

Connotation and Effectiveness of Project-Based Learning (PjBL): A Systematic Literature Review

Mohd Jasmy Abd Rahman , Zhai Yujia, Zhang Linlin, Liu Yang,
Maslawati Mohammad

Faculty of Education, The National University of Malaysia, Malaysia

To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v14-i8/22453>

DOI:10.6007/IJARBSS/v14-i8/22453

Published Date: 08 August 2024

Abstract

Project-Based Learning (PjBL) is one of the key topics in current basic education reform. To solve the real problems of unclear connotation and doubtful effectiveness of PjBL in the research and practice of PjBL, this paper empirically analyzes the viewpoints on the connotation and effectiveness of PjBL in 24 journal articles through a systematic literature review method. The results show that there are three perspectives on the connotation of PjBL: teaching, learning and curriculum, and that the effectiveness of PjBL on students' literacy development and academic achievement is affected by a combination of contextual factors, student factors and teacher factors. On this basis, this paper analyzes the connotation of PjBL from the perspective of integration, proposes three measures to ensure the effectiveness of PjBL, and refines seven future research themes on PjBL to further promote the normalization and high-quality development of PjBL

Keywords: PjBL, Connotation, Effectiveness, Systematic Literature Review

Introduction

In recent years, project-based learning (PjBL) has attracted the attention of governments, schools, teachers, and researchers (Diana et al., 2021). Although PjBL has been written into some national documents, in practice, many teachers are still skeptical about the connotative features and the effectiveness of PjBL, and there is still a lot of confusion about how to carry out PjBL. Although there are some studies focusing on the connotation and effectiveness of PjBL, due to the different perspectives on the connotation of PjBL, inconsistencies in its interpretation have emerged. At the same time, because of the greater focus on the performance of PjBL effects, it also presents a situation of insufficient exploration of the factors affecting the effectiveness of PjBL. Therefore, the objective of this research is to systematically sort out the studies on the connotation and effectiveness of PjBL, analyze the consistency and differences, and provide suggestions and ideas for teachers to carry out PjBL and future research.

Research Method

This paper adopts the systematic literature review method to carry out evidence-based analysis and evaluation of the relevant ideas of the connotation and effectiveness of PjBL in the existing literature. Systematic literature review method advocates procedural screening of the literature and synthesis of evidence, which has the advantage of presenting the details of the research and the lineage and ensuring that the research process is clear and verifiable. The disadvantage is that the process of screening and analyzing the literature is more cumbersome, but it can also be regarded as a guarantee of the reliability of the results.

Research Problem

Given the purpose of evidence-based analyses of PjBL connotation and validity perspectives, this study focuses on two questions:

1. What connotations of PjBL have emerged from established research and what are the consistencies and differences in the connotation?
2. What PjBL has been found by established research to be effective in demonstrating its effectiveness on students, and what factors influence effectiveness of PjBL?

Search and Selection

Systematic literature review method is divided into five steps: formulating the research question, identifying the articles, evaluating the quality of the articles, synthesizing the evidence, and interpreting the findings. The first step has been listed in the previous section. In the second step, identifying the articles, because research on the connotation and effectiveness of PjBL is mainly distributed in literature reviews, the researchers retrieved articles from 2019 in Google Scholar with the Boolean algebra `intitle:("project-based" OR "project-oriented") AND (review OR "meta-analysis") AND (learning OR teaching OR instruction OR approach OR intervention) filetype:pdf`. The search was also initiated in the Chinese Wanfang database with the Boolean algebra `(Title:(项目) AND Title or Keyword:(学习 OR 教学) AND Title:(综述 OR 述评 OR 元分析)) AND Date:2019-*`. The search date was 7th August 2023, and 3037 journal articles were retrieved.

The third step, evaluate the quality of the journal articles. The inclusion criteria are shown in Table 1. An overview of the search process is shown in Figure 1.

Table 1

Inclusion Criteria

NO.	Criteria
1	Related to Education
2	Core Journals
3	Chinese/English
4	Related to Project-Based
5	Review or Meta-Analysis
6	Full Text Available

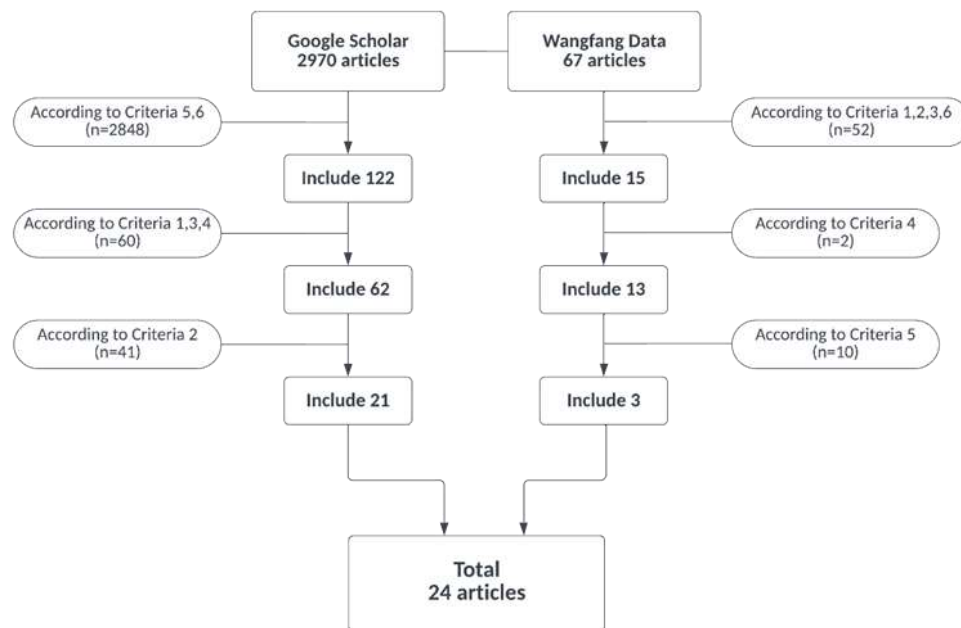


Figure 1. An Overview of the Literature Search Process

In the fourth step, evidence synthesis, a framework for evidence synthesis, was identified based on PRISMA (The Preferred Reporting Items for Systematic reviews and Meta-Analyses) recommendations. The framework contains information such as: author, title, publication, year, and type of review. In the fifth step, the results of the research were interpreted, as detailed in the research findings.

Basic Characteristics of the Articles

24 articles were finally included in the analysis: 21 articles in English (87.4%) and 3 articles in Chinese (12.5%). Publication years were 2019-2023, of which 13 articles were published after 2021 (54.2%). 12 articles were literature reviews (50%). 6 articles were systematic reviews (25%), and another 6 articles were meta-analyses (25%).

Research Findings

Focusing on the two research questions, the evidence from the journal articles was compared with the original articles, and the ideas about the connotation and effectiveness of PjBL were extracted, integrated, analyzed, and defined to form a framework of analyzing in this paper, which contains two main dimensions and their sub-dimensions:

1. The connotation of PjBL analysis dimension, containing three sub-dimensions of teaching perspective, learning perspective, and curriculum perspective.
2. The dimensions of effectiveness analysis of PjBL contain two sub-dimensions of effectiveness performance (academic achievement and literacy development) and three dimensions of effectiveness influencing factors (contextual factors, teacher factors, and student factors).

An Analysis of the Connotations of PjBL

A review of the evidence reveals that most scholars select some characteristics to describe the connotation of PjBL. According to the characteristics of the selected features, the understanding of "project" and the definition form conceptual attributes, the connotation of

PjBL can be divided into three perspectives: teaching, learning and curriculum. At the same time, these three perspectives correspond to the three main expressions in the evolution of PjBL, namely Project Method, PjBL Approach, and Project-Based Curriculum.

The Connotation of PjBL from the Teaching Perspective

The teaching perspective of PjBL asserts that "project" is a concept that originates from real-world thematic tasks. Project tasks can be classified into disciplinary tasks (integration of closely related concepts or topics within disciplines, e.g., algebra and statistics in mathematics), narrow interdisciplinary tasks (integration of different disciplines within the same subject area, e.g., biology and chemistry), and broad interdisciplinary tasks (integration of different disciplinary areas, e.g., literature and mathematics), or according to the number of participants (Hart, 2019). "PjBL" is a type of learning that focuses on real-world thematic tasks and guides students to conduct inquiries or investigations around the project tasks, emphasizing the acquisition of knowledge and enhancement of knowledge through participation in complex, real-world thematic tasks and the development of real-world products and the presentation or demonstration of the products to an audience (Hart, 2019). It is a systematic or inquiry-based approach to teaching and learning that emphasizes students' acquisition of knowledge and skills through engaging in complex, real-world thematic tasks and developing real-world products and presenting or demonstrating them to an audience (Guo et al, 2020).

The Connotation of PjBL from the Learning Perspective

According to the PjBL from the learning perspective, a "project" consists of a driving problem and a final product and is designed to allow students to generate a series of creative behaviors through engaging in inquiry or investigative activities (Rahmawati et al, 2020). "PjBL" is a problem- and product-centered learning approach, which aims to engage students in projects over a long period of time through the design of real products, and to carry out inquiries and investigations in the form of teamwork and self-directed learning. Through PjBL, students could gain interesting and complex experiences and knowledge skills in problem solving and real challenges, and then construct meaning and develop higher-order thinking skills in the process of problem solving and product design (Ferreira & Canedo, 2020).

The Connotation of PjBL from the Curriculum Perspective

PjBL from the curriculum perspective advocates "project" as a method of curriculum design and integrates projects with curriculum development work as a major component of the curriculum, aiming to enable learners to encounter and become familiar with the core concepts of the discipline (Vasiliene et al, 2020; Chen, 2021). "PjBL", on the other hand, advocates the integration of real-life and core conceptual knowledge, and the projectualization of the original curriculum content to form a reconfigured project-based curriculum that includes curriculum content, curriculum objectives, curriculum implementation, and curriculum evaluation, which is a hybrid or convergent curriculum that integrates problem-centered and learner-centered curriculum design (Korkmaz & Kalayci, 2019).

In summary, there are both similarities and differences in the expression of the concept of PjBL from the perspectives of teaching, learning and curriculum. The similarity in the expression of features and the multiplicity in the definition of attributes in the connotation of PjBL are the main reasons for the lack of clarity in the connotation of PjBL. Therefore, it is

necessary to integrate the three perspectives to reinterpret the concept of PjBL to clarify the connotation of PjBL.

Analysis of PjBL Effectiveness Performance and Influencing Factors

Evidence combining revealed that the effectiveness of PjBL was manifested in both the promotion of academic achievement and the promotion of students' literacy development, and was influenced by a combination of contextual, student, and teacher factors, as shown in the analytical framework in Figure 2.

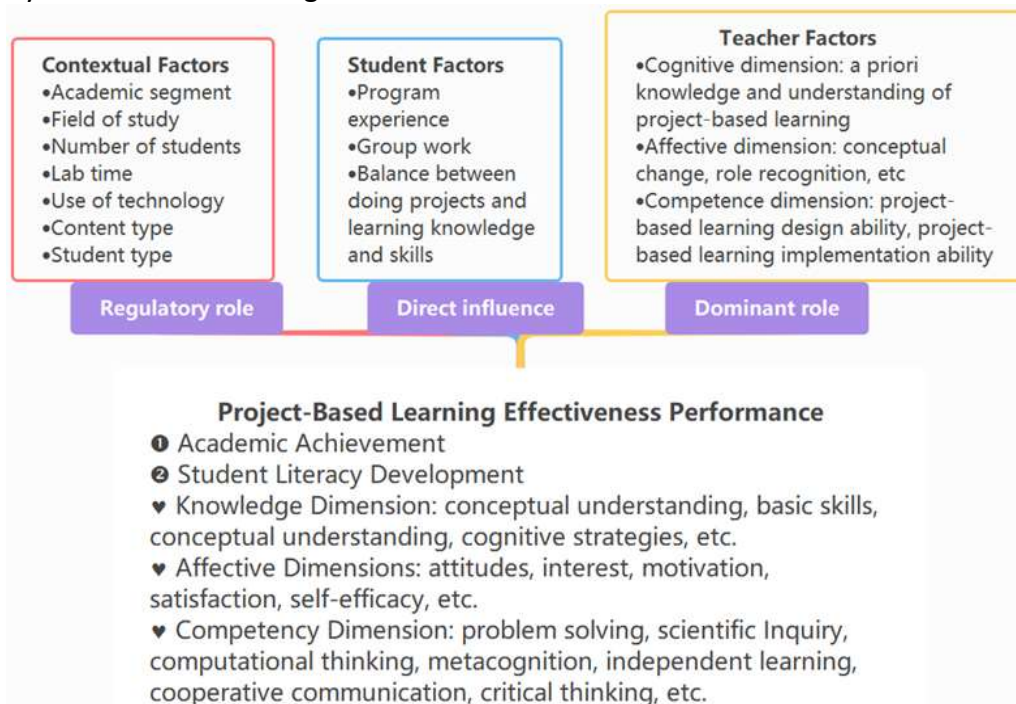


Figure 2. The Analytical Framework of Effectiveness of Project-Based Learning

Evidence that PjBL promotes academic achievement suggests that the positive effects of PjBL on academic achievement are moderated by factors such as subject, level of study, sample size, duration of the experiment, and use of information technology. Evidence for promoting students' literacy development includes: knowledge dimensions such as conceptual understanding, basic skills, and cognitive strategies (Leggett & Harrington, 2021); affective dimensions such as attitudes, interest, motivation, satisfaction, and self-efficacy (Imbaquingo & Cárdenas, 2023); and competency dimensions such as problem solving, scientific enquiry, computational thinking, meta-cognition, self-directed learning, cooperative communication, and critical thinking (Ma & Liu, 2019).

Contextual Factors Affecting the Effectiveness of PjBL

Contextual factors in the development of PjBL, such as subject, discipline, number of students, duration of the experiment, information technology, subject content, type of students, and etcetera, moderate the effectiveness of PjBL. (1) In terms of academic level: The effect value of the basic education level is generally greater than that of the higher education level. (2) In terms of disciplines: The subject that reports the highest impacts are different, but there are no significant differences between disciplines within a subject. (3) With regard to the number of students and the duration of the experiment: PjBL is more effective on academic achievement when moderated by the factors of smaller number of students and longer

duration of the experiment. (4) With respect to information technology, the more technology is used in PjBL, the more effective it is on academic achievement. (5) Subject content may moderate the effectiveness of PjBL, particularly in terms of literacy development. For example, PjBL has the potential to have a positive impact on the non-intellectual dimensions of number and algebra content, and a direct impact on performance and attitudes toward statistics in statistics and probability content (Cruz et al, 2022). (6) There may be a moderating effect of student type on the effectiveness of PjBL. For example, PjBL has shown positive effects on conceptual understanding, motivation, attitudes, and academic achievement for students of low socioeconomic status, intermediate learners, or academically disadvantaged students (Xia, 2019).

Student Factors Influencing the Effectiveness of PjBL

Students are the main body of PjBL. Students' project experience, group cooperation, PjBL ability and other factors are the basic guarantee for the implementation of PjBL, which directly affects students' participation in the project, the achievement of learning objectives and the quality of the results and other aspects. (1) Project experience factor: Experience of the project and its process influences the understanding and participation in the project (Loyens et al, 2023). (2) Factors of group cooperation: Harmonious interpersonal relationships, active participation in discussions, and reasonable division of labor affect the quality of group cooperation, the progress of the project, and the reflection and evaluation of the results (Ferreira & Canedo, 2020). (3) Factors of PjBL ability: Factors such as the ability to reasonably match the project task requirements with the learning objectives, the ability to generate meaningful scientific questions directed towards problem solving based on the driving questions of the project, the ability to translate the results or data from the inquiry or investigation into ideas and products, the ability to strike a reasonable balance between the project inquiry or investigation and the learning of knowledge or skills in the classroom, the ability to use technology appropriately, and the ability to incorporate teacher-provided resources and materials into the project, affect the quality of project participation and achievement of the learning objectives (Megayanti et al, 2020).

Teacher Factors Influencing the Effectiveness of PjBL

Teachers are the leaders of PjBL. Teachers' knowledge, emotion, and ability of PjBL determine the quality of PjBL design and implementation and play a leading role in the effectiveness of PjBL. (1) Cognitive factors: Prior knowledge (student-centered teaching strategies, knowledge of learning scaffolds, etc.) (Ferreira & Canedo, 2020) and understanding of PjBL (connotation, characteristics, design process, implementation phases, etc.) are the prerequisites for teachers to design and implement PjBL. (2) Emotional factors: Whether the teachers' conception is learning-centered and whether they agree with the roles of "designers of project-based curriculum, advisors and collaborators in PjBL, and evaluators of PjBL" directly affects the teachers' recognition and implementation of PjBL (Chen et al, 2021). (3) Competence factors: Teachers' competence in PjBL design, such as selecting projects, integrating projects and course materials, designing driving questions, and designing learning activities, as well as their competence in implementing PjBL, such as organizing and monitoring group work, classroom management, and providing appropriate scaffolding and resources, determine the quality of PjBL (Megayanti et al, 2020)).

In summary, the effectiveness of PjBL should not only focus on the positive effects on students, but also on the multidimensional effects of contextual, student and teacher factors on effectiveness.

Discussion and Implications

The existing journal articles on the connotation and effectiveness of PjBL are diverse, and it is found that there are three perspectives on the connotation of PjBL: teaching, learning, and curriculum, and that the effectiveness of PjBL on students is affected by a combination of contextual factors, teacher factors, and student factors. While PjBL brings greater flexibility, it also places greater demands on teachers, and this paper provides suggestions and ideas for teachers to develop PjBL and for future research.

How to Understand the Connotation of PjBL

Based on the understanding of “projects” and “PjBL” from the perspective of teaching, learning, and curriculum integration, “projects” include not only tasks, problems, and products that are oriented to the real world and life, but also course content and course materials that integrate concepts and principles from disciplines. The connotation of PjBL is as follows: (1) real-life oriented and authentic projects; (2) reconstructed project-based curriculum, (3) student-centered project-based teaching and learning.

According to the above connotations, contextual learning, theme-based learning, unit-based learning, big-concept learning, interdisciplinary learning, task-driven learning, problem-based learning, research-based learning, inquiry-based learning, and etcetera, are similar in some of their characteristics due to their emphasis on a certain connotation of “project”, “curriculum restructuring”, or “student-centered teaching and learning”, which has resulted in some scholars and teachers being confused in various forms of learning that emphasize student-centered learning. For example, some people think that PjBL and problem-based learning, which have been discussed the most, can be used in the same way, while others think that problem-based learning includes PjBL. Therefore, it is particularly important to grasp the wholeness of the connotation of PjBL to help teachers traverse the conceptual jungle and target PjBL.

How to Adequately Safeguard the Impact of PjBL

Based on the analysis of the effectiveness of PjBL, this paper suggests that there are three ways to ensure the positive effects of PjBL.

Enhancing the Fit of PjBL to the Contextual Environment

Factors such as the academic period, subject, type of student, type of knowledge, time of implementation, and use of information technology in the development of PjBL moderate the effectiveness of PjBL. This means that the effectiveness of PjBL can only be maximized when the contextual environment is compatible with PjBL. To maximize performance, it is necessary for teachers to control these factors effectively.

Enhancing Student Comprehension and Engagement in PjBL

It is crucial that students comprehend the distinction between PjBL and the conventional classroom, so that their “voices” can be fully expressed. The reliability of PjBL outcomes can only be assured if students are fully engaged in the project process and achieve deeper understanding and higher-order thinking while working on the project. Strategies and

measures can be adopted to intervene and guide students in the project process, such as thematic training, building a culture that emphasizes student self-management, managing student groups (establishing appropriate grouping patterns and tracking each group's progress through discussion, monitoring, and documenting evidence of progress), project monitoring (guiding groups to organize their projects effectively by monitoring the progress of their projects), and guiding the full use of technological resources, etc. (Imbaquingo & Cárdenas, 2023).

Enhancing Teachers' Recognition and Implementation of PjBL

Teachers need to be made fully aware of and understand PjBL. First, a supportive environment should be provided for teachers. Some studies have shown that support from school administrators, the human environment, resources, and technology can facilitate PjBL for teachers (Chen & Yang, 2019). Second, training, collaboration, and feedback should be used to encourage teachers to reflect on their practice, improve their habits of focusing on aspects, such as technology, that are relevant to their own professional development needs, and promote changes in roles and perceptions that will ultimately lead to the development and enhancement of teachers' project-based teaching and learning competencies.

What Are the Possible Research Themes for PjBL?

Based on the systematic literature review of the established PjBL articles, the following possible research themes are distilled to provide ideas and lessons for future research.

Systematic Exploration of Disciplinary and Interdisciplinary PjBL at the Basic Education Level

While existing studies have paid attention to the differences between different school segments and subject areas, there is a lack of attention to the impact effects, differences, and case studies in basic education segments, different age groups, types of disciplines, types of knowledge, cross-disciplinary integration, and learning environments, which need to be further explored.

The Study of the Impact of PjBL on the Development of Student Literacy

Existing studies have paid more attention to the impact on students' academic achievement, but the performance, influencing factors of student' cognitive, affective, and competency aspects of PjBL have not been fully explored.

The Study of the Impact of PjBL on Diverse Students

There is a lack of existing research exploring the effectiveness of PjBL for different types of students. Therefore, exploring the effectiveness of PjBL on different students and its case studies, as well as the possible paths of PjBL in rural areas, is an important direction that future research should focus on to provide support and evidence for research on PjBL in promoting educational equity.

The Study on the Construction of the Effectiveness Measurement System of PjBL

The construction of the PjBL effectiveness measurement system is a key measure to guarantee the quality of PjBL implementation. The evaluation system can be constructed from the connotation characteristics and influencing factors of PjBL. The evaluation scale of PjBL effectiveness can be developed to transform the theoretical exploration results into measurable indexes, which can be used to comprehensively evaluate the background

environment, teachers' performance, and students' performance, and provide reliable evaluation standards for the evaluation of the quality of PjBL.

The Study of the Path and Impact of Technology-Enabled PjBL

Some aspects of PjBL can be well integrated with information technology in teaching. It will take more investigation and practice in the future to fully utilize information technology's benefits in PjBL, especially the advantages of intelligent learning environments, to create authentic tasks and problematic contexts, to support students' self-directed inquiry and collaborative learning, diversified evaluation, and creation of works, and etcetera. Explore how to carry out PjBL modes of deep integration of online and offline, to promote the normalization of PjBL in the post-epidemic era, to deal with various project data under information technology (Guo et al, 2020) and how to solve the technological load of teachers and students (Vasiliene et al, 2020) and other issues.

Research on Teachers' Emotions, Cognition and Competence in PjBL

Teachers play a leading role in the effectiveness of PjBL, including the comprehensive regulation of the various aspects and elements of PjBL by teachers' cognitive, affective and competency dimensions. Future research can combine the three dimensions of the teacher factor to carry out research on teachers' knowledge and understanding of PjBL, adaptability, difficulties, teaching readiness, competence, as well as evaluation and enhancement of teachers' ability to teach PjBL in different school years and disciplines.

Evaluation Study of the Consistency of PjBL Design and Implementation

This research has found that research on the effectiveness of PjBL relies on a combination of contextual, teacher and student factors and is difficult to replicate, whereas coherence research focuses on the analysis and reflection of inconsistencies and can contribute to the optimization of the design of PjBL to improve the coherence of the design and implementation of PjBL and the effectiveness of the implementation of PjBL.

Conclusion

Since 2000, PjBL has received continuous attention and exploration, and has had a greater positive impact on students' learning. This paper provides a systematic literature review on connotation and effectiveness of PjBL. Through reviewing 24 journal articles, the researchers have reinterpreted the connotation of PjBL by integrating the perspectives of teaching, learning and curriculum. As for the effectiveness of PjBL, the researchers have found that the performance of it reflects on two aspects, academic achievement, and literacy development of students, and are influenced by contextual factors, teacher factors, and student factors. By a full understanding of PjBL, extensive exploration and practice of PjBL, and in-depth research on the adaptability of PjBL, the quality of the implementation of PjBL will be improved and the smooth development of PjBL will be promoted.

Corresponding Author

Mohd Jasmy Abd Rahman; Faculty of Education, The National University of Malaysia; Malaysia;

Email: mjas@ukm.edu.my

References

- Chen, C. H., & Yang, Y. C. (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review*, 26, 71–81. <https://doi.org/10.1016/j.edurev.2018.11.001>
- Chen, J., Kolmos, A., & Du, X. (2021). Forms of implementation and challenges of PBL in engineering education: A review of literature. *European Journal of Engineering Education*, 46(1), 90–115. <https://doi.org/10.1080/03043797.2020.1718615>
- Clemente, F. M., Afonso, J., & Sarmento, H. (2021). Small-sided games: An umbrella review of systematic reviews and meta-analyses. *Plos One*, 16(2), e0247067. <https://doi.org/10.1371/journal.pone.0247067>
- Cruz, S., Viseu, F., & Lencastre, J. A. (2022). Project-Based Learning Methodology as a Promoter of Learning Math Concepts: A Scoping Review. *Frontiers in Education*, 7. <https://www.frontiersin.org/articles/10.3389/feduc.2022.953390>
- Diana, N., Yohannes, & Sukma, Y. (2021). The effectiveness of implementing project-based learning (PjBL) model in STEM education: A literature review. *Journal of Physics: Conference Series*, 1882(1), 012146. <https://doi.org/10.1088/1742-6596/1882/1/012146>
- Ferreira, V. G., & Canedo, E. D. (2020). Design sprint in classroom: Exploring new active learning tools for project-based learning approach. *Journal of Ambient Intelligence and Humanized Computing*, 11(3), 1191–1212. <https://doi.org/10.1007/s12652-019-01285-3>
- Ferrero, M., Vadillo, M. A., & León, S. P. (2021). Is project-based learning effective among kindergarten and elementary students? A systematic review. *Plos One*, 16(4). <https://doi.org/10.1371/journal.pone.0249627>
- Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, 102, 101586. <https://doi.org/10.1016/j.ijer.2020.101586>
- Hart, J. L. (2019). Interdisciplinary project-based learning as a means of developing employability skills in undergraduate science degree programs. *Journal of Teaching and Learning for Graduate Employability*, 10(2), 50–66. <https://doi.org/10.21153/jtlge2019vol10no2art827>
- Hizqiyah, I. Y. N., Nugraha, I., Cartonno, C., Ibrahim, Y., Nurlaelah, I., Yanti, M., & Nuraeni, S. (2023). The project-based learning model and its contribution to life skills in biology learning: A systematic literature network analysis. *Jurnal Pendidikan Biologi Indonesia*, 9(1), 26-35.
- Imbaquingo, A., & Cárdenas, J. (2023). Project-Based Learning as a Methodology to Improve Reading and Comprehension Skills in the English Language. *Education Sciences*, 13(6), Article 6. <https://doi.org/10.3390/educsci13060587>
- Jiménez-Saiz, R., & Rosace, D. (2019). Is hybrid-PBL advancing teaching in biomedicine? A systematic review. *BMC Medical Education*, 19(1), 226. <https://doi.org/10.1186/s12909-019-1673-0>
- Korkmaz, G., & Kalayci, N. (2019). *Theoretical Foundations of Project Based Curricula in Higher Education*.
- Leggett, G., & Harrington, I. (2021). The impact of Project Based Learning (PBL) on students from low socio economic statuses: A review. *International Journal of Inclusive Education*, 25(11), 1270–1286. <https://doi.org/10.1080/13603116.2019.1609101>

- Lunny, C., Brennan, S. E., Reid, J., McDonald, S., & McKenzie, J. E. (2020). Overviews of reviews incompletely report methods for handling overlapping, discordant, and problematic data. *Journal of Clinical Epidemiology*, 118, 69–85.
<https://doi.org/10.1016/j.jclinepi.2019.09.025>
- Ma, Z. Q., & Liu, Y. Q. (2019). From Project-based Learning and Pair Programming to Interdisciplinary Integrated Design: A Meta-analysis based on International Studies of K-12 Computational Thinking from 2006 to 2019. *Journal of distance education*, 37(5), 75-84.
- Markulin, K., Bosch, M., & Florensa, I. (2021). Project-based learning in Statistics: A critical analysis. *Caminhos da Educação Matemática em Revista*, 11(1), 200-220.
- Nurhidayah, I. J., Wibowo, F. C., & Astra, I. M. (2021). Project Based Learning (PjBL) learning model in science learning: Literature review. *Journal of Physics: Conference Series*, 2019(1), 012043. <https://doi.org/10.1088/1742-6596/2019/1/012043>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International Journal of Surgery*, 88, 105906.
<https://doi.org/10.1016/j.ijsu.2021.105906>
- Vasiliene-Vasiliauskiene, V., Vasilis Vasiliauskas, A., Meidute-Kavaliauskiene, I., & Sabaityte, J. (2020). Peculiarities of educational challenges implementing project-based learning. *World Journal on Educational Technology: Current Issues*, 12(2), 136–149.
<https://doi.org/10.18844/wjet.v12i2.4816>
- Xia, X. M. (2019). Project-Based Learning in the Discipline: from the Perspective of Students. *Global Education*, 2, 3-14.
- Lu, Y.F., Li, J., & Hu, M.R. (2023). Can project-based learning effectively improve academic performance: A Meta-analysis of 44 Experimental and Quasi-experimental Studies. *Journal of Educational Science of Hunan Normal University*, 22(3), 1004-3667.
<https://doi.org/10.19503/j.cnki.1671-6124.2023.03.013>
- Ye, B. X., Sang, G.H., & Deng, Y.H. (2022). Can Project Learning Improve College English Teaching Effectiveness: A Meta-analysis of Intervention Experimental Research, *China Higher Education Research*, 2022(7), 83-88. <https://doi.org/10.16298/j.cnki.1004-3667.2022.07.14>
- Zhang, W. L., & Hu, J. (2019). Is the Learning Effect of Project-based Learning Happening: A Meta-analysis of 41 Experimental and Quasi-experimental Studies. *E-education Research*, 40(2), 95-104. <https://doi.org/10.13811/j.cnki.eer.2019.02.012>