

Research Status and Trends of Project-Based Learning in China and Abroad

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Abstract. With the development of society, all countries are gradually realizing the importance of cultivating high-quality and innovative talents, and project-based learning (PBL) is getting more and more widespread attention from scholars. Project-based learning, often based on inquiry, provides students with opportunities to combine theory and practice, independent practice and cooperative communication, and is a crucial way to develop students' core literacy in this day and age. The current research on project-based learning involves a number of fields, and there is a lack of systematic review of project-based learning at home and abroad in China. Therefore, this study examines the current research status of project-based learning at home and abroad in the form of a literature review by sorting out the current research status of project-based learning from three aspects: model methodology, application practice, and effect evaluation.

Keywords: Project-Based Learning, China, Abroad, Review.

1 Introduction

In the context of the current knowledge economy era, independent innovation ability is the country's core competitiveness, and talent cultivation is a hot topic widely concerned by all countries. In recent years, project-based learning(PBL) has received widespread attention at home and abroad. It is a new type of teaching mode focusing on heuristics, cooperation, and inquiry, and is a crucial way to cultivate students' core literacy in today's era.

Project-based learning was derived initially from Dewey's work of "learning by doing" and is guided by constructivist theory. There are various definitions of project-based learning that have not been standardized at home and abroad. However, it can be drawn that the task of project-based learning is for students to promote competence by solving problems in real situations, and the mark of completion is the output of the task[1]. The connotation of project-based learning is a student-centered and teacher-guided inquiry learning, in which the topic of inquiry originates from real problems in actualized life situations.

As of August 2023, a total of 48,779 articles have been searched in the core data collection of Web of Science database with "project-based learning" as the search topic; in the core dataset of CNKI database, using the searching keywords "project-based learning", there have been 45,167 research papers. It can be found that both domestic and foreign scholars have achieved fruitful research results on project-based learning, which shows that project-based learning is a

hot spot of international research from domestic and foreign scholars. Since the emergence of project-based learning in the scholarly landscape, it has been widely recognized as a practical and innovative approach to learning. For example, Balemen N et al. verify the effectiveness of project-based learning in the context of academic performance and various learning characteristics by means of a meta-analysis. The results show that project-based learning is a more practical approach to learning in science education across different disciplines, levels, and scales than traditional instruction[2]. Meanwhile, a number of scholars have explored the integration of project-based learning with other teaching methods. Borden et al. merge the existing PBL framework and various other recommendations in mathematics education into a core framework of instructional practices to help mathematics teachers more easily understand and implement project-based learning[3].

Through the above analysis, it can be found that the current research on project-based learning involves many fields, and at the same time, China lacks a systematic review of project-based learning at home and abroad. Therefore, this paper conducts systematic literature combing on project-based learning at home and abroad, and reviews the current literature on project-based learning at home and abroad from three categories of model methodology, application practice, and effect evaluation, so as to help people understand the hotspots and trends of the current research related to project-based learning.

2 Methodology

This study systematically combines domestic and international research on project-based learning in the form of literature review to grasp the current research status and progress. Through sorting out the relevant literature, the research related to project-based learning is divided into different dimensions to understand the current research status in the field of project-based learning at home and abroad, and the similarities and differences between the research related to project-based learning at home and abroad are understood by comparing their respective research focuses under different dimensions. Based on this, targeted countermeasures are proposed for future research on project-based learning to promote better the enrichment and development of the theory of project-based learning as well as the improvement and enhancement of practical effects.

2.1 Research Question

In order to clarify the focus of the research, this paper puts forward the following research questions:

Q1: What is the current status of domestic and international research in the field of project-based learning model methodology?

Q2: What is the current status of domestic and international research in the field of project-based learning application practice?

Q3: What is the current status of domestic and international research in the field of project-based learning effect evaluation?

2.2 Searching Strategy

To address the above issues, this paper conducts a search using the following keywords as shown in Table 1. It includes exploring the different names of project-based learning in China and abroad, and comprehensively accessing the research literature about project-based learning through comprehensive search keywords. The literature search comes from different databases, in which the foreign literature search mainly comes from Web of science database and the Chinese literature search mainly comes from CNKI.

Table 1. Search keywords

Chinese search keywords	English search keywords
项目式学习	project-based learning
项目学习	
基于项目的学习	PBL(NOT problem-based learning)
PBL (排除基于问题的学习)	

3 Results and Discussion

In terms of literature selection, we choose Chinese and English literature from open journal papers, conference papers, and degree papers to answer the above three questions. Therefore, this section is divided into three parts, one of which is the current status of research on model methodology at home and abroad, the second is the current status of research on application practice at home and abroad, and the third is the current status of research on effect evaluation at home and abroad.

3.1 what is the current status of domestic and international research in the field of project-based learning model methodology?

The reform of new teaching methods will inevitably lead to changes in the teaching mode. Based on Dewey's pragmatism education theory and J. S. Bruner's discovery learning theory, project-based learning derives from various environments in the project-based teaching mode and methods.

Abroad, Toolin discusses in detail the steps of implementation of project-based learning applied in learning activities in disciplines[4]. Much research has been conducted on project-based learning teaching models and methods at different stages of education. Harris et al. conduct a survey study of 42 schools using the curriculum materials of "Project Based Inquiry Science" in a middle school, and find that the course materials, regional guidance, and teacher support are essential factors in the project-based learning model[5]. Alenka Žerovnik et al. analyze the main reasons for implementing PBL in higher education courses and discuss the stages and pedagogical value of implementing PBL in terms of authentic practical courses[6]. As research continues, some scholars have begun to explore project-based learning models and methods in different settings. Chikurteva, A et al. explore the role of communication technologies in PBL and the benefits and problems of implementing PBL and propose a conceptual model of a PBL platform in education[7]. Huang, WD et al. review the literature

on "gamified PBL" (GPBL), which combines project-based learning and gamified learning, focusing on GPBL methodology, learning outcomes, technological tools, and theories[8]. Saad A et al. review the literature related to project-based learning (PBL) and computational thinking (CT) and find a lack of methodological guidance for implementing PBL-CT, identifying several common factors for the PBL-CT framework or models[9].

In China, Zhong et al. believe that the four major components of project-based learning are content, activities, context, and results. The process model of project-based learning is divided into six basic steps: selecting a project, making a plan, activity exploration, work production, results exchange, and activity evaluation[10]. The rapid development of information technology and multimedia teaching has provided technical support for project-based learning, and many scholars have studied project-based learning from the perspective of a network environment. The research of Zhang et al. proposes a project-based learning model based on the concept of curriculum reconstruction in the network environment from the perspective of project-based reconstruction of the national curriculum. It demonstrates the application of the model in the field of primary education through practical cases in combination with the teaching practice[11]. Meanwhile, many scholars in China believe that the two teaching modes, project-based learning and the flipped classroom, can be effectively integrated. Li et al. take the "Animal Microbiology" course as an example, exploring and practicing online and offline blended experimental teaching modes based on PBL and the flipped classroom. The teaching evaluation is carried out by the experimental method and questionnaire survey method, and the results show that the online-offline blended experimental teaching mode is superior to the traditional teaching mode[12].

3.2 what is the current status of domestic and international research in the field of project-based learning application practice?

With the social and economic development and scientific and technological progress, new requirements have been put forward for talents by the new era, and project-based learning has been widely used at home and abroad and has achieved fruitful research results.

Abroad, K. Gavin applies "Civil Engineering" courses, combining the characteristics of engineering education with project-based learning, which provides a blended form of "project-based learning" for the field of engineering specialization and provides a reference for developing student's professional skills[13]. Ruamcharoen J et al. purposively sample 12 B.Sc. students for STEM linked project-based learning (STEM-PBL) on the topic of polymer materials, and the results of the study show that STEM-PBL can help students develop their STEM competencies and 21st-century skills[14]. Also basing on the technological advantages of the online environment, scholars continue to explore the application of PBL. P.S. Hsu et al. create a graphically oriented computer-aided project-based learning environment and point out that a computer-aided project-based learning environment can be used to enhance student's scientific knowledge and develop scientific argumentation skills[15]. Younis, AA et al. divide computer science students into 51 different groups and assign five projects, each lasting two weeks. The study applies project-based learning to teach skills and measures parallel programming and soft skills by applying pre-investigation and post-investigation and finds that PBL significantly impacts on students' parallel programming and soft skills[16].

In China, Mu discusses the specific application measures and significance of project-based learning in elementary school mathematics to stimulate enthusiasm for learning and train students' thinking and inquiry abilities[17]. Zhu et al. take the course "Cultural Life of Hometown" in the unified textbook of the general high school as an example, and practically explore contemporary culture by means of project-based learning, so as to realize the value of the curriculum and the function of educating people[18]. The study of Liu et al. applies project-based learning activities to the teaching of "radio and television" courses, which helps learners construct solid professional knowledge and skills. It effectively improves learners' comprehensive ability[19]. Taking the Zhuzhou Museum as an example, the research of Xiao develops a series of project-based courses using the collection resources, giving full play to the students' subjective initiative and realizing in-depth learning in the educational activities[20].

3.3 what is the current status of domestic and international research in the field of project-based learning effect evaluation?

As an innovative teaching mode, Project-based learning can help students develop relevant abilities and qualities. Furthermore, most scholars believe that research results on the implementing disciplinary applications of project-based learning are primarily positive .

Abroad, Pellegrino, J.W et al. state that performance-based assessment, which is often used in PBL, maybe a way of assessing 21st-century competencies, including critical thinking, metacognition, etc.[21]. Based on this, the study of Ngereja B et al. conducts a quantitative study of project management students for two consecutive semesters. The findings of the inquiry indicate that project-based learning has a positive impact on students' learning, motivation, and performance in both the short and long term. The study further shows that project-based learning creates real-life experiences that further contribute to creating and developing real-life competencies[22]. Many studies examine the effects of integrating project-based learning with other teaching methods. Kuo H C et al. focus on developing thinking and creative skills in STEM interdisciplinary project-based learning, and the questionnaire survey shows that the use of STEM interdisciplinary project-based learning effectively improves students' thinking and creativity[22]. Under the influence of COVID-19, online learning has received more attention from scholars. D. L. Edy et al. use experimental methods to explore the results of capacity building in a project-based online learning approach, and the results show that there are differences and improvements in students' learning outcomes during COVID-19[23].

In China, Yu based on the first New College English textbook written with the idea of project-based learning in China, conducts a questionnaire survey on more than 250 students who have completed the course, so as to explore the understanding and evaluation of the educational value of project-based learning. The study shows that students have a positive attitude towards project-based learning, which can effectively promote their English learning[24]. Chen applies project-based learning to the "Computer Networking" course of higher vocational education and uses questionnaires at different stages to determine the students' evaluation of the project, the teacher, and their situation. It is summarized that project-based learning can improve the learning effect and professional ability to a certain extent[25]. Zhou and Wang apply project-based learning to undergraduate education, and it also has a significant role in cultivating innovative spirit[26]. Regarding the evaluation method of project-based learning, Yu et al.

propose a project-based learning evaluation index system based on student portraits to carry out online teaching evaluation of project-based learning[27]. Hong et al. integrate the educational concept of PBL into the teaching evaluation standard, and construct an evaluation standard system that meets the characteristics of the higher education discipline and the PBL teaching mode based on the multiple evaluation subjects and multiple evaluation methods[28].

4 Conclusion

This study reviewed the relevant literature on project-based learning at home and abroad and conducted a systematic literature review from three aspects: model methodology, application practice, and effect evaluation.

In terms of model methodology, foreign research tends to integrate with other teaching methods on the original basis of the project-based learning teaching model to form a new teaching method. On the other hand, domestic scholars are more inclined to explore the modes and methods of project-based learning in different online teaching environments. Meanwhile, domestic scholars generally believe that project-based learning and the flipped classroom can be effectively integrated, which have many similarities.

Regarding application research, foreign scholars have been more in-depth on the application of project-based learning, mainly focusing on the higher education stage (undergraduate). The application subjects or majors are mainly science and engineering subjects and science-related subjects or majors. And the implementation of project-based learning has been explored in the network environment[29]. Domestic scholars find that China's research on the application of project-based learning in secondary and higher education mainly focuses on English subjects and particular practical subjects, and primary education mainly focuses on the language, mathematics, and English subjects, as well as the scope of integrated practice.

In the area of teaching effect and evaluation, scholars at home and abroad agree from different perspectives that project-based learning is closely related to the cultivation of ability. The effect evaluation system of project-based learning in foreign countries focuses on vocational competence, and the teaching effect pays more attention to the knowledge and skills required by vocational workplaces. At the same time, the effect evaluation system of domestic scholars focuses on the learning effect and the improvement of core literacy. Different types of universities in China have different objectives for talent cultivation, and the current application of project-based learning in undergraduate education is more inclined to cultivate high-quality talents who can engage in long-term scientific research and high-end technology.

Therefore, future research on project-based learning can expand the scope of applied disciplines and the focus of effectiveness evaluation. At the same time, with the continuous development of application-oriented universities, more attention can be paid to the effectiveness of project-based learning in cultivating professional abilities in applied universities. This study helps researchers understand the current status of project-based learning research through systematic combing to promote the in-depth development of theories and better enhance the learning experience of project-based learning. This paper also has some limitations, the literature search website is limited and the research results are only generated from a few selected keywords, so some articles are not included.

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