

# Protocol-Guided Learning as a Facilitator of the Integration of Project-Based Learning into Chinese Compulsory Education

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**Abstract:** Currently, there are growing conversations about how to successfully integrate project-based learning into regular curricular instruction at the compulsory education level in China. Protocol-guided learning, which originated in Chinese basic education, has proven to be one of the most productive teaching methods in recent decades. It shares comparable educational philosophies with project-based learning and has the potential to compensate for the inadequacy of the latter's application in Chinese compulsory education by providing effective implementation paths for it. The purpose of this article is to reveal the significance of the protocol-guided learning method for the successful implementation of project-based learning in China by pinpointing the issues the project-based learning approach faces, delineating the characteristics of protocol-guided learning, and expounding on its potential roles in supporting the application of project-based learning in Chinese compulsory education schools.

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**T**HE CURRENT educational reform in China places a high premium on the transformation of learning methods to promote the cultivation of key competencies and all-round development in students. In this context, project-based learning (PBL) has instigated widespread interest and debate in the education world. “*Opinions on Intensifying Educational and Instructional Reform and Comprehensively Improving the Quality of Compulsory Education*,” released by the State Council of China (2019), stresses the necessity of introducing PBL in Chinese compulsory education. “*The Compulsory Education Curriculum Program and Course Standards 2022*” (hereinafter referred to as “The New Curriculum Program”) underscore the importance of intensifying instructional reform and strengthening practical instruction to foster students’ ability to apply knowledge to problem solving and recommend promoting comprehensive learning by introducing teaching strategies such as module-based learning, theme-based learning, and PBL (State Council of China, 2022).

At the same time, Chinese compulsory education schools (including primary and junior secondary schools) are faced with many challenges in applying PBL to their regular teaching, and teachers are making ongoing explorations in an effort to overcome them. Numerous primary and secondary schools have employed the protocol-guided learning (PGL) method, which originated in China more than 30 years ago, as a meaningful experiment of PBL, to varying degrees (Yan, 2023). PGL, based on Chinese educational experiences, has the advantage of suiting the domestic education environment. In the meantime, its emphasis on student autonomy and practical competence conforms to the education philosophy underlying PBL. Using learning protocols to support PBL is likely to help overcome the barriers to its adoption in curricular instruction. This article summarizes the issues with the application of PBL to regular teaching in compulsory education schools, describes the characteristics of the PGL method, and lays out the benefits of integrating PGL into PBL, seeking to provide valuable insights for educators to optimize the application of PBL in China.

## **Issues with the Application of PBL in Regular Teaching in Chinese Compulsory Schools**

PBL, a student-centered instructional strategy, engages students in solving real-world problems or completing specific projects through situated inquiry, practice, and teamwork (Huo, 2023). The Chinese education community has placed a high value on the implementation of PBL in compulsory education. In 2021, the education departments of Fengtai District and Haidian District in Beijing City, Huangpu District in Shanghai City, Jinzhong City in Shanxi Province, and Wenzhou City in Zhejiang Province jointly signed a three-year agreement with Beijing Normal University’s China Education Innovation

Institute to establish pilot zones for “regional reform pivoting around PBL for the cultivation of key competences in children” in the said five regions (China.com.cn, 2021). Yet, in practice, PBL poses serious challenges to all actors because it seemingly breaks the original orderly pattern of instruction, disrupts established learning procedures, makes learning outcomes unpredictable, and leaves students to make arbitrary decisions in the learning process on their own (Lyu, 2019).

## ***The Low Fit between PBL and the Current Teaching System in China***

PBL, rooted in Western education philosophies and culture, is contradictory to the Chinese teaching system in many ways. Major issues lie in the conflicts between the subject-based instructional system and PBL’s interdisciplinary tendency, between the academic results-focused culture and PBL’s emphasis on all-round education, and between the established evaluation system and PBL’s assessment method.

“*The New Curriculum Program*” explicitly states that the explicit division of subjects in the curriculum forms the basis of teaching at the compulsory education level in China (State Council of China, 2022). Subject-based teaching highlights the importance of the complete knowledge structure of each separate discipline (Li, 2005). On the other hand, PBL requires the integration of multidisciplinary knowledge to facilitate students’ reaching solutions to real-world issues. Additionally, PBL demands more diverse, cross-disciplinary education resources, whereas for subject-based teaching, the school tends to deploy assets targeted at each individual subject (Li, 2005). Therefore, how to successfully implement PBL to meet students’ needs for integrated knowledge under the current subject-based teaching system is a huge challenge for schools and teachers.

The conflict between the emphasis on academic results in the subject-based teaching system and PBL’s focus on competence cultivation is another issue. Chinese compulsory education prioritizes content knowledge delivery to best support students’ academic success (Yin, 2021). On the contrary, PBL stresses the development of essential competences through practical exploratory activities such as autonomous inquiry, innovation, critical thinking, and more (Yu, 2023). Yet, it may appear as a disruption to established curricular instruction, compromising students’ acquisition of disciplinary knowledge (Yin, 2021). The issue of how to ensure students fulfill the national compulsory education curriculum while simultaneously meeting their needs for competence development by introducing PBL is pending further research.

In addition, there are gaps in the assessment method between the established evaluation system for compulsory education and PBL’s evaluation

criteria. Currently, student evaluation at the compulsory education level primarily relies on summative assessments, including quizzes, midterm and terminal examinations, and external high-stakes examinations. Contrarily, formative assessments are central to PBL instruction. The teacher needs to adopt formative assessments to track students' engagement and progress in PBL, as well as the challenges they encounter, in order to give them timely feedback and directions (Zhu, 2023). The absence of formative assessments significantly reduces PBL instruction outcomes. Also, teachers' undeveloped knowledge of PBL assessment criteria is an impediment to achieving PBL's objectives (S. Wang, 2023).

### ***Teachers' Inability to Adapt to New Roles in PBL Instruction***

In the traditional classroom, the teacher acts as a provider of knowledge, playing a central role in the process of instruction (Kang, 1986), whereas in a PBL environment, they need to assume more diverse roles, such as research participants, project designer, and PBL manager and evaluator, in addition to being an instructor. These new roles demand higher levels of educational competence and require a student-centered position (Cheng, 2022). According to X. Wang's (2023) investigation into "challenges facing teachers in implementing PBL in mathematics instruction," the majority of teachers had difficulty developing PBL curricula, assessment criteria, and teaching resources, among other matters.

The lack of generalist teachers further complicates the integration of PBL into regular curricular teaching. Generalist teachers' involvement is beneficial to the implementation of PBL. Because of the subject-based teaching system, the vast majority of compulsory education teachers in China are non-generalists with limited interdisciplinary expertise and competence (Liu, 2020). Generalist teachers' education necessitates a special teacher training program that differs from the current mainstream teacher education pattern. The dearth of mechanisms for large-scale generalist teacher training results in the minimal number of these professionals in Chinese compulsory education (Zhang, 2015).

### ***Insufficient Readiness for PBL in Students***

PBL poses a serious challenge to students' active learning abilities and skills. Under the traditional transmission-and-acquisition teaching pattern, students are passive receptacles of knowledge; their learning is fraught with textbook-workbook-driven activities. PBL expects students to actively explore and construct knowledge, utilizing their initiative to identify issues, analyze questions, and seek solutions (Zhu, 2023). Central to PBL is students' auton-

omous inquiry, which concerns comprehensive competences including self-directed learning, problem-solving, and critical thinking (Lei, 2023). Due to their dependence on their prior passive role in the classroom, the majority of students have difficulty accommodating the PBL environment in their initial experiments with the new learning model. In addition, compared with traditional learning modalities, PBL requires more input of time and energy on the part of students as it entails a lot of in-person investigations and practical manipulations. Frequently, a PBL activity unfolds in phases over a prolonged duration and involves numerous intricate tasks. Students without a certain measure of perseverance can hardly hold on to the end (X. Wang, 2023).

## **The History and Characteristics of the PGL Method**

### ***The Background of the PGL Method***

Based on the principle of “learning by autonomous inquiry,” PGL is seen as one of the most significant teaching models in Chinese basic education. It can be traced back to the use of “instruction protocol” initiated in 1996 by Donglu Middle School in Nanjing City, whose mathematics and chemistry teachers adopted “goal-directed teaching” as an instructional reform and developed teaching materials for this purpose, known as “instruction protocols” (He & Xu, 2009).

Inspired by Donglu Middle School’s instructional reform, schools across China set about reforming their own classroom instruction to realize mutual promotion of teaching and learning (Xia & Zhou, 2020). In 1998, Dulangkou Junior Secondary School in Liaocheng City, Shandong Province, attempted to morph “instruction protocols” into “learning protocols.” Following this instance, other schools undertook comparable teaching reforms, generating a host of learning protocol-based, innovative teaching models, for example, the 271 high-efficiency classroom model of Changle Middle School in Shandong Province, the extended classroom model of Yanzhou No.1 Middle School in Shandong Province, and the module learning model of Tianhui Middle School in Hebei Province, to name a few (Li, 2014). The recent history of classroom instruction in China exhibits a transition from the “teaching protocol-based model” to the “learning protocol-based model,” “teaching and learning protocol-integrated model,” and “protocol-guided learning model.”

The “Compulsory Education Course Standards 2011,” released by the Ministry of Education of China (2011), propose to modify the established notions and behaviors of instruction to instigate students’ initiative and self-motivation in learning and highlight competence development as a fundamental requirement of the compulsory education curriculum. The course

standards also outline the fundamental procedures and general methods of inquiry-based learning, a recommended key measure for students' competence development. PGL, built on the notion of "learning by autonomous inquiry," was in line with the chief objective of the 2011 curriculum reform. Under these circumstances, the practice and study of PGL took a significant step forward.

Amid the worldwide wave of educational reform in the early 21st century, the Chinese education community made great efforts to modify teaching paradigms and methods, with special emphasis on fostering students' active engagement in learning. This move not only met the actual needs of domestic education but also conformed to the prevailing educational notions across the globe. The U.S. National Science Curriculum Standards advanced the concept of inquiry-based learning earlier in the 1990s (Zhang, 2007). The revised *2000's National Science Education Curriculum Standards* in the UK also reflected a parallel instructional notion (Hu, 2002). Global dynamics in education indicated that learning by autonomous inquiry had been widely recognized as an instrumental strategy for enhancing students' learning gains and fostering their critical thinking and problem-solving abilities. The emergence and development of the PGL model were a reaction to the Chinese education reform as well as a result of drawing on internationally advanced educational concepts. PGL, as a visionary pedagogical method, contributes to the development of a pool of talent with innovative spirit and practical competence in China.

### ***Characteristics of the PGL Method***

Protocol-guided learning is now widely accepted as an instruction style in which teachers construct learning protocols for students prior to the session based on course standards, textbook subject matter, and student learning conditions. Typically, these learning protocols include learning goals, materials, methods, and procedures, and instructors use them to lead students toward autonomous learning (Wang, 2022).

The "Four Steps of Guidance" approach is commonly adopted by most schools in their design of learning protocols, which guide students through the whole learning process, from pre-class preparation to classroom inquiry, summary and reflection, and instructional assessment. Each component of the learning protocol pertains to specific objectives. The learning protocol suggests a variety of pre-class learning activities for students to help them integrate into learning situations by presenting familiar concepts and evolving relevant information. It includes specific planning for class activities to guarantee that classroom inquiry is well organized and that the goals of these activities are fulfilled. The following steps of summary and reflection assist students in generalizing approaches and constructing knowledge

structures. Every step of the student learning process, including self-directed learning, problem-solving, mastery of learning methods, and knowledge consolidation after class, incorporates the instructional assessment process (Wang & Zhu, 2022).

In PGL, teachers do not directly impart knowledge to students but rather guide them to inquire and practice independently; the primary purpose of PGL is to enhance students' capacities and skills through student-centered and teacher-led classroom learning (Wang, 2022). The learning protocol not only provides students with basic learning materials and teachers with an instruction framework, but it also serves as a guide for student learning by restructuring textbook substances with well-designed questions that allow them to inquire in an organized and sensible manner. Well-structured learning protocols optimize learning by increasing students' initiative and self-motivation (Wang & Zhu, 2023). Specifically, the PGL method has the following features:

### ***Focusing on Student All-Round Development to Meet the Requirements of “The New Curriculum Program”***

Underpinning the PGL method is the principle of education for the all-round development of students, which is the overarching goal of “The New Curriculum Program.” It supports student holistic development by fostering students' comprehensive competences and changing the roles of teachers in the classroom. The Ministry of Education of China (2022) claimed that the reformatory aims of “The New Curriculum Program” are threefold: (i) to prioritize the development of key competences for students' lifelong growth and social adaptation, particularly the capacity to solve problems in real-world situations; (ii) to optimize the arrangements of curriculum delivery by revising the traditional categorization of knowledge and integrating curriculum subject matter through theme-, project-, and task-based learning; (iii) to increase the weight of practical education by engaging students in inquiry-based activities, which give them the chances to experience the complete process of spotting the problem, applying prior knowledge, working out solutions, and constructing new knowledge such that they develop and upgrade their understanding of the world on the basis of practice.

### ***Restructuring Textbook Subject Matter with Meaningful Questions to Support Student Autonomous Learning***

Learning could be monotonous and boring in a traditional classroom featuring the transmission-and-acquisition style. To make it more engaging and productive, the PGL model requires curriculum designers to restructure



teaching materials with meaningful questions, a crucial strategy for PGL. This strategy can successfully turn students from passive learners into active explorers by piquing students' interest in learning and increasing their critical thinking and autonomous learning abilities, thus significantly improving teaching outcomes (Wang, 2022). Well-designed questions not only make the learning process engaging and inspiring but also provide clear directions to students (Yu & Xia, 2020). To address these questions, students need to actively seek out relevant material, analyze information, and even validate their answers with experiments. In this process, the student develops new knowledge and, more importantly, learns how to learn. According to Lin's (2023) case study of PGL in junior secondary physics education, the use of learning protocols was highly effective in enhancing students' autonomous learning capacities. Among student participants, 85.29% claimed that the regular application of PGL in physics instruction resulted in their more efficient mastery of key concepts in this subject.

### ***Customizing Learning Routes and Providing Diverse Education Resources for Students***

The PGL model takes effect through well-crafted learning protocols that contain explicit learning goals, materials, and procedures. Learning protocols provide students with highly efficient learning routes to guide their reading, thinking, and practice (Zhang, 2023). In the traditional education paradigm, the learning routes are often homogeneous among various groups of students. In contrast, with learning protocols, the teacher can prepare legitimate learning routes for students in light of their actual cognitive levels and learning conditions, as well as the teacher's instruction objectives. Such routes can lead students to conduct in-depth, effective inquiry. Furthermore, learning protocols provide students with a wealth of information essential for in-depth learning, often overlooked by textbooks (Liu, 2022). The teacher can leverage all sorts of channels to enrich students' learning materials; these colorful learning materials can take various forms such as text, images, audio, and videos (Li, 2023). Richer learning resources help students comprehend knowledge in historical and cultural settings and give them diverse perspectives on the same knowledge, substantially broadening their knowledge horizons and boosting their enthusiasm for learning. In X. J. Wang's (2023) lesson study of "Appreciating Patterns and Decorations: Using Shanghoumuwu Cauldron as an Example," the instructor created a learning protocol that led students' learning route from observing the patterns on the bronze Shanghoumuwu Cauldron throughout drawing national cultural characteristics from the artifact. In order to assist students in gaining a better understanding of the meaning of its patterns, the teacher provided a wealth of

materials on the cauldron, including videos, images, and interactive games; students could discretionarily select those that suited their interests and needs.

## ***Normalizing Inquiry-Based Learning in a Teacher-Led and Student-Centered Classroom Setting***

In a PGL classroom, there is a marked shift in the teacher's roles: from an authority of knowledge to the class participant; from a lecturer of knowledge to the learning facilitator and guide (Zhao, 2023). Meanwhile, the PGL model transitions students' learning methods from passively accepting lectures to actively participating in group activities like conversations, debates, and collaborative inquiry (Zhang, 2023). As a result, inquiry-based learning becomes the norm in the PGT classroom, where students delve into certain questions or issues to fulfill exploratory tasks (Li, 2021). Regular inquiry-based learning helps foster students' critical thinking and problem-solving abilities, laying the groundwork for their future academic research and professional development.

## ***Emphasizing the Connection between Learning and Practice and Promoting Learning through Evaluation***

Learning and practice are of equal importance for students' mastery of knowledge. Adequate practice helps internalize theoretical knowledge, making its application possible (Yang, 2020). In PGL, the learning protocol includes a reasonable number of pre-class exercises for students to conduct self-directed learning in order to prepare them for the learning objectives and main challenges of the session (Wang, 2023). It also provides well-selected after-class exercises for students to consolidate new knowledge and generate necessary extensions (Li, 2021). The purpose-built combination of learning and practice facilitates the development of textbook knowledge into practical competences in students.

Additionally, the PGL method emphasizes harnessing evaluation and assessment to boost learning outcomes. Not only do assessments occur on a periodic basis to gauge students' academic performance, but they also permeate every stage of their learning journey, enabling teachers to monitor each student's learning progress and enabling students to promptly adjust their study methods for enhanced efficiency and effectiveness (Zhang, 2022).

## **The Potential Roles of PGL in Integrating PBL into Regular Teaching in Chinese Compulsory Education**

## ***Bridging the Gap between PBL and the Current Teaching System in China***

The most pronounced challenge of PBL's application in Chinese compulsory education stems from the conflicts between PBL's interdisciplinary tendency and focus on student competence development, and the Chinese subject-based curriculum's primary attention to student academic results. The use of PGL's learning protocols has the potential to bridge the discrepancies between PBL and China's current teaching system. Firstly, students can use learning protocols to build an interdisciplinary knowledge framework and prepare a necessary knowledge background and skill repertoire for PBL execution. The integration of multidisciplinary knowledge using learning protocols enables students to master the basic content knowledge of various subjects as well as develop cross-disciplinary competences (Kang, 2014). The teacher can utilize learning protocols to select relevant subject matter for specific PBL activities based on their respective themes. Such well-designed learning protocols will help students build solid knowledge foundations for curricular subjects and, in the meantime, develop in-depth understandings of the connection and interaction between different strands of knowledge. Second, the process of collaborative inquiry in PGL can serve as a rudimentary PBL experiment to help students adapt to the problem-solving-focused PBL style. For Deng's (2023) study on the experiment of the teaching method of "learning protocols plus group cooperative study" in secondary biology education, the results and interviews showed that this way of teaching made students much more interested in studying biology, more aware of collaborative learning, and surer of their communication, critical thinking, and practical exploration skills. Third, PGL-based, structured learning can compensate for the inadequacies of the established compulsory education teaching system by progressively directing students towards more competence-focused learning while also supporting them in achieving academic success. Guo's (2023) empirical research with pre- and post-tests found that the use of learning protocols contributed to reducing the gaps in academic achievements between members within a class while improving their social and emotional skills.

## ***Bolstering the Effects of PBL in Regular Teaching***

The absence of meaningful driving questions and formative assessment mechanisms in the curriculum design of Chinese compulsory education contributes significantly to the less-than-ideal results of PBL instruction. There is a great chance that incorporating PGL's learning protocols will significantly enhance the effects of PBL in primary and secondary classrooms. First, the deployment of well-designed questions to restructure textbook sub-

ject matter is a prominent feature of learning protocols. In preparing the learning protocol, the teacher formulates meaningful questions based on thorough analyses of teaching materials, students' life contexts, and social concerns; these questions can elicit deep contemplation and exploration interest among students. For instance, in Ma's (2023) study of the learning protocol for the all-present  $\text{CaCO}_3$ , the teacher asked questions that got the students interested in exploring the idea of  $\text{CaCO}_3$  and helped them meet the course standards' learning goals in both the preparation before class and the classroom inquiry parts of the protocol. Thus, leveraging learning protocols to provide effective driving questions for PBL activities can render PBL instruction more targeted and productive.

Furthermore, PGL's emphasis on promoting learning through built-in evaluation at every stage of learning could make up for the inadequacy of formative assessments in PBL in Chinese schools. With the learning protocol, the teacher can make a comprehensive, objective appraisal of the whole process of the student's learning by administering the before-class test, observing their in-class inquiry performance, and evaluating the groupwork results. In the study, Ma (2023) used before-class questions to assess students' prior knowledge of  $\text{CaCO}_3$  and make corresponding adjustments to the teaching strategies for the forthcoming class study. Likewise, based on the evaluation of student in-class performance, after-class activities were assigned to consolidate their understanding of  $\text{CaCO}_3$ . Formative assessments like these could be used as valuable references for establishing evaluation mechanisms for PBL in Chinese compulsory education classrooms.

## ***Assisting Teachers in Fulfilling Their New Roles in a PBL Environment***

A major challenge of PBL for teachers is the transition of their roles from knowledge preachers (common in traditional teaching modalities) to class participants, designers of cross-disciplinary projects, and managers of the PBL programs. The introduction of the PGL method can facilitate the transition, helping teachers meet the requirements of PBL instruction. First, by creating learning protocols for a PBL activity, the teacher establishes learning goals and routes as a framework for students' autonomous inquiry. In this process, the teacher naturally becomes a guide for student inquiry. The PGL method gives full play to students' agency in the classroom, making changes to the unilateral, cramming way of instruction (Wang, 2024); it strengthens the connection between teaching and learning and makes it possible for the teacher and students to collaborate to complete the PBL program in a highly efficient manner. Second, PGL's learning protocols play a supporting role in the teacher's construction of cross-disciplinary learning projects. By designing learning protocols in advance, the teacher has the

chance to thoroughly screen knowledge of relevant disciplines and integrate it into an interdisciplinary program. Third, the PGL method helps teachers better manage and evaluate the PBL process. In PBL, the teacher needs to follow up and assess the progression in a timely manner, which is not always easy because of the openness and flexibility of PBL. However, with the aid of learning protocols, which specify learning goals and tasks, the teacher can track students' progress in their PBL program clearly and instantly. The evaluation results generated by the learning protocol are an important consideration for the teacher's instruction planning (Zhou & Li, 2020).

In addition, the application of the PGL method in PBL instruction gives impetus to teacher professional development. The teacher needs to research new educational ideas and teaching strategies in endeavoring to integrate the PGL method into PBL, which places them in a better position to accommodate the current educational and instructional reforms. Moreover, the school's learning protocols for a specific course are often the results of the collective efforts of a group of teachers. That means the incorporation of PGL in PBL instruction is beneficial for promoting inter-teacher communication and cooperation (Xia & Zhou, 2020).

## ***Supporting Student Autonomous Learning in the PBL Paradigm***

Through activities involving practical manipulations and group collaboration, PBL fosters students' autonomous learning and teamwork abilities. It is a challenge for students without sufficient levels of self-regulation, perseverance, and teamwork competence. The adoption of the PGL method in PBL instruction can help students better adapt to this challenging education paradigm. First, PBL tasks are mainly concerned with active, self-directed exploration. The before-class learning protocol in PGL provides students with opportunities to research background information and relevant knowledge on the PBL questions on their own, paving the way for their active engagement in the PBL activity. Tang's (2023) lesson study of the learning protocol for teaching velocity found that students became more perceptual of velocity by watching a race on video or reenacting a race before class. They also learned how to convert between different forms of the velocity unit by doing learning tasks outside of class, which made their participation in the next classroom inquiry more active and useful. Second, students with the habit of self-directed learning often do better in PBL in that it requires students to use their initiative to seek out material, analyze underlying issues, and design investigations. The goal-directed nature of PGL happens to be effective in helping students develop the habit of self-directed learning. In his study of learning protocols for Chinese language education, Shi (2017) emphasized the importance of specifying learning goals in the protocol and advanced the

three-dimensional goal-setting approach characterized by three questions: “What do I want to reach?” “What can I do?” “What new ideas can I bring forth?” This approach drove students to delve deeper into the text voluntarily and made their learning more targeted. Third, the majority of PBL activities necessitate student collaborative inquiry to reach solutions to real-life issues. Inquiry-eliciting questions and tasks are the paramount components of PGL’s learning protocols, which often need to be addressed through group efforts. Such learning protocols are beneficial for encouraging collaborative exploration in PBL. In her study on learning protocols for teaching essays on natural scenery tours in Archaic Chinese, Yang (2022) found that well-designed group tasks, such as group investigation and group contest, significantly enhanced students’ deep understanding of Archaic Chinese and their internalization of traditional Chinese culture.

## Conclusion

Against the backdrop of the advancement of Chinese education reform, there is a growing trend towards integrating PBL into its compulsory education curriculum, despite the serious challenges it faces. The incorporation of the PGL method can breathe new life into the practice of PBL in Chinese classrooms by supporting the restructuring of curriculum subject matter, providing explicit learning goals and routes, encouraging autonomous learning and in-depth probe, and more. A more widespread use of the PGL method has the potential to further advance the application of PBL in Chinese compulsory education and contribute to creating an educational climate that promotes student all-round development.

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