Trend Research of Project-Based Learning in The Database Scopus 1964-2023

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Abstract

This research intends to track the progress and focus of project-based learning research in Scopus publications. Researchers focus on analyzing Scopus-indexed publications on project-based learning from 1964 to 2023 using bibliometric analysis techniques. Data was analysed using Excel, R/R-Studio. VOSviewer provides a visual analysis of keywords and document citations co-occurring. The author found research data of 1,803 published documents according to the function, subject, and criteria specified. This research demonstrates an annual growth rate of 8.04% for project-based learning research and the highest number of publications in 2022. The United States had the most research papers, while National Taiwan Normal University had the most document affiliates. Barak, M. and Yang, S.C. became the most productive writers on project-based learning themed. Researchers were limited to using Scopus data for bibliometric analysis. The study solely focused on one database without considering other national or international databases. The research presents a brief literature review on learning methods for educators, with recommendations for future research in the field of education.

Introduction

The rapid development of technology and science in the 21st century dramatically facilitates life (Hariyadi & Darmuki, 2023), makes everything fast and instant in accessing the desired information (Efendi & Maksum, 2022), but also demands individuals to upgrade their life skills (Bui & Nguyen, 2021). It found that many education graduates need more soft skills, making it challenging to meet professional demands (Yong & Saad, 2023). So, it is the task of education today (de S. Oliveira & de Souza, 2022) to reform in order to create quality graduates (Andriyani & Apriantoro, 2023) through assistance and development of individual potential (Insani & Maksum, 2023), including (Rushd, 2017), mind, body, hopes, thoughts, until can growth the identity of the nation (Maksum et al., 2021) in a comprehensive and integrated manner (Dartim & Ali, 2022).

Education in the 21st century is more focused on developing students' skills (S.-K. Chen et al., 2023), namely critical thinking, effective communication, collaboration, and creativity, better known by the abbreviation 4C (Hariyadi & Darmuki, 2023; Rati et al., 2023). In an era with much information that is occasionally unknown, critical thinking—or the capacity to analyse and come up with a solution to a problem—is essential (Chua & Islam, 2021; Rofik et al., 2022). Additionally, collaboration skills help foster the development of other abilities like adaptability, communication, problem-solving, information sharing, and responsibility (Siswono et al., 2018). These abilities can be developed using appropriate learning models to transmit knowledge and develop student abilities (Gutiérrez-Martínez et al., 2021).

The abilities needed in the 21st century will not be more accessible if the learning process is teacher-centered while students tend to listen more (Pantiwati et al., 2023). So, one of the learning model options that is known to be more modern and effective in developing thinking skills (C.-S. Chen & Lin, 2019; Janor et al., 2013) and student creativity in solving real-world problems is project-based learning (Lukitasari et al., 2021; Ökmen et al., 2022; Zhang et al., 2018).

Project-based learning was first initiated by John Dewey (Zulu, 2011) from several scientific works that focus on learning by doing (Ghosheh Wahbeh et al., 2021). It was continued by Klipatrick, who defined it as a series of activities to solve problems based on solid experiments resulting from teamwork (Ayaz & Söylemez, 2015). Vygotsky's social constructivist theory (Bronfman, 2007) further supports Project-based Learning activities that learning with this model is more effective because there is a transaction of opinions between learners, thus helping them to develop thinking skills and gain more knowledge (Ghosheh Wahbeh et al., 2021).

Several aspects are needed in project-based learning (Siswono et al., 2018): authentic, real-world challenges, applying high-performance skills, active exploration, interacting and establishing relationships with adults, and assessment practices. Project-based learning always ends with a product's publication according to the team discussion's creativity (Ortega-Sánchez & Jiménez-Eguizábal, 2019; Sudjimat et al., 2020). Thus, we know that project-based learning can train them to

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develop several skills, including problem-solving strategies skill (Glazewski & Ertmer, 2020; Shekhar & Borrego, 2017; Whelan et al., 2008), working in groups (Karppinen et al., 2019), creating authentic products as the final result (Reynolds et al., 2009), and learning cooperation, responsibility, critical thinking, and decision-making (Isa et al., 2020; Jalinus et al., 2019; Mimica, 2010; Žnidaršič, 2020).

The many 21st-century capabilities that are grown through the project-based learning model make researchers want to critically analyse the findings of existing publications to enrich the scientific treasures in the field of education and provide projections for future research proposals. Researchers need the availability and accuracy of previous research and the tools that play a role in analyzing it. Bibliometric analysis is one of the tools that play a role in determining the distribution of a scientific publication (Muh. Asriadi et al., 2023), examines the interaction between science and technology (Apriantoro et al., 2022), tracking the development of new science, and helping strategic mapping of science fields in the future (Belmonte et al., 2020; Boquera et al., 2021; Zheng et al., 2019).

This study aims to map the development and research direction of the Project Based Learning model in publications indexed by the Scopus database from 1964 to 2023. The year 1964 was chosen by researchers because that year was the first time there was a publication on Project Based Learning, as many as 1 document.

Previous Research

Previous research is needed to add to the literature review and strengthen the originality of this research. Research conducted by (Yong & Saad, 2023) shows that approaches that involve students' activeness in the learning process can develop knowledge and higher-order thinking skills and maximize the use of foreign languages to bring out life's creativity. In addition, (Yong & Saad, 2023) also added that learners prefer project-based learning because it is more effective and empowering than teaching with the lecture method.

Project-based learning is also famous for its flexibility, and this is evidenced by research (Pantiwati et al., 2023), which found project-based learning practices combined with literacy and character education activities (character education integrated project-based literacy: Li-Pro-GP). The results showed that students who received the Li-Pro-GP learning model tended to think more broadly because, with projects, they were trained to analyse, interpret, and evaluate problems critically as the culmination of creating a work. In addition, project tasks encourage learners to express their opinions about their findings because expressing opinions is a skill that has an essential role in life, both in Society and place.

Research by (Ghosheh Wahbeh et al., 2021) discusses the implementation of project-based learning to develop communication skills in Arabic language subjects. In the project planning stage, the teacher introduces students to the problem of child labour. Then, divide learners into groups to carry out a public awareness campaign on the dangers of child labour. Each group discussed and proposed products to make it easier for learners to carry out the campaign. Some groups make final products through short stories, poems, and brochures. The teacher only served as a learning facilitator, and learners carried out their tasks in groups, after which the results of the designed journal were posted on the school hall board, and some leaflets were distributed to school students. The impact of project activities on research (Ghosheh Wahbeh et al., 2021), among others, can increase self-confidence, and learners also practice being responsible for their learning.

The average achievement of the project-based group's cognitive domain was significantly higher than that of the other group. The findings (Alacapinar, 2008) showed a significant difference between the two groups regarding average pre- and post-test testing. Students stated that project-based learning increased creativity and high-level skills, helped obtain more information, and increased cooperation and collaboration with their classmates, creating a sense of trust between friends.

Meanwhile, the novelty of this research is the use of bibliometric analysis methods that have yet to be widely applied in previous studies. This is to provide the advancement of literature in the field of education through analysis and visualization of Scopus-indexed research publications, such as research growth every year and the most productive countries, affiliations to the authors.

Research Method

The method used in this study is bibliometric analysis. Researchers obtained the data through a Boolean search engine to comb through the Scopus database from 1964 to 2023. The search was conducted on August 12, 2023, at 12: 43 pm. Researchers then analysed citation data, document content, and networking using R/RStudio, VOSviewer, and Microsoft Excel tools. There are three stages to processing the dataset that has been obtained.

In the first stage, researchers conduct a literature review of related themes to ensure that relevant research is carried out with bibliometric topics. In addition, a literature review helps determine appropriate keywords and is considered to represent the scope of research.

In the second stage, researchers used the Boolean OPERATOR TITLE-ABS-KEY (project AND based AND learning AND in AND class) on a Scopus search and generated 6,946 documents. Furthermore, filtration is carried out with Boolean operators (LIMIT-TO (SUBJAREA, "SOCI") AND (LIMIT-TO (DOCTYPE, " ar") AND (LIMIT-TO (SRCTYPE, "J") AND (LIMIT-TO) LANGUAGE, "ENGLISH")), while limiting this research, only to articles sourced from journals, using English and the subject area of social science, resulting in a final document of 1803.

In the last stage, researchers analyse the final document search using Scopus analyser and R and RStudio to determine the number of documents per year by journal, author, affiliation, country, and subject/field. Next, analyse the network level

of the document with visualization through VOSviewer and Microsoft Excel data processing. This research procedure can be seen in Figure 1.
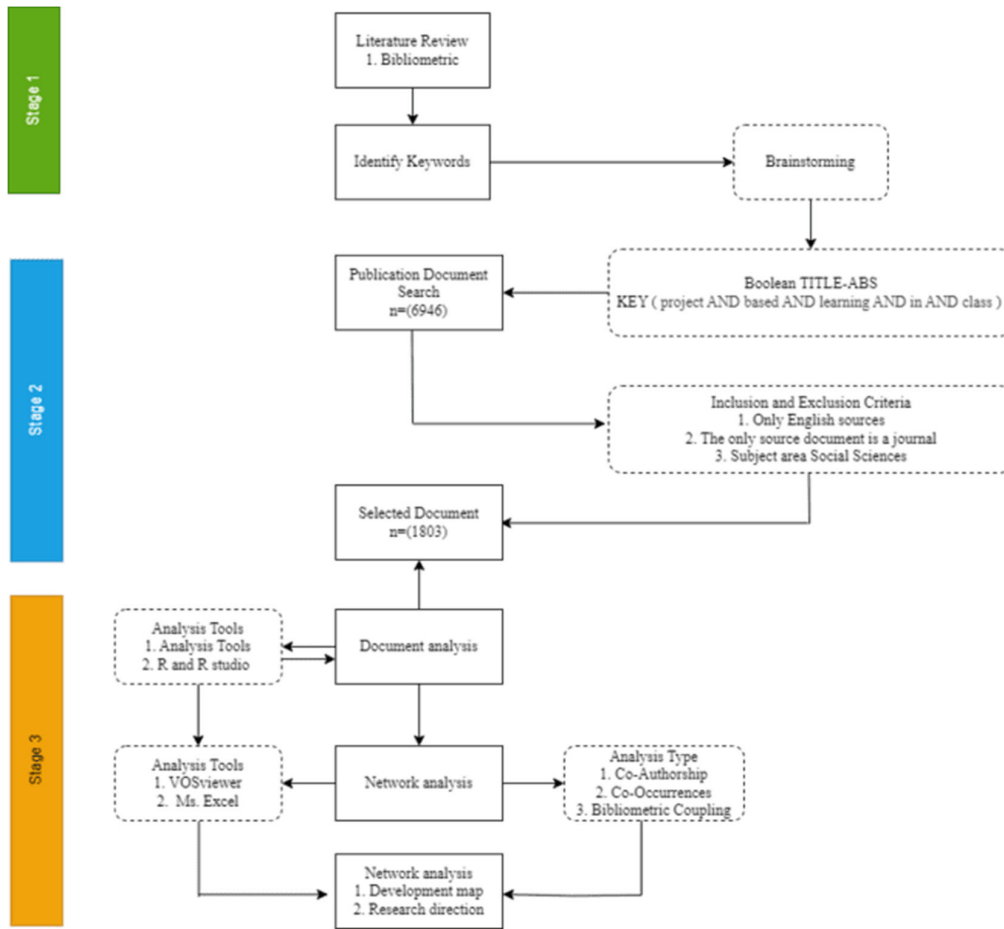

Figure 1. Research Flow Diagram

Result and Discussion
Document Analysis

Table 1 shows a summary of 1803 Scopus-indexed Project Based Learning themed documents that have been collected over 59 years. The following table shows some information, including the number of authors is 4855, 439 single authors, the percentage of international authorship collaboration is 9.489%, and the number of references used by the authors is 61057, with an average document citation per year of 14.22.

Table 1. Project-based Learning Research Summary

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1964:2023
Sources (Journals, Books, etc)	674
Documents	1803
Annual Growth Rate %	8,04
Document Average Age	8,09
Average Citations Per Doc	14,22
References	61057
DOCUMENT CONTENTS	
Keywords Plus (ID)	3012
Author's Keywords (DE)	4672
AUTHORS	
Authors	4855
Authors Of Single-Authored Docs	439
AUTHORS COLLABORATION	

Single-Authored Docs	451
Co-Authors Per Doc	2,84
International Co-Authorships %	9,489
DOCUMENT TYPES	
Article	1803

Documents by Year

Figure 2 shows the development of Scopus-indexed Project-Based Learning-themed publications from 1964 to 2023. Research publications with this theme first appeared in 1964 in as many as 1 documents and experienced stagnation until 1993, but they peaked again at the end of the 20th century, precisely in 2022, with 186 documents.
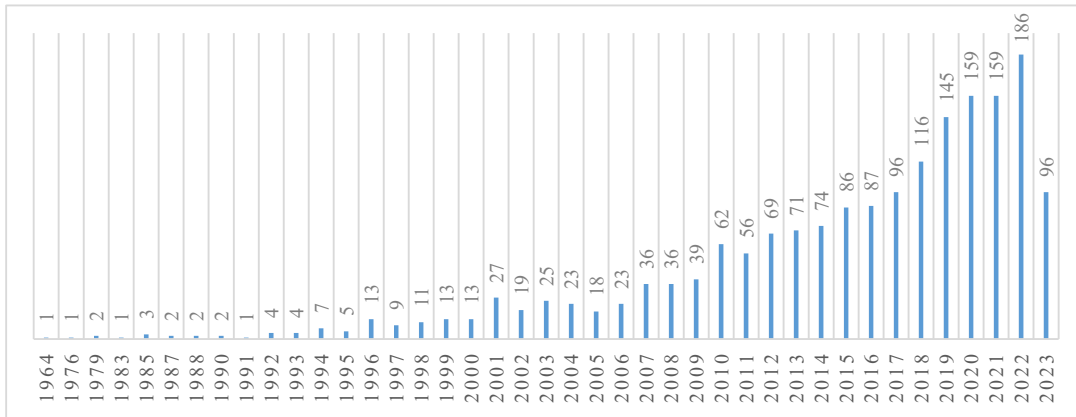
Figure 2. Documents by Year

Documents by Authors

Figure 3 shows the ten most influential authors in Scopus-indexed Project-Based Learning-themed publications based on the number of documents. The most actively contributing authors are Barak, M. and Yang, S.C., with four published documents. They are followed by Anaya, R.H., Chang, C.C., Chu, S.K.W., Chua, K.J., Eilks, I., Espinoza, P.A., Gomez, H., and Hemmit, H with the number of publications of 3 documents each.
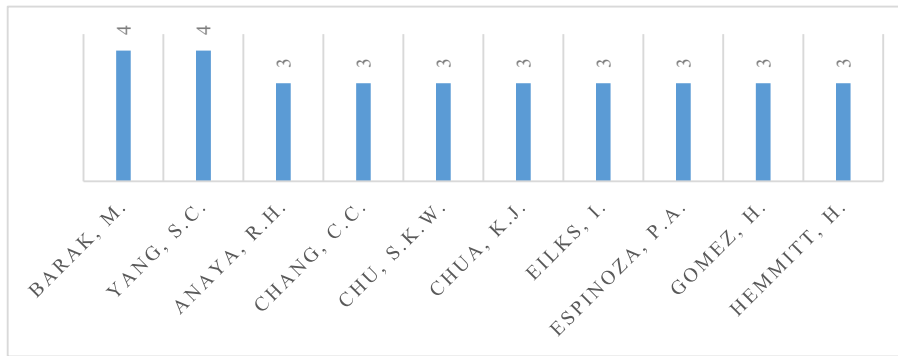

Figure 3. Documents by Authors

Documents by Affiliation

Figure 4 shows the ten most influential affiliates in Scopus-indexed Project-Based Learning-themed publications. The affiliate that contributed the highest number of publications of 19 documents was the National Taiwan Normal University, followed by Affiliates of the University of Michigan, Ann Arbor, and Universitas Negeri Malang with 16 documents, and The University of Hong Kong with 13 documents. Other affiliates also contributed that have almost the same number of publications, in the range of 9-19 documents.
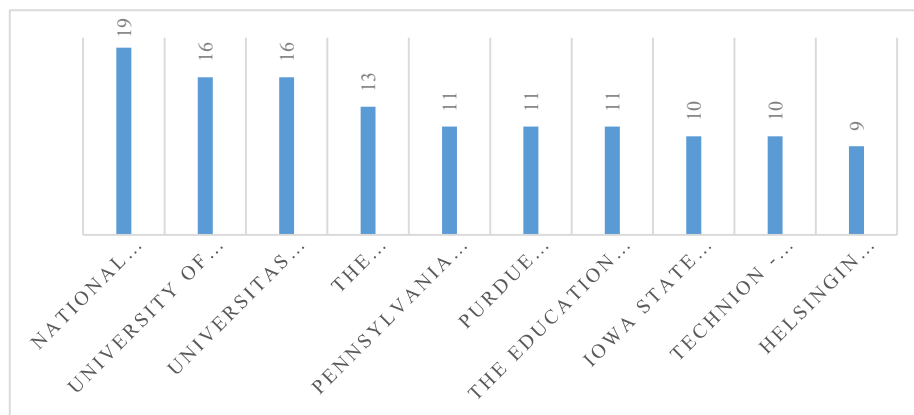
Figure 4. Documents by Affiliation

Documents by Country

Figure 5 shows the number of publications by country with the Scopus-indexed Project-based learning research theme. The most assertive dominance comes from the Asian continent, followed by the continents of Europe, America, and Australia. This dominance can be proven by the number of Asian continent countries that actively contribute more publications than countries from other continents. Countries from the Asian continent include Indonesia, Taiwan, China and Hong Kong. The European continent became the second continent that also dominated publications, originating from 3 countries, namely England, Spain, and Germany. They were followed by the United States and Canada from the American continent and the country of Australia from the Australian continent. Thus, it can be seen that research-themed Project Based Learning is quite popular and carried out on the Asian continent.
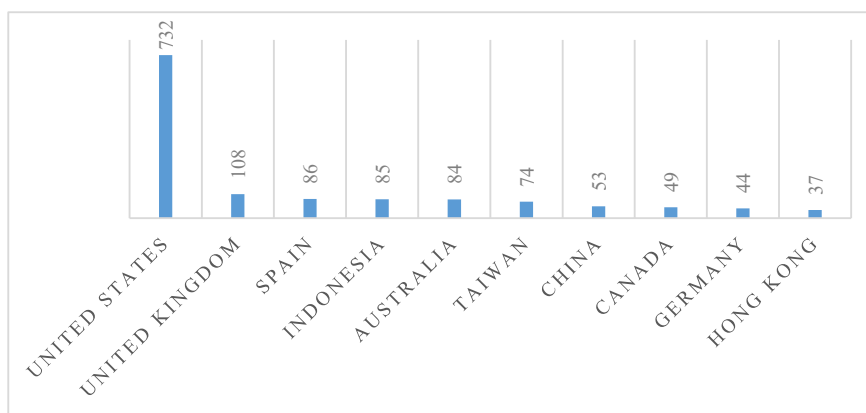

Figure 5. Document by Country

Documents by Source

Figure 6 shows ten journals that actively contribute to the Scopus-indexed Project-based Learning theme publication led by the Journal of Chemical Education, which has a total of 57 publications, followed by the International Journal of Engineering Education with 39 documents, Sustainability Switzerland Teaching with 31 documents, Computers and Education with 27 documents, and other journals that have almost the same number of publications, in the range of 17-22 documents.
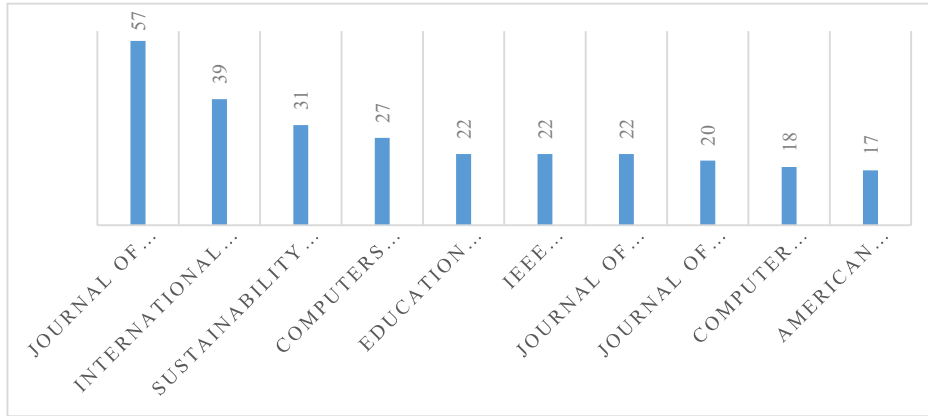
Figure 6. Documents by Source
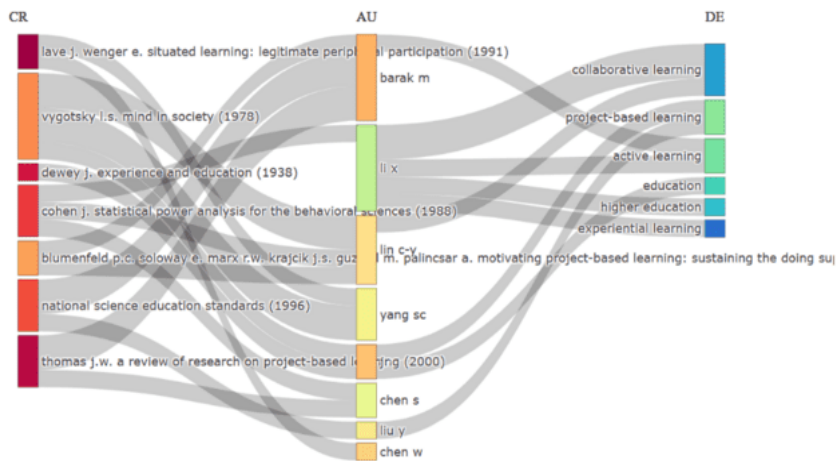
Three-Field Plot

Figure 7. Three-Field Plot

Figure 7 is a Three-Field Plot image containing three elements observed by the author, including references (CR element), author names (AU element), and keywords (DE element). The three elements are then connected by grey plot lines that are linked to each other. The CR element is a reference article used by the authors. Mind in Society (1978) became the most widely used reference by the author to publish documents themed Project Based Learning, which was as many as three outflows and had a thicker stem size compared to others—followed by the article Statistical Power Analysis for the Behavioral Science (1988) with an outflow of 3. Furthermore, the article National Science Education Standards (1996) has 2 outflows, and the article A Review of Research on Project-based Learning (2000) has 2 outflows.

Based on the image above, the authors (AU element) who most popularly publish their research can also be identified. The bar chart's size shows that among the eight authors who contributed the most are Barak M., Li X., Lin-CY., Yang SC, and JR. The DE element is a keyword that is the result of the author's research topic that is connected to a reference article regarding the topic of Project Based Learning. From the results of the analysis conducted by researchers, there are six main keywords. The words Collaborative Learning, Project-based Learning, and Active Learning are at the top, with two inflows. Thus, this word is very closely related to research related to Project-based Learning.

Corresponding Author's Countries

From the picture below, researchers try to show the countries that most often publish authorship, individually and in collaboration with other countries. The United States is the country that has the most published documents, both the results of Multiple Country Publication (MCP) and Single Country Publication (SCP), followed by China, Britain, Spain, and America. From the picture below, we also know the continent that dominates the study: Asia.
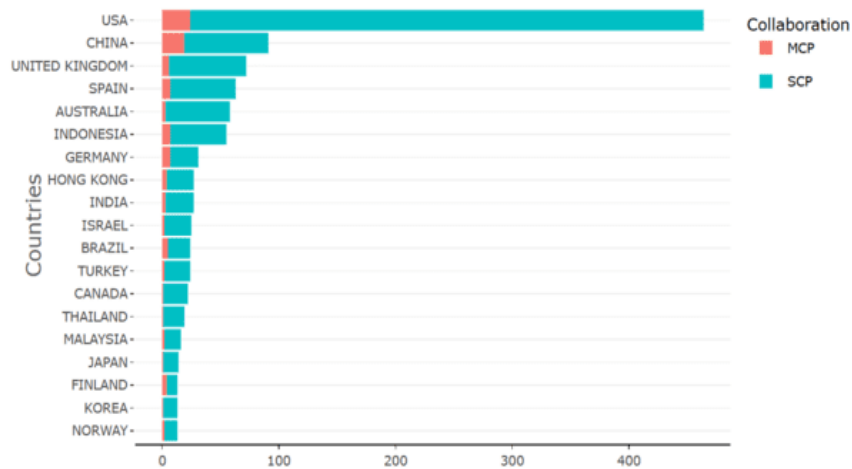
Figure 8. Corresponding Author's Countries

Most Global Cited Document

Based on the table below, it can be seen that Osborne J's paper, 2004, J Res Sci Teach, has the most total citations (TC) and the most extensive total citations per year (TC per Year). Through the table, we can also know that total citations (TC) do not affect the total citations per year (TC per Year), and the year the paper is published also does not affect the total citations (TC).

Table 2. Most Global Citied Document

| Paper	Total Citations	TC per Year
Osborne J, 2004, J Res Sci Teach	853	42,65
Huizenga J, 2009, J Comput Assisted Learn	380	25,33
Gutstein E, 2003, J Res Math Educ	280	13,33
Mclaughlin Je, 2013, Am J Pharm Educ	254	23,09
Ballantyne R, 2002, Assess Eval High Educ	231	10,50
Grover S, 2015, Comput Sci Educ	211	23,44
Freed Bf, 2004, Stud Second Lang Acquis	205	10,25
Chang S-C, 2018, Comput Educ	202	33,67
Wallace Rm, 2000, J Learn Sci	199	8,29
Stockwell G, 2007, Comput Assisted Lang Learn	182	10,71

Network Analysis
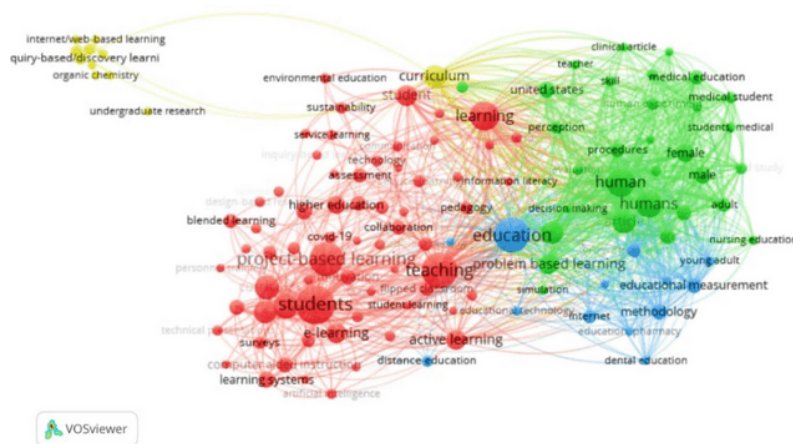
Figure 9. Occurrence Analysis

The picture above results from occurrence analysis from Project-based Learning research using VOSviewer tools with a minimum cluster size of 1. These results found that there were 4 clusters, namely red, green, blue, and yellow clusters. The red cluster consists of 66 items, the green cluster consists of 31 items, the blue cluster consists of 13 items and the yellow cluster consists of 11 items.

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The keyword "Education" is the dominating word with a total link of 1317 strength, the keyword "Human" has a total link of 1300 strength, the keyword "Teaching" is the dominating word with a total link of 1241 strength, the keyword "Students" has a total link of 1009 strength, the keyword "Learning" has a total link of 868 strength, the keyword "Problem-Based Learning" has a total link of 646 strength, the keyword "Curriculum" has a total link of 639 strength, the keyword "Project Based Learning" has a total link of 386 strength.
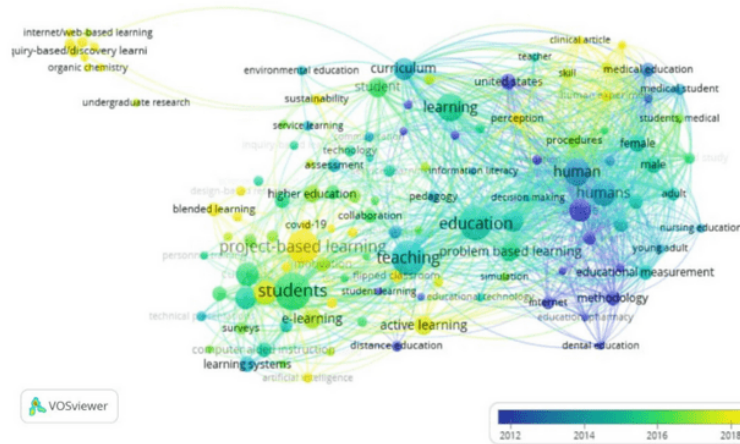

Figure 10. Keyword Network Analysis

The image above is a keyword network analysis based on overlays. It can be seen that the words Project-based Learning, Active Learning, Discovery Learning, Blended Learning, Web-based Learning, and Sustainability are the keywords of the latest research, around 2018 to 2023. The keywords Methodology, Distance Education, Educational Measurement, Learning System, and Curriculum are keywords with relatively long usage.

Figure 11. Research Density

The picture above is an analysis of research density. Keywords with high density are those with light colours, among others, education, students, teaching, and learning. Keywords with a dark or less clear colour have yet to be widely studied, such as project-based learning, internet / web-based learning, and active learning.

The Occurrences of Each Cluster
The table below shows the occurrence in each cluster that represents the central theme in the research field of Project Based Learning. The theme of the first cluster is Learning Method, the theme in the second cluster is Capability development, the theme in the third cluster is Evaluation Measurement, and the theme of the fourth cluster is student.

Table 3. The Occurrence in Each Cluster

Keyword	Occurrences	Cluster
1. Students	229	1
2. Teaching	194	
3. Project-based Learning	179	
4. Learning	132	
5. Active Learning	63	
1. Human	132	2
2. Female	48	
3. Male	45	
4. Pilot Project	36	
5. Procedures	32	
1. Education	185	3
2. Methodology	36	
3. Educational Measurement	34	
4. Program Evaluation	27	
5. Internet	27	
1. Curriculum	80	4
2. Inquiry-based/ discovery learning	22	
3. Laboratory instruction	21	
4. Upper-division undergraduate	20	
5. First-year undergraduate	15	

Conclusions

Based on the research that has been done, it is known that there is a positive growth in Project-based Learning research of 8.04%, with the peak of publication occurring in 2022. Authors Barak, M. and Yang, S.C., are the most relevant authors with four publications. National Taiwan Normal University is the most influential and high-productivity affiliate, with 19 documents. The United States has the most publications, with 782 documents. Thus, the continent that dominates publications comes from the Asian continent. The Journal of Chemical Education is the most relevant source of publication with the theme of project-based learning in as many as 57 documents. Barak, M., and li X are the most influential authors producing 4 main keywords from the Three Fields Plot analysis. Osborne J, 2004, J Res Sci Teach is the document with the most extensive total citations of 853, with an average citation per year of 42.65 on the global citation index. In network analysis, several keywords dominate, including "Education", with a total link strength of 1317; the word "Problem-based Learning" has a total link strength of 646; the keyword "Curriculum" has a total link of 639 strength, the keyword "Project Based Learning" has a total link of 386 strength. Active Learning, Discovery Learning, blended learning, and sustainability are the most used keywords from 2018 to 2023. These keywords indicate the novelty of research in project-based learning or education.

Based on The Occurrence in Each Cluster, it is known that there are four main themes: Cluster 1 is Learning Method, cluster 2 is Capability development, cluster 3 is Educational Measurement, and Cluster 4 is Student. However, this study has limitations, only analyzing Scopus data without considering other databases and only considering English documents. Future research is expected to explore other databases, such as WOS, and consider analysis with more complex languages.

Acknowledgments

References

Alacapinar, F. (2008). Effectiveness of project-based learning. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, *33*, 17–34. https://www.scopus.com/inward/record.uri?eid=2-s2.0-57549108899&partnerID=40&md5=a87cbe2dfc553b64556e4080316a52f7

Andriyani, N., & Apriantoro, M. S. (2023). Enhancing Students Cognitive Abilities in Integrated Islamic High Schools: A Need-Based Analysis for Developing Chemistry Modules Infused with Islamic Values. *International Journal of Humanities and Social Science Studies*, *1*(1), 1–10.

Apriantoro, M. S., Mellinia, R. ', Maheswari, S. G., & Hudaifah. (2022). Islamic Financial Research Directions During Pandemic : A Bibliometric Analysis. *At-Taradhi: Jurnal Studi Ekonomi*, *XIII*(5).

Ayaz, M. F., & Söylemez, M. (2015). The effect of the project-based learning approach on the academic achievements of the students in science classes in Turkey: A meta-analysis study. *Egitim ve Bilim*, *40*(178), 255–283. https://doi.org/10.15390/EB.2015.4000

Belmonte, J. L., Segura-Robles, A., Moreno-Guerrero, A.-J., & Parra-González, M. E. (2020). Machine learning and big data in the impact literature. A bibliometric review with scientific mapping in web of science. *Symmetry*, *12*(4). https://doi.org/10.3390/SYM12040495

Boquera, L., Castro, J. R., Pisello, A. L., & Cabeza, L. F. (2021). Research progress and trends on the use of concrete as thermal energy storage material through bibliometric analysis. *Journal of Energy Storage*, *38*. https://doi.org/10.1016/j.est.2021.102562

Bronfman, S. V. (2007). Beyond technocentrism and infocentrism: designing effective e-learning courses for professional education. *International Journal of Continuing Engineering Education and Life-Long Learning*, *17*(6), 406–417. https://doi.org/10.1504/IJCEELL.2007.015590

Bui, G. T. T., & Nguyen, H. T. M. (2021). Students' and Teachers' Perceptions on the Impacts of Service-Learning in a Language Course. *Pertanika Journal of Social Sciences and Humanities*, *29*(3), 69–84. https://doi.org/10.47836/pjssh.29.s3.04

Chen, C.-S., & Lin, J.-W. (2019). A Practical Action Research Study of the Impact of Maker-Centered STEM-PjBL on a Rural Middle School in Taiwan. *International Journal of Science and Mathematics Education*. https://doi.org/10.1007/s10763-019-09961-8

Chen, S.-K., Yang, Y.-T. C., Lin, C. P., & Lin, S. S. J. (2023). Dispositions of 21st-Century Skills in STEM Programs and Their Changes over Time. *International Journal of Science and Mathematics Education*, *21*(4), 1363–1380. https://doi.org/10.1007/s10763-022-10288-0

Chua, K. J., & Islam, M. R. (2021). The hybrid Project-Based Learning–Flipped Classroom: A design project module redesigned to foster learning and engagement. *International Journal of Mechanical Engineering Education*, *49*(4), 289–315. https://doi.org/10.1177/0306419019838335

Dartim, & Ali, M. (2022). Studi Filosofis Konsep Pendidikan Menurut Hamka dan Relevansinya dengan Sistem Perkaderan Muhammadiyah. *HEUTAGOGIA: Journal of Islamic Education*, *2*(2), 20–33. https://ejournal.iainbukittinggi.ac.id/index.php/fuaduna/article/view/4260/pdf.

de S. Oliveira, K. K., & de Souza, R. A. C. (2022). Digital Transformation towards Education 4.0. *Informatics in Education*, *21*(2), 283–309. https://doi.org/10.15388/infedu.2022.13

Efendi, H., & Maksum, M. N. R. (2022). Efektivitas Pengajian Rutin Terhadap Peningkatan Religiusitas Siswa Kelas VII Di Smp Negeri 2 Sawit Boyolali. *Issedu: Journal of Islamic Educational Thoughts and Practices*, *6*(2), 239–250. https://doi.org/10.23917/iseedu.v6i2.22124

Ghosheh Wahbeh, D., Najjar, E. A., Sartawi, A. F., Abuzant, M., & Daher, W. (2021). The role of project-based language learning in developing students' life skills. *Sustainability (Switzerland)*, *13*(12). https://doi.org/10.3390/su13126518

Glazewski, K. D., & Ertmer, P. A. (2020). Fostering complex problem solving for diverse learners: engaging an ethos of intentionality toward equitable access. *Educational Technology Research and Development*, *68*(2), 679–702. https://doi.org/10.1007/s11423-020-09762-9

Gutiérrez-Martínez, Y., Bustamante-Bello, R., Navarro-Tuch, S. A., López-Aguilar, A. A., Molina, A., & Longoria, I. Á.-I. (2021). A challenge-based learning experience in industrial engineering in the framework of education 4.0. *Sustainability (Switzerland)*, *13*(17). https://doi.org/10.3390/su13179867

Hariyadi, A., & Darmuki, A. (2023). The Effectiveness of PBL Collaborated with PjBL on Students' 4C in the Course of Basic Education. *International Journal of Instruction*, *16*(3), 897–914. https://doi.org/10.29333/iji.2023.16348a

Insani, Z. N., & Maksum, M. N. R. (2023). INOVASI KREATIF GURU BIMBINGAN KONSELING DALAM MENINGKATKAN MOTIVASI BELAJAR SISWA DI SMA AL-FIRDAUS SUOHARJO. *Jurnal Bimbingan Konseling Indonesia*, *8*(3), 127–135.

Isa, M. U., Kamin, Y. B., Salihu, Y. I., Shuaibu, H., & Cledumas, A. M. (2020). Enhancing employability skills of woodwork technology education students through project based learning at colleges of education (technical) in Nigeria. *Universal Journal of Educational Research*, *8*(9A), 31–40. https://doi.org/10.13189/ujer.2020.082005

Jalinus, N., Jama, J., Irfan, D., Efendi, R., & Ropianto, M. (2019). Competence improvement of visual basic programming through project-based learning. *International Journal of Scientific and Technology Research*, *8*(9), 1757–1760. https://www.scopus.com/inward/record.uri?eid=2-s2.0-

85073413514&partnerID=40&md5=83a1cdb2d60d40496a3fc428991387b0

Janor, H., Rahim, R. A., Rahman, A. A., Auzairy, N. A., Hashim, N. A., & Yusof, M. Z. (2013). Integrating student-centered learning in finance courses: The case of a malaysian research university. *International Education Studies*, *6*(6), 108–123. https://doi.org/10.5539/ies.v6n6p108

Karppinen, S., Kallunki, V., & Komulainen, K. (2019). Interdisciplinary craft designing and invention pedagogy in teacher education: student teachers creating smart textiles. *International Journal of Technology and Design Education*, *29*(1), 57–74. https://doi.org/10.1007/s10798-017-9436-x

Lukitasari, M., Hasan, R., Sukri, A., & Handhika, J. (2021). Developing student's metacognitive ability in science through project-based learning with e-portfolio. *International Journal of Evaluation and Research in Education*, *10*(3), 948–955. https://doi.org/10.11591/IJERE.V10I3.21370

Maksum, M. N. R., Ramdhani, D., Fatimah, M., & Nisa, A. T. (2021). Realizing Democratic Education Through the Development of Pesantren Education Process. *Profetika: Jurnal Studi Islam*, *22*(2), 207–214. https://doi.org/10.23917/profetika.v22i2.16665

Mimica, M. (2010). Implementation of new educational methods: How to overcome obstacles? *Collegium Antropologicum*, *34*(SUPPL. 1), 11–14. https://www.scopus.com/inward/record.uri?eid=2-s2.0-77951890786&partnerID=40&md5=69f47a72609573939f483cb5c228d65a

Muh. Asriadi, A. M., Hadi, S., & Istiyono, E. (2023). Trend research mapping of differentiated instruction: A bibliometric analysis. *Journal of Pedagogical Research*, *7*(3), 194–210. https://doi.org/10.33902/JPR.202320544

Ökmen, B., Şahİn, Ş., & Kiliç, A. (2022). THE EFFECT OF PROJECT-BASED CHARACTER AND VALUES EDUCATION COURSE ON STUDENTS' KNOWLEDGE, SKILLS, VALUES AND ATTITUDES. *Milli Egitim*, *51*(236), 2947–2968. https://doi.org/10.37669/milliegitim.942450

Ortega-Sánchez, D., & Jiménez-Eguizábal, A. (2019). Project-based learning through information and communications technology and the curricular inclusion of social problems relevant to the initial training of infant school teachers. *Sustainability (Switzerland)*, *11*(22). https://doi.org/10.3390/su11226370

Pantiwati, Y., Kusniarti, T., Permana, F. H., Nurrohman, E., & Sari, T. N. I. (2023). The Effects of The Blended Project-Based Literacy that Integrates School Literacy Movement Strengthening Character Education Learning Model on Metacognitive Skills, Critical Thinking, and Opinion Expression. *European Journal of Educational Research*, *12*(1), 145–158. https://doi.org/10.12973/eu-jer.12.1.145

Rati, N. W., Arnyana, I. B. P., Dantes, G. R., & Dantes, N. (2023). HOTS-Oriented e-Project-Based Learning: Improving 4C Skills and Science Learning Outcome of Elementary School Students. *International Journal of Information and Education Technology*, *13*(6), 959–968. https://doi.org/10.18178/ijiet.2023.13.6.1892

Reynolds, B., Mehalik, M. M., Lovell, M. R., & Schunn, C. D. (2009). Increasing student awareness of and interest in engineering as a career option through design-based learning. *International Journal of Engineering Education*, *25*(4), 788–798. https://www.scopus.com/inward/record.uri?eid=2-s2.0-69949115563&partnerID=40&md5=7cedaae519f3447b9ccef93eeb489b17

Rofik, A., Setyosari, P., & Effendi, M. (2022). The Effect of Collaborative Problem Solving & Collaborative Project-Based Learning Models to Improve The Project Competences of Pre-Service Teachers. *Pegem Egitim ve Ogretim Dergisi*, *12*(3), 130–143. https://doi.org/10.47750/pegegog.12.03.15

Rushd, D. I. (2017). Personality of Transformative Muslim by Buya Hmka. *Issedu*, *1*(1), 219–236.

Shekhar, P., & Borrego, M. (2017). Implementing project-based learning in a civil engineering course: A practitioner's perspective. *International Journal of Engineering Education*, *33*(4), 1138–1148. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85022027950&partnerID=40&md5=9795ed28a6a7af3bda6a72913051f84e

Siswono, T. Y. E., Hartono, S., & Kohar, A. W. (2018). Effectiveness of project based learning in statistics for lower secondary schools. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, *2018*(75), 197–212. https://doi.org/10.14689/ejer.2018.75.11

Sudjimat, D. A., Nyoto, A., & Romlie, M. (2020). Implementation of Project-Based Learning Model and Workforce Character Development for the 21st Century in Vocational High School. *International Journal of Instruction*, *14*(1), 181–198. https://doi.org/10.29333/IJI.2021.14111A

Whelan, J. J., Spencer, J. F., & Rooney, K. (2008). A "RIPPER" Project: advancing rural inter-professional health education at the University of Tasmania. *Rural and Remote Health*, *8*(3), 1017. https://www.scopus.com/inward/record.uri?eid=2-s2.0-55549132963&partnerID=40&md5=e472c1055af286d8c9e5754d13552b90

Yong, M. F., & Saad, W. Z. (2023). Fuelling Grammar Mastery and 21st Century Skills Through Project-Based Learning. *Pertanika Journal of Social Sciences and Humanities*, *31*(1), 99–124. https://doi.org/10.47836/PJSSH.31.1.06

Zhang, J., Xie, H., & Li, H. (2018). Project based learning with implementation planning for student engagement in BIM classes. *International Journal of Engineering Education*, *35*(1), 310–322. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85060971082&partnerID=40&md5=11026c640a9e639d814d60688e53c8a2

Zheng, L., Chen, K., & Lu, W. (2019). Bibliometric Analysis of Construction Education Research from 1982 to 2017.

Journal of Professional Issues in Engineering Education and Practice, 145(3). https://doi.org/10.1061/(ASCE)EI.1943-5541.0000412

Žnidaršič, J. (2020). The impact of arts and cultural education on pupils' opinions of musical culture – interdisciplinary project. *Croatian Journal of Education*, *22*(specialedition), 11–24. https://doi.org/10.15516/cje.v22i0.3837

Zulu, C. (2011). Empowering first year (post-matric) students in basic research skills: A strategy for: For social justice. *South African Journal of Education*, *31*(3), 447–457. https://doi.org/10.15700/saje.v31n3a546