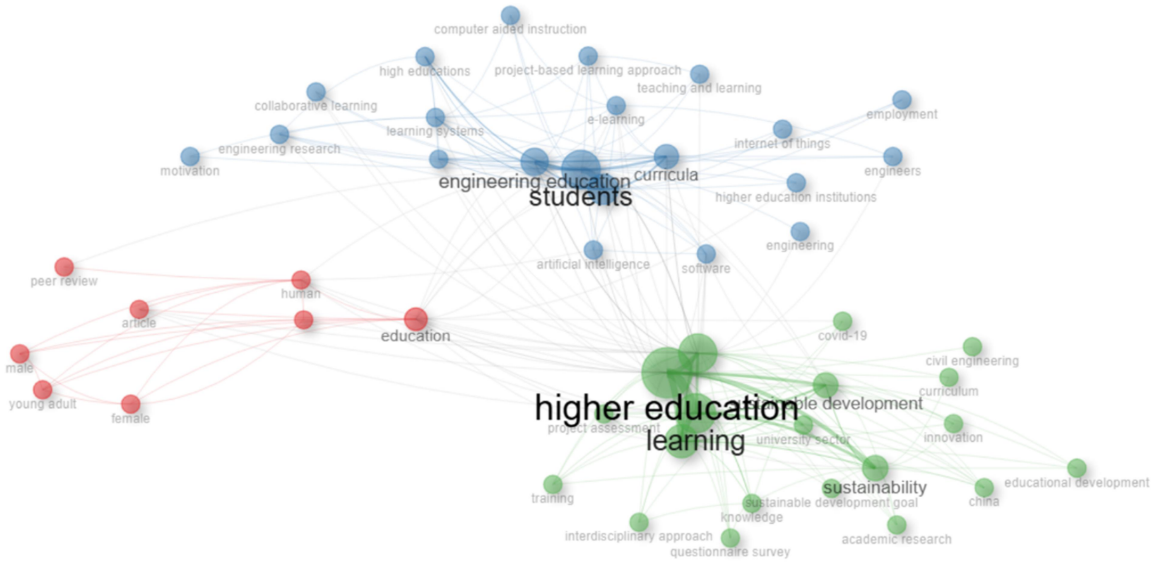


Figure 6. Keyword network of PjBL caps in higher education

RQ4 Disciplines implementing PjBL in higher education

The development of the use of PjBL learning models shows the diversity of various disciplines. Social sciences, stem, engineering, linguistics, and multidisciplinary dominate the research focus on this topic (table 8).

Table 8. Disciplines that apply PjBL in higher education

Number	Author	Discipline	Research Subject
1	(Alamri, 2021; Al-Busaidi & Al-Seyabi, 2021; Espino-Díaz et al., 2025; Fernandes, 2023; Granado-Alcón et al., 2020; Hasan et al., 2023; Istiningsih et al., 2024; Son & Penry, 2022)	**Social science**	**Higher education**
2	(Bolick et al., 2024; Hargraves et al., 2021; Taconis & Bekker, 2023)	**STEM**	**Higher education**
3	(Ekayana et al., 2024; González-Domínguez et al., 2020; Karkoub et al., 2020; Kim, 2019; Leung	**Engineering**	**Higher education**

	et al., 2024; Paleenud et al., 2024; Torrijo et al., 2021; Unzueta & Eguren, 2023)		
4	(Gao et al., 2024; Kusmanto et al., 2024; Martins & Ferreira, 2019; Nguyen, 2021; Rochmahwati et al., 2024)	**Linguistics**	**Higher education**
5	(Alrasheed & Hamdan Alghamdi, 2023; Crespí et al., 2022; Jaiswal et al., 2021; Lake et al., 2021; Mohammed, 2017; Sydorenko et al., 2024)	**Multidisciplinary**	**Higher education**
6	(Santoso et al., 2023)	**Entrepreneurship**	**Higher education**
7	(Mayar et al., 2023)	**Art**	**Higher education**

Contributions to social science disciplines are shown in research conducted by (Alamri, 2021; Al-Busaidi & Al-Seyabi, 2021; Espino-Díaz et al., 2025; Fernandes, 2023; Granado-Alcón et al., 2020; Hasan et al., 2023; Istiningsih et al., 2024; Son & Penry, 2022). Research in social science disciplines tends to examine aspects of student engagement, psychosocial, and pedagogical transformation. The existence of PjBL topics in social science disciplines shows that PjBL can be applied to social science disciplines, which at first the perception in the social community thought that social science was rote science.

STEM and engineering disciplines show high intensity (table 8). This indicates the suitability of the PjBL learning model with related disciplines. STEM and engineering disciplines are sciences with characteristics based on practice, experimentation and problem solving. PjBL in the engineering curriculum can improve students' collaborative skills and systematic thinking (Bolick et al., 2024; González-Domínguez et al., 2020).

The discipline of linguistics is emerging as an interesting context for the application of PjBL. The results of research conducted by (Gao et al., 2024; Kusmanto et al., 2024)show that the application of PjBL in a linguistic context is able to improve language acquisition through context-based authentic activities, although the application in linguistic disciplines is still limited.

The PjBL learning model is also applied in a multidisciplinary context which indicates that PjBL can be applied in various disciplines through an integrative approach. Studies in these disciplines as a cross-field medium in developing soft skills and transversal competencies of students.

Meanwhile, the arts and entrepreneurship disciplines are still relatively minor. Specifically, only a few studies devoted to the exploration of PjBL in the context of entrepreneurship (Santoso et al., 2023) (Mayar et al., 2023).or in artistic development

These findings indicate a recognition of the effectiveness of PjBL in a wide range of disciplines in higher education. The disciplines of social science, STEM, engineering, and linguistics are the most dominant disciplines in applying PjBL. The dominance of engineering, STEM, and social science disciplines reflects the recognition of the effectiveness of PjBL in

developing students' cognitive, affective, and psychomotor abilities. However, these findings are still not found in the disciplines of entrepreneurship and arts which could be the potential for PjBL development in these two disciplines.

The results of bibliometric analysis show the growth rate of scientific publications on the topic of PjBL in higher education is 1,06% which is an indication that this topic has entered the maturity stage. The maturity stage generally has a scientific community that has been built and an even distribution of publications.

However, although bibliometric indicators state that this topic has matured, empirical conditions in various higher education institutions, especially in developing countries, show significant disparities in its implementation. The implementation of PjBL still faces a number of barriers such as limited lecturer competence in authentic project design, resistance to change from traditional learning, and lack of technology-based learning infrastructure support. This indicates a mismatch between the conceptual maturity in the literature and the implementative reality in the field.

Keyword distribution and co-occurrence analysis confirmed that PjBL is widely integrated with contemporary issues such as "sustainability", "higher-order thinking", and "collaborative learning". However, the dominance of keywords such as "engineering education" and "curricula" also shows that the focus of PjBL is still very much centered on engineering and STEM disciplines. Empirically, today's challenges demand students' abilities in entrepreneurship, humanities, and creative arts that have not been optimized by the PjBL approach in scientific publications. Thus, there is a gap between the urgency of multidisciplinary competencies in the field and the thematic focus in academic literature.

Geographically, the dominance of countries such as Spain, Indonesia and the United States shows that attention to PjBL has spread in both developed and developing countries. However, the level of international collaboration is still low (18,87%), and research is still largely locally rooted without strong global networks. This has an impact on the limited generalizability of findings and the slow process of adaptation across educational cultures. In fact, based on current empirical conditions, the issue of globalization of education, cross-country learning, and adaptation of local culture-based learning models is increasingly urgent to study.

Furthermore, the results of thematic mapping show that most of the themes of PjBL research are still in the category of basic and niche themes. Themes such as students, learning, and project-based learning are crucial, but the approach used tends to be descriptive and has not fully addressed the transformational dimension of PjBL - namely how project-based learning can change students' identity, values, and professional orientation. This has the potential to reduce the substantive impact of PjBL in the long run if it is not followed up with a more transformative and critical research approach.

The findings also show that most of the articles were written by only one author (97,7%), indicating that PjBL research is still dominated by individual or institutional approaches. In fact, the complexity of implementing PjBL requires cross-institutional, cross-disciplinary, and cross-country collaboration to answer the challenges of curriculum, authentic assessment, and personalization of learning.

CONCLUSION

PjBL in higher education is a topic that is widely studied by researchers in various worlds and various disciplines. Although bibliometrically this topic has been in a steady state, empirically

there are still implementation challenges, thematic limitations, and lack of global dialog that hinder the diffusion of knowledge and pedagogical innovation.

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