



The Impact of the PBL Course Model as an Emerging Model on High School Teachers in China

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Abstract. Problem-based learning is a mode has been invented and developed gradually in the late 1960s. This model has been introduced into the teaching systems of many Western countries. The Chinese government has also promoted the growth of the overall quality of students and the abandoning of the cramming teaching method in recent years. As a teaching method that requires in-depth learning and self-directed learning, PBL has also received much attention in China. This paper aims to explore the benefits of PBL, the role of teachers in PBL, and the challenges that PBL imposes on Chinese high school teachers. The main findings of this paper were: (1) PBL is not only effective in knowledge acquisition but also in competence enhancement; (2) instructors should act as content experts, facilitators, evaluators, and supervisors in terms of students' competence in the PBL tutorial process; (3) challenges for instructors to have PBL in their classes resides in problem construction, the conflict with reality, and overcoming the traditional idea of teachers. These Findings of this paper can encourage educators to use international schools or departments as pilot sites for PBL and investigate the viability of implementing PBL on a wider scale.

Keywords: Problem-Based Learning · Chinese Education · The Role of Teachers

1 Introduction

With the development of education, the information-explosion world also demands individuals to think critically and judge various types of information. Under the conventional teacher-led system, textbooks and the standard answers to exercises practically serve as a sign of authority, students are not permitted to dispute them, and the “proper” test responses fall within a set range. In contrast, PBL (Problem-based learning) is an instructional strategy that enables students to actively investigate issue solutions and acquire the scientific knowledge implied in the problems. Students are placed in ill-structured problems which originate from the real world. They are expected to actively explore the knowledge implied by the problem in small groups, thereby developing higher-level thinking, problem-solving, self-directed learning, and communication and cooperation skills.

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Since the 1970s, problem-based learning has been influential at all levels of education in the United States extensively and positively, and it has evolved into a distinctive teaching and learning model [1]. The education system in the United States is highly developed, and education, along with politics, the economy, and the military, which is a major national priority. Although some courses and disciplines have already adopted PBL in higher education in China, it has rarely been seen in high school curricula. However, implementing PBL or other student-centered techniques should start at lower grade levels so that cognitive and metacognitive learning abilities, time and environment management skills, and critical thinking skills can develop at a young age. The earlier students develop these skills, when they reach a certain stage of physical and mental development, the better it will be for their future development. Notably, the possible impact of problem-based learning on high school teachers in China is rarely discussed.

2 The Feasibility and Necessity of Implementation

2.1 The Comparison of PBL and Traditional Teaching Model

Since the end of the last century, problem-based learning has advanced as a way of learning that complements and replaces conventional lecture methods. Investigators have conducted extensive research on the differences between traditional lecture methods and problem-based learning in different learning disciplines. The advantages of PBL compared with the traditional way of teaching can be divided into two aspects: knowledge acquisition and student competence development.

Knowledge Acquisition

In terms of the academic process, PBL students place a greater focus on meaning (understanding) than on reproduction (processing of content in memory), which is the opposite trend observed among students utilizing traditional learning strategies [2]. In problem-based learning, students acquire knowledge through independent group learning and analysis of authentic tasks. In contrast, the knowledge teachers teach students in conventional education may be better organized, clearer, and simpler. They merely need to memorize the knowledge included in the curricular standards, then practice using it to tackle some idealized exercises. Previous studies have shown that PBL students perform better in applying knowledge, for example, assessment of clinical knowledge and skills [3, 4]. Though there is a mismatch in judging the efficiency of PBL using traditional teaching approaches, the excellence of PBL in enhancing students' knowledge application cannot be neglected.

The goal of studying is not only to pass an examination. College students frequently discover that they have forgotten much of what they learned in high school, particularly in subjects unrelated to their college majors. In comparing previous studies, Gallagher found that "studies of long-term content retention are consistent and favor PBL over traditional instruction [5]". PBL enables students to apply their acquired knowledge to comprehend and address problems. In other words, students may have the chance to practice their mastery of prerequisite knowledge throughout each problem-solving session, which contributes to long-term retention.

PBL influences the teaching and learning process positively. By integrating theoretical information into practical applications, the PBL approach may make complex and challenging theoretical knowledge simpler to comprehend and help students figure out the relevance of what they have studied to real-world situations [6]. After successfully resolving authentic problems, students are more likely to experience satisfaction and develop a passion for learning.

Student Competence Development

As a mode that involves both group study and independent study, problem-based learning not only has advantages in knowledge acquisition but also promotes the promotion of students' abilities. Students are required to collect information in person. Besides that, students share information with their group members, assess one another's thoughts, monitor each other's work, interact actively by exchanging ideas, etc. [6]. During the whole tutorial process, PBL facilitates the development of student's critical thinking, problem-solving, communication, and collaboration skills, stimulates students' enthusiasm and interest in learning, and helps establish the concept of lifelong learning. For reasons of space, this subsection will elaborate on the advantages of PBL in developing students' critical thinking and problem-solving skills.

Critical thinking is the capacity to examine events, situations, or ideas with a keen eye and make judgments and decisions and investigate the reliability and validity of knowledge by the norms of logic and the mind [7]. Consequently, the purpose of education should not be restricted to delivering information and skills but also fostering critical thinking. For instance, if a person is intelligent but lacks the cognitive abilities to harness his knowledge, he or she can be readily used by others. He or she may even do extremely damaging acts to society. Correspondingly, PBL has been identified by researchers as being more effective in enhancing students' critical thinking [8, 9]. The PBL instructional process requires the capacity to create excellent questions, identify and gather information, organize and present findings systematically, examine and analyze findings, establish conclusions, and evaluate the value and significance of those conclusions [10]. By analyzing the context and choosing among different solutions and ideas, students can be trained to compare and evaluate the strengths and downsides of various solutions. These aspects are closely related to students' critical thinking.

Albanese noted that standardized tests measure the examinee's ability to recognize the correct answer from a restricted list of probable correct responses, with a heavy emphasis on memory [11]. Traditional teaching models that focus on learning outcomes and test results produce students who are more likely to search for similar experiences in their memories when solving problems. People who have engaged in problem-based learning are more accustomed to solving problems by collecting information and analyzing the current situation. In the process, they develop the habit of acquiring new information, which promotes the idea of lifelong learning.

To specify, Boshuizen, Schmidt, and Wassmer proposed that physicians from problem-based courses seem to take an analytical approach to the problem, first exploring its biochemical aspects and then linking them to the clinical aspects. By contrast, conventionally trained doctors preferred a "memory-based" approach and found answers directly in their memories [12]. But issues in the real world are extremely complicated, frequently the result of multiple factors, and even dynamic in nature. Thus, theoretical

knowledge is only a framework for problem-solving; in reality, specialized examination of situations is frequently required.

2.2 The Role of Teachers in PBL

As with many great educational concepts, PBL has proven appealing to teachers seeking course enhancements [13]. The problem is that PBL has its own set of norms, which are rather different from the approaches that are typically used in traditional education (lecturing, purposeful assignments, mnemonics, etc.). Therefore, many classes that simply appropriated the PBL structure did not get the outcomes that were anticipated. Because the students and educational objectives remain the same, it is necessary to reevaluate the instructor's role (which is also one of the fundamental factors in teaching) if changing the instruction structure alone does not provide the intended outcomes.

Teachers as Content Experts

Many studies have been conducted to determine if a content expert or a non-content expert contributes to the best performance outcomes for students in PBL [14–16]. Among these studies, researchers have not reached a consensus so far. According to Kaufman and Holmes, non-content instructors tended to place greater emphasis on the PBL process [14]. However, Neville asserted that the more knowledge the teacher has about the problem, the greater his inclination to steer the process [15]. Students self-directed and collaborative learning is likely impaired when teachers give lectures or teach students with expertise [16]. They typically provide more direct responses to student inquiries. These features of content experts are not conducive to fully exploiting the advantages of PBL.

However, most of the challenges that content expert tutors may provide may be mitigated by teacher training. A teacher with broad and deep content knowledge can wisely apply his expertise within the wider curriculum's framework [17]. A comprehensive knowledge base will enable him to connect disparate pieces of knowledge and assist students in structuring a knowledge network or identifying the disciplinary knowledge relevant to problem-solving.

To better integrate with the problem-based learning approach and maximize the benefits of this model, content-expert educators should combine content knowledge with pedagogy in their lectures, resist the desire and urge to demonstrate their learning, and encourage students to engage in self-directed learning.

Teachers as Facilitators

Most previous studies have defined the role of teachers in PBL as facilitators or guides [17–20]. PBL is primarily a student-centered model, as opposed to a faculty-led one in traditional teaching. The function of the tutor in problem-based learning is to assist students in gaining the information and skills necessary to solve the issue, as well as build thinking, teamwork, and self-directed learning abilities [19]. It is not the responsibility of a teacher to impart knowledge or information. Rather, they are expected to aid students with self-directed learning and attempt to bring it closer to the teaching objectives. Whether they need to give feedback will be further illustrated in the following subsection.

Some support the growth of peer tutoring over the employment of faculty and staff [21]. However, this concept places additional obligations on students. Not all students can provide fair assessments of their own and other students' work. Meanwhile, students with relatively little knowledge may be more shortsighted in their assessments, even if they are objective.

Novice learners need tutors' facilitation, especially in identifying learning issues, or they may be bewildered. Too much intervention may frustrate mature students [15]. So whether and to what extent a student's learning needs to be facilitated by the teacher is specific to the student's situation.

Teachers as Supervisors and Evaluators

Normally, teachers using conventional learning methods play the role of evaluating students' performances through daily verbal evaluation, assignment feedback, test paper corrections, etc. However, it is still debatable whether teachers should continue to supervise and evaluate student performance, particularly classroom performance in problem-based learning.

Walton and Matthews put in 1989 that andragogical self-directed learning in a PBL setting emphasizes a student-centered learning strategy in which students select their learning objectives, how to learn them, and how to assess their learning [22]. Evaluation in problem-based learning should, at least, involve peer evaluation. Besides, teachers are normally better at making performative evaluations of learning outcomes, which runs counter to PBL's philosophy of valuing the process of problem solving.

Needham and Begg's research has shown that rarely does a proper problem-oriented training procedure result in a correct solution interpretation and explanation [23]. A corrective feedback during the initial problem-solving effort can provide students with a clearer perception and grasp of their learning direction. Therefore, students still require professors' evaluative direction.

What is needed is a form of assessment that is recognized and valued by both students and faculty, that is meaningful to students, and that is consistent with PBL [24]. In any case, assessment is only a means to facilitate the learning process; it should not be a source of anxiety for students or instructors.

2.3 Challenges for Teachers in the PBL Model

Teachers were enthusiastic about PBL but encountered several transitional difficulties [25]. Three main challenges for high-school educators in China are problem construction, social reality, and overcoming cultural characteristics of Chinese teachers.

To Construct an Educationally Sound Problem

Problem selection is crucial in PBL because well-chosen tasks facilitate the implementation of PBL's primary purpose, which is to make students actively participate in learning [26]. However, the function of a problem is not only a trigger for learning but provides contextualized knowledge for learning. Instead of presenting a heuristic-based approach to problem-solving, teachers in PBL teach issue solving via discovery and the framework of subjects [5]. Thus, the problem setting of problem-based learning is very important, and some criteria should be completed.

An Ill-Structured Problem

Traditionally, students are presented with well-defined, verification-style problems as a problem-solving practice of what they have learned in class [27]. As students search for the expected solutions without questioning, the core of inquiry may have shifted and distorted. On the contrary, the ill-structured problems lead students to a self-regulated investigation and prompt them to generate questions that lead to transdisciplinary areas [28]. Students' lives are not segmented by subjects, and interdisciplinary education enables students to apply their knowledge to real-world situations effectively.

To have an ill-structured and authentic problem means that the problem should not be carefully described in all aspects. More knowledge is needed than is initially provided to analyze the situation or problem and determine what actions are necessary for resolution. As new information is acquired, students' definitions of the problem may change [29]. Diverse perspectives on the definition of the problem will result in varied approaches to its resolution. Consequently, a well-designed problem should be open-ended without a single correct solution [30].

A Reality-Based Problem

There is generally a mismatch between reality and theory in traditional teaching approaches. To be specific, many students believe that Science is one of the most challenging subjects to study and comprehend since they can only obtain information from their lecturers [31]. Even when teachers abandon a purely didactic mode of instruction, the impact on student progress may still be minimal.

Dealing with real-life and authentic problems from a professional field gives meaning to the abstract content knowledge involved in the problem [32]. Weiss proposed two authenticity aspects that educators should be aware of. First, the problem should be related to the experiences of students [33]. Nevertheless, some investigators argued that if the problem set is not based on students' experiences, the students may acquire a new identity or play the role of adults while attempting to solve the problem [5, 34]. Second, given that PBL is used chiefly in practical disciplines, the challenges must relate to students' current or future experiences [33].

The Conflict Between PBL Implementation and Social Reality

Problem-based learning, an emerging teaching model, does not perfectly fit the structure of traditional Chinese teaching philosophy. Implementing PBL in curricula needs to stay in line with the old educational notions, which means that the old and new curricula are judged under the same evaluation system [35].

In China, teachers' competence is evaluated based on their master of disciplinary knowledge, instructional abilities, and students' scores in examinations [36]. In other words, there is a direct correlation between the test scores of students and the evaluations teachers receive. In 2015, the Ministry of Human Resources and Social Security and the Ministry of Education proposed, as part of the process of intensifying the reform of the primary and secondary school teacher title system, that one of the critical elements of the reform is to improve the evaluation criteria for teachers and to place greater emphasis on the work performance of education and teaching [37]. Student exam scores are the most straightforward indicator of work performance. Connecting test performance

to instructor titles emphasizes the significance of test scores, making faculty members reluctant to experiment with a student-centered teaching methodology, choosing the more secure teacher-centered methods instead. Since the instructor, in a teacher-centered approach, controls the distribution and sharing of knowledge, the teacher can maximize the information transmitted while minimizing time and effort [38]. Under such institutional conditions, this is the most efficient teaching method.

However, traditional education method has a deep historical origin in China. Since the inception of the imperial competitive examination, education in China has been of teachers instructing pupils directly in the acquisition of subject knowledge [39]. Since then, teachers have been evaluated based on their ability to assist students in advancing academically through exams. Consequently, teachers' shared experiences, the prevalent teaching methods in China, and how teaching outcomes are evaluated are all appropriate and unique to the conventional teaching model.

In general, teachers must overcome the enormous pressures placed on them by social realities and be prepared to earn their titles in methods with unclear success rates to implement PBL in their classrooms. They will even take the risk if problem-based learning does not provide positive student outcomes. Indeed, the optimal option is for PBL to become a paradigm that works well with exam-oriented education, but this is still a long way off.

Overcoming Cultural Characteristics of Chinese Teachers

The cultural traits of Chinese educators differ significantly from those of their Western counterparts. Traditional Chinese culture does not regard education as an ordinary means of making a living but entrusts teachers with multiple missions such as cultural inheritance, cultivation of talents, and national governance. In contrast, Western education emphasizes vocational activities and teaching skills and methodologies [40]. These disparities also hinder the implementation of the PBL paradigm among educators.

Teacher's Sanctity

Respect for teachers is a fundamental value of traditional Chinese teacher culture. The current emphasis on respecting teachers and teaching is essentially an inheritance and innovation of the value orientation of teacher culture in the new era [41]. The teacher's dignity places the educator in a position of authority and requires the educator to impart knowledge and truth to the educated with strict requirements and rigorous governance [42]. However, an overemphasis on teacher dignity will widen the psychological distance between teachers and students, which will not be conducive to the influence of students' critical thinking. Therefore, the teacher-student relationship under this concept is not well suited for implementing the PBL model. Teachers must face the challenge of establishing a suitable balance between "respect for teachers" and democracy to foster a harmonious relationship where students have the courage to question.

Exemplary Learning Functions

Adolescents are highly imitative, and teachers, as the individuals who spend the most time with adolescents, are frequently considered models by adolescents; hence, instructors have a significant impact on the healthy development of their pupils. For this reason, teachers in China not only convey theoretical knowledge by giving lectures but teach

students how to behave by using themselves as examples and models to influence students implicitly. However, taking students as the center of teaching will reduce the influence of teachers playing the role as a model for students in the traditional concept to a certain extent, as teachers only appear as facilitators. To execute the new educational model, instructors must abandon previous ideas and take the role of teaching as a profession rather than a social figure.

3 Conclusion

The core of problem-based learning, including short-term gains and long-term impacts, attracts people to consider introducing this teaching method in classrooms. To take full advantage of this approach, teachers need to adjust their role and perception of their identity, primarily from being a lecturer to a facilitator, which needs to be aided by teacher training. But exposing all teachers and students to the challenges that the introduction of PBL may bring is not very feasible. Although PBL has been assessed as beneficial to students' long-term development in the past, the country's and nation's future should not be put at risk. PBL targets the development of deep-level capacities and demands a lot from students regarding self-control and other factors.

One implication of this paper is to apply the PBL model into the international departments of domestic high schools or schools that focus on training students willing to study abroad. Heuristic education is a teaching style used in other countries where students independently figure out the solution to the question. Education overseas is of remarkable similarities with the notion of PBL. Using international centers or schools as pilot places to promote the PBL teaching approach helps students feel more at ease in a foreign educational setting. Besides, these students are less constrained by the needs of domestic test-based education and are better suited to experimenting with new teaching styles.

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