

Conference Paper

Bibliometric Analysis of Research Development Trends on Project-Based Learning

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ORCID IDRiza Weganofa: <https://orcid.org/0000-0002-1497-5023>**Abstract.**

This study aimed to analyze the developmental trend of national and international publications about Project Based-Learning (PjBL) through a systematic Literature Review (SRL) and bibliometric. The study also explores how scholars worldwide contributed to the SCOPUS databases from 2010 to 2022. A total of 2,003 papers comprised the sample. Data collection in this study was done by searching the SCOPUS website using the keywords 'Project-based Learning', PjBL, 'PjBL and research, instruction,' and 'PjBL and learning' with the category of the search being 'article titles, abstract in the period 2010-2022.' Data in the form of publications per year, journals containing PjBL articles, authors and subjects were analyzed using Microsoft Excel. The developmental trend of publications on PjBL was analyzed using the VosViewer software. The study results revealed that the number of scholarly articles on PjBL is increasing. Research findings can assist relevant researchers in recognizing PjBL research trends and recommending paths for further study.

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1. Introduction

Project-Based learning (PjBL) currently takes the spotlight as a learning method that empirically promotes 4Cs and other soft skills needed in the 21st century teaching mode [1], [2], [3], [4], [5]. This active learning method is believed to be able to stimulate critical thinking and creativity [6], [7], [8]. These two important skills are needed to be addressed by teachers as it is carefully well-designed through the curriculum. In critical thinking learning design, the students are doing activities that demand them to activate their higher order thinking skills. In other words, the students are not only able to use the language as a means of communication, but also to acquire knowledge, analyze problems, solve problems, innovate and pioneering [9]. This is possible as PjBL which is rooted from constructivist approach exposes students to decision making, problem

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solving and different types of investigative activities [10] through questioning posing and designing a project. Among the higher order thinking skills, the most developed skill is analysis while evaluation is the least although it is still effective as well [11]. Reflection methodology at the end of the syntax of project-based learning provokes students to comprehensively self-asses their achievement as well as their weakness. This allows students to think critically and analytically.

Besides stimulating critical thinking and creativity, PjBL also assists students to communicate and collaborate among peers and teachers [12]. Planning, organization and monitoring in the PjBL methodology are key aspects in developing communication and collaborative teamwork skills [13] as these methodologies enables students to exercise giving arguments, exchange ideas within groups, communicate and formulate possible solutions and negotiate tasks and design [14]. The methodologies project the opportunity for interpersonal competence exercise where students learn how to self-aware, listening, empathy, and probing which involves encouraging and prompting speakers to talk about themselves during teamwork [15]. It indicates that students not only learn one-way mode of communication but also how to listen to and understand the interlocutors' emotions, feelings, and motives.

Another important soft skill that is developed through PjBL is students' self-reliance. Self-reliance is the students' attitude who try to overcome their own problems without the help of others but do not close themselves to the possibility of cooperation with others for success in their lives [16]. Empirically, PjBL helps students develop this skill as designing methodology gives authority for students to independently design and decide the activities, the crew members, the schedule, and the tools to accomplish the project.

To date, research on PjBL was started in 1998 and it is still counting nowadays. This current research aims at investigating whether it is on trend and its correlations with other research topics, including research, approach, curriculum, method, higher education, and others. This current research can be used as an information on the novelty of PjBL.

2. Method

In this study, the systematic literature review (SLR) method consists of two steps: selecting relevant research articles to the theme and analyzing the reports.

2.1. Selection of Relevant Articles

The data used in this study is a collection of scientific publications about PjBL derived from journal indexers. All publications, citations, and plentiful contextual information are freely available for personal, non-commercial use. Access to a complete, comprehensive, connected data set dimensions on data that includes publications. The type of publication used in the study was limited to articles published from 2010 to 2022. This study used the keyword "project based-learning" for data retrieval. The first step was to determine the search criteria with the keyword "project based-learning," selected 2,003 articles indexed on Scopus. Furthermore, a screening of the title of the article discusses project-based learning is carried out. It is evident from the title that the PjBL article first appeared in 1998. However, the author analyzes the paper starting from 2018-2022. From the results of inclusion and exclusion research articles, 200 articles were selected.

2.2. Article Analysis

The next step was to group 200 articles based on the journal selected to publish articles on "Project based learning" using VOSviewer software and link those groupings. VOSviewer was used to create maps based on network data and to visualize and explore maps.

3. Result and Discussion

3.1. Number of Articles Published Each Year

It showed that PjBL research tends to grow from year to year. The search for articles on project-based learning has turned up to 200, which is more than in the last two years. In 2019, there may be as many as 14 articles and 17 articles in 2020. Also, in 2021, it grew even more, to 22 papers.

Table 1 lists journals with the highest citation ratings each year. In 2013, the International Journal of Technology and Design Education achieved the highest of citations 209 per author, with 23.22 per year. Meanwhile, in 2020, the International Journal of Educational Research gained the highest annual citations for journals and only 91 citations per author.

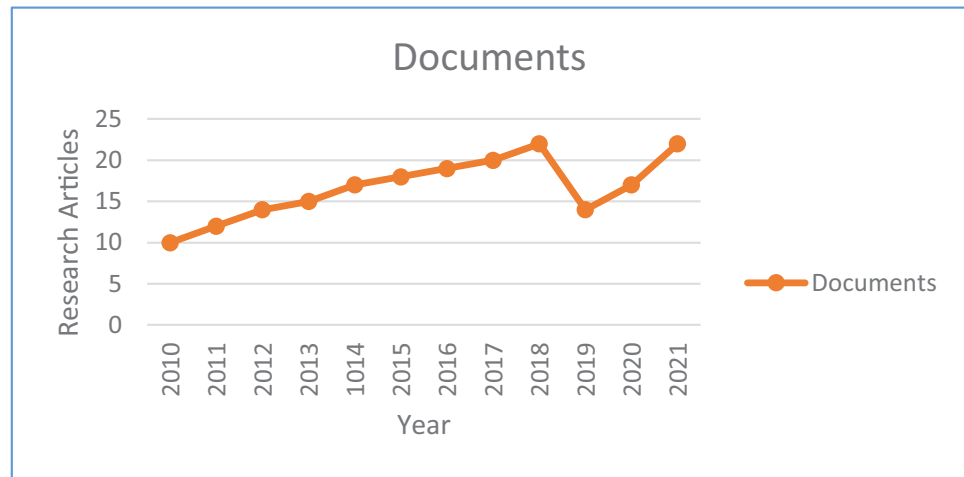


Figure 1: Number of Publications on PjBL from 2010 to 2021.

TABLE 1: The Highest Number of Citations in Journals and Authors Per Year.

Year of Publication	Nama Jurnal	Cites Per Year	Cites Author	Per
2010	American Journal of Community Psychology	8.58	103	
2011	European Journal of Engineering Education	7.91	87	
2012	European Journal of Engineering Education	9.9	99	
2013	International Journal of Technology and Design Education	23.22	209	
2014	International Journal of Sustainability in Higher Education	18.88	151	
2015	International Journal of Science and Mathematics Education	30.14	211	
2016	Global Journal of Engineering Education	8	48	
2017	Australasian Journal of Educational Technology	13.4	67	
2018	Journal of Computer Assisted Learning	17.75	71	
2019	Journal of Research in Science Teaching	25	75	
2020	International Journal of Educational Research	45.5	91	
2021	International Journal of STEM Education	19	19	

3.2. Visualization of Research Trends on PjBL Based on VoSViewer Software

Among the 2,003 papers related to the PjBL study in the Scopus database, the researchers visualized research trends on this topic assisted by VoSViewer software.

These efforts helped to find the novelty of research on PjBL. Figure 3 shows the entire study on PjBL. Researchers in the world produced 11 clusters. The first cluster consists of 12 items. The first cluster is the relationship between PjBL and: approach, comparison, course, development, higher education, measurement, online project, skill, and students' perception. The second cluster covers the relationship between PjBL and activity, design, high school students, motivation, and STEM project. The third cluster relates to PjBL with community, context, evaluation, experience, initiative, lesson, pedagogy, and project management. At the same time, this fourth cluster is a relationship between PjBL and achievement and positive psychology such as; self-efficacy, student achievement, and technology. The fifth cluster shows the relationship between PjBL and curriculum, organizational learning, process, and role. The sixth cluster is the relationship between PjBL and optimization and student engagement. The intended cluster is to connect PjBL with the concept or theoretical framework of learning and sigma education. The relationship between PjBL and collaborative learning is described in cluster 8. 5 items have been explained in cluster 9: the relationship between PjBL and attitude, case study, experiential learning, interdisciplinary project, and problem-solving. The relationship between PjBL and service learning is explained in cluster 10. Meanwhile, cluster 11 illustrates the relationship between PjBL and the case study.

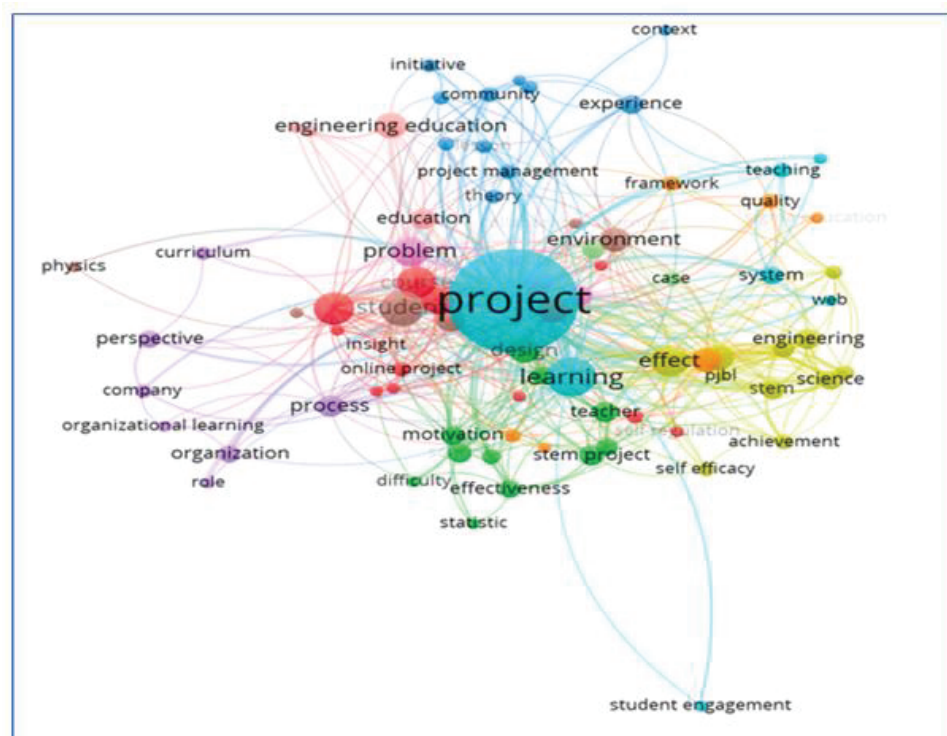


Figure 2: The Whole Picture of Research on PjBL from 2010 to 2021.

The development of PjBL is used for curriculum development and implementation in higher education. By looking at visualizations, researchers found that researching PjBL was becoming popular and exciting. Figure 2 shows that research on PjBL focuses on curriculum and higher education. Also, the effect of PjBL implementation on the implementation of learning in higher education. PjBL researchers often use quantitative analysis with experimental research models in research paradigms. Researchers usually link PjBL to achievement and use moderator variables like self-efficacy and student engagement. This study is mainly about the effect of the independent and dependent variables, as shown in Figure 3.

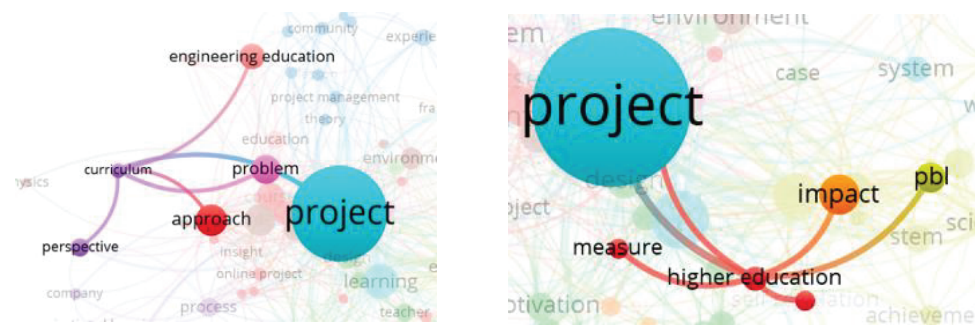


Figure 3: PjBL in Concerning to Curriculum and Higher Education.

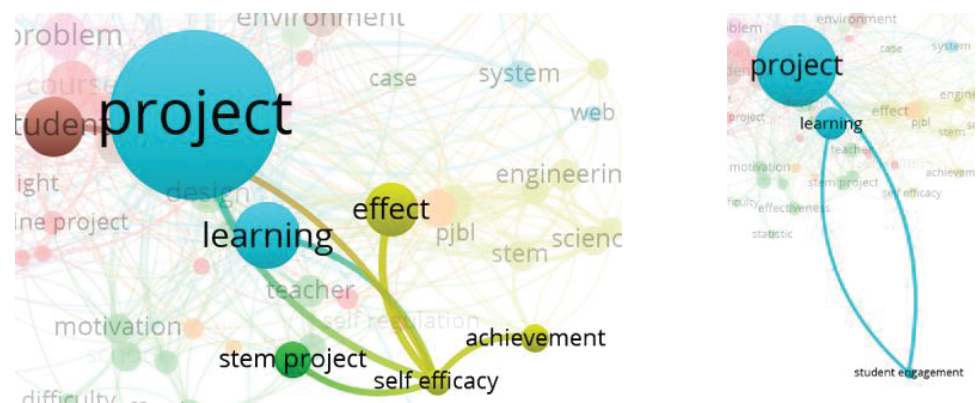


Figure 4: PjBL in relating to research paradigm.

From a learning perspective, the implementation of PjBL pays attention to technology, as shown in Figure 5. Research on PjBL has also been related to STEM and technology, as shown in Figure 5. The researchers examined how the PjBL approach could mediate the development of STEM education, as shown in Figure 5.

3.3. Discussion

The research topic on PjBL is increasing as its methodologies are rooted from constructivism which supports experiential learning [17] carried out through a project within a

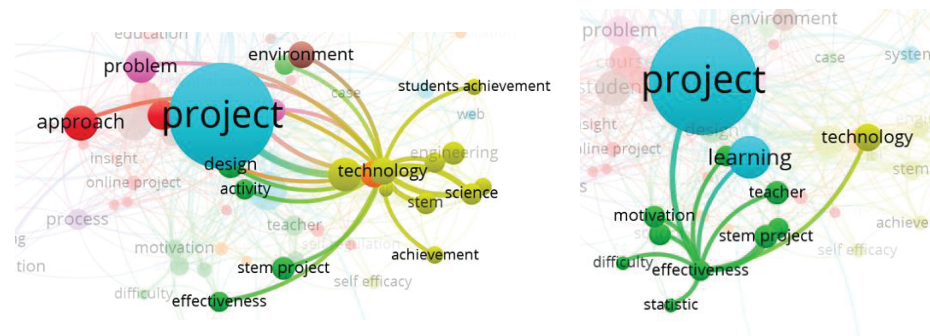


Figure 5: PjBL Concerning STEM and Technology.

predetermined time period with steps that include preparation / planning, implementation, reporting and communicating the results of activities and evaluations. Through project learning, there is the development of an inquiry process in learning real topics to attract students to study [18].

Further, the gain recognition of the needs to master 21st century skills [19], [20], [21], PjBL is seen to be a promising learning method that facilitate students with best practices. Each methodology enables students to simulate the soft skills. Formulating methodology, for instance, enables students to critically identify and analyze the problem suggested by the instructor's context. Then, the designing methodology allows students to creatively search the possible solutions which are later communicate to the team through negotiation and offering ideas. Arranging the schedule to accomplish the project allows the students to work independently based on their own pace and capacity. The monitoring the project methodology allows students to work together in team while self-assessing the progress collaboratively. The next methodology, presenting the product, enables students to confidently communicate their work while building self-confidence to convince the audience. Above all important methodologies, the last step is the ultimate skill that should be addressed. The reflection and evaluation methodology allows students to see the project as a whole task. The idea is not only finishing the project, but also the progress of achievement that they get.

4. Conclusion

The current research proofs that PjBL topic is still on the trend nowadays. The research publication is increasing each year with 11 clusters around the world. This might happen because the hype concern about the integration of 21st century skills in the education, covering critical thinking, creativity, collaboration, and communication. The finding from this research can be used by further researchers to find the novelty of their research

regarding the trend of PjBL, focusing on one level of education (secondary school, or higher education and university), and has certain topics (fields of study) including EFL and ESL.

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