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A Review Of Research On The Use Of Project-Based Learning In Subject Teaching In China

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Abstract:
The quintessential objective of educational reforms in China is to reinforce pedagogical standards and accentuate the cultivation of students' core literacy and critical capabilities. Project-Based Learning (PBL), a dynamic educational paradigm diverging from traditional Chinese instructional methods, is increasingly being employed across a diverse array of subjects and fields. Utilizing a methodology combining literature review and inductive analysis, based on academic databases from the China National Knowledge Infrastructure, this study comprehensively analyzes PBL's application across various educational levels—from preschool to higher education—and disciplines within China. It intends to promote the adoption of PBL within university management courses, thereby contributing to its role in the evolution of tertiary education in China, as well as providing scholars with a broader spectrum of practical PBL case studies.

Keywords: *Project-Based Learning; Disciplines; Overview*

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I. Project-Based Learning: An Concept

Project-Based Learning (PBL) is an engaging, student-centric pedagogical approach in which educators cultivate a nurturing environment by offering guidance and essential resources. Within this setup, students proactively embark on a quest for knowledge, tackling open-ended questions through collaboration and cerebral diligence. The essence of PBL lies in preparing pupils for future adversities by guiding them to distinguish between what is known and unknown, pinpoint sources of requisite knowledge, and devise strategies to acquire new insights vital for problem-solving. Consequently, PBL fosters an array of competencies, including knowledge procurement, project planning, execution oversight, and the fortification of communicative and cooperative team dynamics.

Scholars Dolmans and Grave (2005) perceive PBL as an innovatory and student-focused approach,

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enhancing cross-disciplinary acumen, teamwork synergy, problem resolution capacity, intercommunication, critical analysis, and self-directed learning. Several Chinese scholars and educators have also proffered delineations of PBL. Li Zhihe and Zhang Limei (2017) describe it as an optimal and rational utilization of learning assets by learners to address pertinent questions within a project of interest, thereby garnering comprehensive and specific knowledge, specialized skills, and progressive educational development.

II. Disciplinary Literature Analysis on Project-Based Learning

A thematic search on "Project-Based Learning" through the China Journal Network yielded a total of 2,459 pertinent documents cataloged in the CNKI database. The study, segmented by academic discipline, embarks on an analytical journey to probe the application of Project-Based Learning within tertiary curriculum. Its ambition: to extrapolate a methodology poised to elevate the suboptimal learning efficacy discerned amongst university students. The research encompasses an examination of literature spanning 29 articles on preschool education, 657 on primary education, 1,438 on secondary education, and 73 on higher education.

Preschool Education

In evaluating the 29 scholarly pieces pertaining to preschool education, the research can be synthesized into several categories:

The first centers on the cultivation of young children's abilities. Fang Hanzheng's study (2022) steered toddlers through planting peanuts across varying environments, observing the developmental shifts of the legume to deduce the essential conditions for growth and the transformation of raw peanuts into their edible counterpart. This autonomous exploration amidst real-world complexities not only spawned problem discovery and resolution but also epitomized an educational pursuit grounded in childhood curiosity, proactive learning, and the fostering of investigative aptitude. Zhuang Min (2021), in alignment with the "Joyful Play and Learning" initiative held in kindergartens, fixated on the construction of a "Goldfish Home" as the medium, propelling a series of inquisitive undertakings targeting a superior habitat for the fish, thereby nurturing the children's capacity for independent inquiry, new knowledge framework formation, and practical problem-solving prowess. Zheng Xiaoshuang and Wang Jieping (2022) orchestrated an experiment centering on problem-solving, segmenting children into groups and embarking on a trio of Project-Based Learning activities, eventually demonstrating the merit of PBL in augmenting the problem-solving capabilities of five to six year-olds. Other contributory works by Zang Xiaoguo (2021), Yang Lu (2023), and Zhou Jiaxin (2022) equally spotlight children's abilities. Early education prioritizes the enhancement of both cognitive and kinetic proficiencies. As such, the "Project-Based Learning" studies advocate for a student-centric approach, judiciously selecting pedagogical content with discernible learning value. Through problem-driven, expansive collaborations and rigorous inquiries, this paradigm facilitates youngsters' authentic situational engagement, magnifying their individual creativity, and bolstering their cognitive faculties, resolution acumen, and cooperative competencies.

The second category pertains to the enhancement of teacher capabilities. Wang Yueting and Yao Lei (2022) addressed issues such as the monotony, low efficacy, dissatisfying content, and insufficient intensity of preschool teacher training. Their discussion advocated for the adoption of educational methods and mindsets underscored by Project-Based Learning. Within this framework, instructors metamorphose into facilitators and learners into explorers, effectively boosting educators' capacities for autonomous thought and inquiry. Qiu Xuehua (2021) chronicled the curricular transformation of Shenzhen's Third Kindergarten from integrated thematic activities to project teaching and ultimately, Project-Based Learning, since 2011. This pedagogical shift has transmuted the

teacher's role from a mere purveyor of knowledge to a collaborative creator, a transition emblematic of innovation in contemporary education.

The third category reflects joint cultivation efforts between family and school—coined as "home-school co-education". The COVID-19 pandemic revolutionized the existent home-school co-education model, leveraging home-based Project-Based Learning to foster both practice pathways and process guidance strategies. This methodology not only boosted parents' capability in home education but also stimulated children's exploration, critical thinking, and practical skills, further advancing home-school synergy. Zhang Jing and Zhang Xiaoyue (2020) elucidated on the dynamic where, within the family context, children lead and parents support in a community of collaborative learners, engaging in progressive, inquiry-based activities through parent-child cooperation. Such initiatives reposition parental focus onto their children's interests and needs, optimizing parent-child relationships and interaction quality in the problem-solving process. Appropriate teacher support not only propels projects forward but also enriches parenting strategies, elevating parental confidence, strengthening trust and support between home and school, and facilitating the effective continuation of these alliances. Pandemic-era "home-based Project-Based Learning" has proffered novel perspectives on home-school co-education and collaboration. The literature on this style of learning chiefly explores the responsibilities endowed upon educators in modern times, guiding parents in executing home-based Project-Based Learning initiatives. This practice not only acquaints teachers more intimately with the procedural nuances and comprehensive operations of Project-Based Learning but also hones their professional competence by enabling the application of their expertise to interpret children's behaviors in both learning and daily life, accruing extensive and meaningful experience, thus augmenting their professional prowess.

In conclusion, Project-Based Learning has become extensively integrated into preschool education, primarily implemented through hands-on practice, teacher-generated problem-solving guidance, and participatory action research. Ultimately, children derive conclusions from their practical experiences, learning joyfully while exercising both mental and physical skills. Throughout this process, the professionalism and competency of preschool educators, acting as guides, concurrently undergo development and refinement.

Elementary Education

An examination of 657 scholarly works on elementary education reveals a tendency to categorize research according to subject matter, such as primary language arts, mathematics, information technology, science, English, and visual arts. Within these, language arts is further divided into specific domains like reading instruction. In addition to these categories, there are also studies on pedagogical practices. This article synthesizes research findings in mathematics, language arts, and other disciplines:

One key area is elementary mathematics. Lin Sujian (2022) delineated the essence of Project-Based Learning, its significance in primary mathematics education, the principles for its application, and proposed four instructional strategies: context introduction to clarify project tasks; information gathering and design of inquiry plans; collaborative group work to conduct project learning tasks; and summative assessment to deepen understanding of the project learning process. Chen Fang (2022) applied educational practice to examine three types of project learning in elementary mathematics: exploratory, investigative, and statistical. These forms illustrate the essential integration of mathematics with real life at the primary level, aligning with students' learning patterns while transforming their passive learning stance. Students thus cultivate habits of deep thinking and inquiry, promoting the development of key skills, fostering a spirit of investigation, and enhancing creativity. Similarly, extensive research by Zhang Yalian (2023), Xu Yuanyuan (2023), and others delves into elementary mathematics, exploring it in depth.

Another focal subject is primary language arts. Wang Heqin (2022) used specific instructional content to craft authentic and meaningful scenarios and task clusters, building systematic learning tasks and projects that encourage students to boldly question, actively explore, and collaboratively learn, using various tools to creatively solve problems. Adoption of project learning in elementary language arts instruction represents education that merges cognitive activities with overall personal development, honing students' comprehensive abilities in listening, speaking, reading, and writing, as well as core literacy skills. Through practical application, Wang Lulu (2022) integrated project learning into language arts instruction at the primary level, fostering not just the implementation of teaching reforms, but also enhancing educational quality and outcomes. The effectiveness of project learning's application to language arts instruction was thoroughly discussed, with specific implementation measures proposed. Research by Li Chunmei (2022), Wang Jun (2022), and others indicates that project learning in primary language arts not only sparks student interest and elevates classroom teaching quality, but also cultivates students' core subject literacy. Current reforms in language arts instruction are focusing increasingly on nurturing these core literacies, with many scholars paying attention to improving and enhancing reading instructional methods. For example, work by Jiang Shengyu (2023), Chen Fangyuan (2023), and others demonstrates how reading facilitates deep learning and the application of project learning within primary language arts serves as a crucial means to enrich reading instruction, ignite student interest in reading, strengthen collaborative skills, and bolster overall student competency (Zhao & Wu, 2022).

The third aspect pertains to research findings in various disciplines. Following the introduction of China's compulsory education curriculum standards, Project-Based Learning has been integrated into the teaching of various subjects in primary schools, with the widespread adoption of new pedagogical approaches aimed at fostering the core competencies of elementary students. Xie Zizhong (2023) has employed project-based learning to effectively implement labor education in schools, advancing through four key steps: sparking interest and setting clear tasks; establishing goals and affirming their value; distilling themes and clarifying direction; and developing measures for consistent support. This approach ensures children gain a genuine appreciation of labor, fulfilling the educational goal of labor cultivation. Emphasizing the cultivation of students' work habits, the promotion of agriculture-related projects, and the organization of themed activities has led to innovative breakthroughs in labor education. Wang Kang (2023) examined the life cycle of animals in the third-grade elementary science textbook published by the Teaching and Research Press as a case study, elucidating how project-based learning can be successfully applied in primary science education, offering fresh perspectives for implementing new curricular standards and enhancing the educational value of the subject. Zhang Rongli's (2023) practical analysis of the value and application strategies of project-based instruction in elementary information technology classes indicates that this teaching method is adaptable and dynamic. The curriculum reform has set a clear direction for the improvement of information technology courses, with diverse teaching methods and efficient strategies playing a significant role in advancing the teaching of this subject post-reform, among which project-based learning stands out as an effective and liberating pedagogical approach. Wu Lijuan (2022) proposed a set of teaching strategies for elementary music education based on project learning that includes setting project themes and content aligned with disciplinary literacy goals, adhering to curricular timelines, promoting open-ended learning with driving questions, valuing experience, emphasizing expression and creativity, and using evaluation methods that guide toward learning objectives to comprehensively enhance students' musical literacy. Lu Yan (2022), drawing from practical teaching scenarios, explored effective strategies for implementing project-based learning in elementary English education, assisting students in developing autonomous learning skills, improving their English language proficiency, and building comprehensive language competencies. Wei Lei (2022) used the teaching of "The Bridge" as an illustrative case to delve into five facets of art education: driving cognition, guiding understanding, evaluating experience, practicing in units, and reflecting on experiences,

thereby making a profound inquiry into classroom instruction for art projects or studies.

In summary, since the curricular reforms in compulsory education, project-based learning as a teaching methodology has become widely recognized and applied by educators across China, garnering positive practical results.

Secondary Education

The corpus of secondary education research consists of 1,438 papers, testifying to the extensive and profound exploration of Project-Based Learning (PBL) in secondary education. In this article, we review relevant literature addressing both junior and senior secondary education.

Firstly, outcomes in junior secondary education are discussed. Zhu Youlin (2023) contends that executing PBL necessitates a collaborative search for appropriate projects by teachers and students. During the project's implementation, educators must utilize their pedagogical experience and professional acumen to guide pupils in acquiring relevant knowledge, mastering pertinent skills, and enhancing their core competencies and abilities. Zhu (2022) proposes the "Guided Learning-Experiment-Innovation" PBL model to holistically advance the physical science core competencies of junior high students and steer them toward innovative outcomes. This method uses experimental inquiry as a foundation, guided learning strategies as a bridge, and efficacious teacher-led instruction to navigate students through the complete PBL process, therefore ensuring the research objectives are effectively met. Chen Xuelin (2023), drawing from the specific objectives of "integration and practice" in the new junior high mathematics curriculum standards, re-designed a PBL scheme for the subject, aspiring to merge curricular goals with core competencies through project-based study of internet era's pertinent issues. Chen's case studies and analytical research infer that PBL can foster students' robust creative thinking, collaborative teamwork and leadership abilities, basic hands-on skills, and the capacity for planning and efficiently executing specific project tasks. Rational selection of project content can also immerse students more deeply in confronting and resolving numerous real-world issues encountered in their environment. Liang Yuming (2023) analyzes trends in students' motivational changes from the perspective of their learning incentives within the PBL paradigm, leveraging novel entities, methodologies, and patterns to impart fresh experiences, to ignite students' initiative and enthusiasm, thus fully engaging them in PBL and achieving educational outcomes that entertain as they enlighten, with the aim of enhancing English language prowess and literacy for more holistic student development. Moreover, documents from authors like Lin Shuangshuang (2023) and Chen Longsheng (2023) suggest that PBL's pedagogical methods and teaching styles have been widely adopted across various subjects in junior secondary schools.

Secondly, achievements within the realm of senior secondary education are acknowledged. The didactic model of "teacher lectures, students listen" has grown archaic, failing to align with the evolving zeitgeist. Under the auspice of macroscopic concepts and centering on a learner-focused approach, the organization of knowledge into project-based units enables the assembly of fragmented information and transforms dry subject matter into engaging, lifelike, and immediate experiences. This approach fosters a profound interaction between teaching and learning, engendering core competencies within students that become ingrained as a perpetual impetus for their growth. Zhang Xue (2023) introduces Project-Based Learning into the senior high school Chinese language curriculum, constructing a unit-teaching model based on PBL to promote the development of students' core qualities and holistic aptitudes. As the new high school curriculum reforms deepen and their effects become more pronounced, establishing an active, student-centric learning environment has become the fundamental mission in the teaching of all subjects at this level. In this context, Cui Haiqing (2023) conducts comprehensive research into the innovative integration of Project-Based Learning in high school physics instruction, examining aspects such

as theme selection, scaffolding construction and application, design of driving questions, facilitation of team collaboration, and construction of an evaluative framework for PBL. Cui (2023) concludes that PBL is an effective model for enhancing the quality of physics education. Zhou Guile (2023) reviews literature on engineering thinking and Project-Based Learning, both domestically and internationally, to define pertinent concepts. Guided by multiple intelligences theory, constructivist learning theory, and John Dewey's "learning by doing", Zhou (2023) analyzes components of PBL and engineering thinking and their respective characteristics to develop a PBL model tailored for fostering engineering thinking. This model is also structured with an instructional ideology and assessment plan, aiming to cultivate engineering thinking in senior high school chemistry students and equip them to address practical chemical problems.

Moreover, in addition to the integration of PBL in senior high school curriculum, courses such as political science by Yan Yunxia (2023), mathematics by Zhu Rui (2023), computing by Tian Yang (2022), history by Dai Hao (2023), and geography by Hou Kaiyun (2023) have already adopted the PBL teaching model. Within the context of the latest curriculum reform, the question of how to effectively cultivate core competencies has captured the attention of many educators. Compared with traditional teaching models, Project-Based Learning places greater emphasis on the active role of the student. By establishing clear project research objectives, it stimulates the cooperative inquiry mindset of students, allowing them to enhance their subject-specific core competencies through diverse learning methods (Zhou, 2023). Consequently, amidst pressures of middle and high school entrance exams, PBL is increasingly applied in the teaching of various subjects at the middle school level, with educators paying growing attention to its application and research.

Higher Education

In the compendium of 73 scholarly articles on Project-Based Learning (PBL) in higher education cataloged by CNKI, PBL also manifests in its application across various academic disciplines within universities.

Pei Yuqiong and her colleagues (2023), drawing on the experiential project-based approaches advanced by numerous international universities, navigate novel pathways for developing an innovation and entrepreneurship education model centered around PBL for undergraduates in Chinese medicine. Cooperating with external resources, they undertake collegiate innovation and entrepreneurial simulation experiments and practice projects. By integrating the unique characteristics of the Chinese medicine field, they transition away from traditional talent cultivation methods and establish a cutting-edge instructional model built around projects to foster entrepreneurial capabilities within students. In the context of the burgeoning online teaching methods, Si Changdai and others (2022) have utilized the classical Carnot theorem model from physics and chemistry as a case study. They aim to propel students into in-depth learning, enhance classroom instruction effectiveness, and fulfill the tripartite educational objectives: knowledge and skills; processes and methods; emotions, attitudes, and values, by practicing PBL in online education founded on an analysis and elucidation of its methodology and traits. PBL is distinguished by its autonomous, cooperative, and inquiry-based learning characteristics and is now widely employed in the innovative teaching and reform practices of higher education institutions in China. Understanding that teaching evaluation is a crucial component of gauging educational outcomes in Chinese universities, Hong Xia and Liu Ziying (2022) combine principles of effective teaching assessments. They systematically establish evaluation philosophies, indicators, systems, methods, and principal evaluators, analyzing prevalent issues in PBL assessments. These insights lay the groundwork for exploring pathways to execute efficacious teaching evaluations in university PBL. Effective teaching assessments must align with the distinct nature of PBL and underscore its pedagogy to fully leverage its guiding role. In the face of China's lofty demand for talent, higher-order thinking skills have become a salient objective in higher education. PBL, as an internationally recognized

model that fosters the progression of students' deep learning abilities, is instrumental in cultivating and augmenting higher-order thinking skills. Studies have established that PBL enhances students' metacognitive levels and problem-solving capacities. Furthermore, there is a substantial positive correlation between students' higher-order thinking abilities and their academic achievements: the stronger the students' higher-order thinking skills, the higher their academic achievement tends to be. Thus, higher-order thinking constitutes a positive predictor of student success, with PBL serving as a vital pedagogical approach to elevate higher-order thinking skills among university students (Bu et al., 2022).

Considering the current prevalence of large lecture-based courses in Chinese universities, which often yield unsatisfactory educational outcomes, this paper is dedicated to exploring a more effective mode of instruction. Research on Project-Based Learning (PBL) in higher education remains sparse within CNKI's database, focusing primarily on explaining what PBL's philosophies and methods entail: its viability in the context of university teaching; and, if feasible, what advantages and limitations it presents when applied in the academic environment. PBL in university curricula should ideally involve inquiry into real-world problems and development of tangible products, embodying an approach to learning rooted in disciplinary education. This pedagogy enables students to learn research methodologies and draw conclusions through hands-on experiences. However, due to existing constraints, it cannot supplant traditional classroom teaching and its widespread implementation is restricted (Hou, 2021). Furthermore, Hong Xia and Liu Ziying (2022), acknowledging the particularities and standards of university disciplines, have leveraged the "gold standards" of Project-Based Learning, as established by the Buck Institute for Education, into China's tertiary instructional practices. They propose and thoroughly discuss seven pivotal standards: project design and planning; aligning with standards; crafting culture; managing project activities; using scaffolding to enhance learning; participating and facilitating student performance; and evaluating student learning. The literature posits that a structured system of standards for PBL in university curricula has yet to be established. Implementing these seven "gold standards" of PBL is a critical step towards enriching and enhancing the instructional reforms in ideological and political education within higher education. Adopting these standards in teaching practices will likely optimize and standardize PBL instruction, advancing curricular development in universities and providing guidance for establishing PBL standards in higher education teaching approaches.

III. Summary

In summary, a review of the literature suggests that although PBL is widely applied and practiced in China, particularly in elementary and secondary education, its integration within the breadth of student learning and teaching in universities lags behind and necessitates reinforcement. Its wide application aims at developing students' multiple competencies and core literacies. In the new era of the internet, the support for PBL is evident across various aspects such as learning resources, technology, and methodologies. This also signals that China's educational industry still harbors ample room for growth and areas to implement PBL, especially within higher education. Consequently, this article contends that there is a need for deeper promotion of PBL teaching models in Chinese universities and for university educators to shift their focus towards incorporating modern instructional means. This shift involves transforming disciplinary knowledge into a project-based, integrative, comprehensive format that satisfies the pedagogical demands of teachers and students, establishing a sound evaluation system. Furthermore, aligning Chinese education with global development, maximizing the potential of PBL, will facilitate progression in the nation's educational endeavors in this new epoch.

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