



The Role of Teacher in the PBL Teaching Model

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Abstract. PBL, which is pointed out by Barrows, is a teaching theory that emphasizes study should base on problem situation and encourages students to solve the problem independently. This paper reviews the development of PBL teaching theory, then summarizes the discussion of Chinese scholars about the position teachers should take in the PBL teaching mode, then elaborates on the role of teachers in four dimensions, and finally summarizes and puts forward several problems in practicing the PBL teaching mode and try to make some feasible suggestions. Main findings of this paper were: teachers are 1) designers of the teaching program; 2) promoters of the teaching process; 3) organizers of the teaching atmosphere; 4) assessors of teaching outcomes. This paper inspires future researchers to focus on the different roles that teachers need to play in PBL method and the problems which may exist in practicing that, so that measures can be taken in advance to ensure the smooth implementation of teaching and learning activities.

Keywords: Education · PBL · Teaching mode · The role of the teacher

1 Introduction

PBL teaching theory was pioneered by Barrows, Professor of Neurology in the United States, at the medical school program at McMaster University in Hamilton Canada in the 1960s. The PBL curriculum was developed to stimulate learning by allowing students to see the relevance and application of future roles. It maintains a higher level of motivation towards learning and demonstrates the importance of responsible, professional attitudes with teamwork values.

Problem-based learning had subsequently been adopted by other medical school programs suitable for undergraduate teaching. The use of PBL had expanded from the initial introduction of medical school programs to other areas including education, health sciences, mathematics, law, economics, business, social studies, and engineering fields.

Barrows argued that this mode of learning is problem-oriented. He described that PBL teaching theory is a way of learning through the process of understanding and solving problems which are raised at the very start [1]. Barrows also argued that it is not easy to find the best solution to problems in educational situations. However, in real-teaching situations, teachers do not give students questions as learning stimuli in advance, but give them questions after they have learned some facts, principles, examples, important knowledge, or exercises that apply knowledge [1].

Some scholars regarded it as a way of teaching and guiding method [2, 3]. Barbara J. Duch pointed out PBL is a kind of instructional teaching method that guides students learn through group cooperation to find solutions to real-world problems so that students could gain the ability to critically examine and analyze problems, as well as the ability to find and use appropriate learning resources [2]. Hmelo-Silver also saw PBL as a teaching method in which students learn by solving problems that will advance their development. The cores of these problems are complex, which are not just some simple correct answers, and students may come up with many different results [3].

The American scholar Fogarty based on recognizing PBL as a teachers' teaching style and students' learning style, and described it as a curriculum design model. He pointed out that PBL mainly focuses on real-world problems which are ill-structured, open-ended or ambiguous as the core of the curriculum. In the curriculum, teachers assign problems to students, who should identify their own learning needs by exploring the problems and ultimately become self-directed learners [4].

In China, the earliest research and application of PBL teaching models could date back to the end of the 1980s. During that period, Shanghai Third Medical University and Xi'an Medical University pioneered PBL teaching theory in their medical subject teaching [5]. Research on the meaning of the PBL teaching method in Chinese education circles mainly has the following views and conclusions. Li pointed out that the PBL teaching method is problem-oriented, emphasizing that learning should be placed in complex and meaningful problem situations. Teachers guide learners to solve authenticity problems by cooperating in the form of a group so that learners can build a broad and flexible knowledge base, some instruct effective problem-solving skills and independent learning and lifelong learning capabilities [6]. Lin believed that PBL is a teaching method designed around poorly structured, open, vague, realistic problems, through independent inquiry and group collaboration to solve real-life problems, so that students could learn how to learn, to cooperate, to improve their independent learning ability, lifelong learning ability and creative ability [7]. Zheng's views also affirmed the research of others. Zheng believed that the PBL method is a teaching model that embeds instruction in complex and significant problem situations and promotes students work together in small groups to solve problems while learning the knowledge behind the problem. It is designed to enable learners to build a broad and flexible knowledge base. This cultivates and nurtures students' intrinsic motivation to learn and develops their problem-solving, cooperative, independent learning and lifelong learning skills [8].

2 Teachers' Positions in Researches Related to PBL Teaching Theory

Although the implication of the PBL teaching method in the international education has been recognized extensively, however, compared with other countries, the research on the PBL teaching method in the Chinese education started late, areas which the research focused on were mostly concentrated on medical disciplines, and the practical application of the method also focused on the design of relevant curriculum programs. There was few research concentrated on the role that each link should play in the PBL

teaching method, especially the core figures in teaching activities, teachers, that the liabilities should be undertaken.

Tang was one of the first to pointed out a summary view in this area. Tang compared the status of teachers in the traditional teaching mode and the emerging PBL teaching mode, then introduced the view that 'the transformation of teachers' status is actually the transformation of two teaching modes', and pointed out the problems that teachers should pay attention to in the process of these status conversion. Finally, Tang briefly explained the role of teachers should play in designing, motivating, managing, helping, and evaluating in this teaching mode [9].

Chu had refined the roles that teachers should play in applying PBL in various aspects. Chu believed that the premise of the application of the PBL teaching method is that teachers need to design specific problem scenarios for students to stimulate their curiosity. Chu emphasized that teachers need to conduct a large number of subject research before practicing the PBL method, judge students' learning conditions, design appropriate learning tasks, and rationally allocate existing learning resources. From Chu's point of view, it can be known that 'teachers should not only design scientific and effective teaching methods, but also become promoters, leaders and guides during the student's learning process [10].'

Song's view is basically the same as Chu's. Song pointed out that teachers should become organizers and promoters of curriculum reform. From the data of a 2004 questionnaire on the academic situation of secondary school students mentioned in the article, it can be seen that most students do not approve of the traditional instructional teaching model. Song believed that teachers should try guided teaching, give priority to the student, and stimulate students' autonomy and initiative [11].

Zhang mainly put forward innovative suggestions for teachers' teaching methods. Zhang believed that teachers should pay attention to the teaching of humanistic knowledge in teaching process, not just a single theoretical knowledge. At the same time, students should also be guided by teachers to use several skills to memorize knowledge. In addition, it is necessary to apply the theory of the development law of things to the curriculum teaching, so that students can acquire the essence through the phenomenon. And they can also learn such skills from one example and then master the universal rules to follow. The above involves the guiding role of teachers, who inspiring students to explore the essential laws behind the problems in order to help them better grasp the knowledge system [12].

O and Liu articles pointed out the importance of the teacher guidance link in their summary of the constructivist learning theory in the theoretical basis of the PBL teaching model. Liu also mentioned the advantages of the PBL method for teachers' own ability improvement and how this method help teachers to clear their teaching positions in the future, which has rarely been mentioned before [5, 13].

The innovative points of Zhen and Liu are that they put forward positive assessments of the possible failures of project-based learning and defined them as 'effective failures'. Zhen and Liu emphasized that when a project is at risk of failure in the course of teaching practice, teachers should think about how to guide students to effective learning from failed attempts. The article provides a detailed explanation of how to implement this scenario. First of all, teachers are required to select challenging projects for students,

and then provide strategic support and process assessment for students during the project, and finally reflect on the whole project, and encourage students to continue to promote the project and practice reflection [14].

3 The Position of Teachers in PBL Teaching Method

The problem in the design of the PBL teaching method need to be deeply analyzed and considered, and non-students can solve them based on common sense, or make conclusions through the accumulation of past knowledge, or directly read the textbook to find the answer. The setting of such deep-seated problems requires teachers to put forward problems on the basis of comprehensive consideration of students' abilities which have profound meanings, certain difficulties and are not easy to understand and solve. So that students can face challenges appropriately, so as to gradually explore the hidden knowledge system behind these problems in the process of mutual cooperative exploration, and entirely let the setting of the problem situation play its due role. Li combined with her own teaching experience using the PBL method in infectious diseases at Capital Medical University, pointed out that the importance of the role of teachers is reflected in all aspects of teaching from lesson preparation to teaching. The teacher should be the planner of the teaching process in the lesson preparation stage, the organizer and guide of the activity before the student's discussion, the observer, recorder, encourager and guide during the student's discussion, and the reviewer and summarizer in the summary stage [15]. It can be seen that teachers play very important roles in the practice of the PBL teaching method, so it is of some significance to discuss the position of teachers in the PBL teaching method.

3.1 Designers of the Teaching Program

Because the PBL teaching method revolved around the problem, the teaching purpose, teaching content, etc. will be reflected through the setting of the problem, so how to choose and design the problem is extremely challenging for the teacher. Teachers must consider what the purpose of setting up the problem is, how to set the problem, what information the student can obtain through solving the problem, what knowledge can the student learn, what kind of problem-solving ability can the student master, how to connect the various problems in the entire teaching, how to explain the relationship between the problems, and so on.

Yang believed that teachers themselves should first clarify the purpose and significance of the school's choice of PBL for teaching. The main purpose of the problem-centered construction of the curriculum is to stimulate students' interest in independent learning; to let the student review, consolidate, and skillfully apply the basic knowledge they have learned before; to exercise students' ability to find and solve problems; to exercise students' language expression skills, interpersonal skills, and to promote students to cultivate a sense of teamwork [16]. In terms of course preparation, Yao argued that teachers should prepare the curriculum rigorously and need to have a full understanding of the teaching objectives and processes, which will help teachers to have a good grasp

of the progress also depth and breadth of students' discussions, and to make each major learning objective in the syllabus as discussed as possible as well [17].

In addition to reflecting and emphasizing the learning content, the design of PBL should also pay attention to the real situation of the problem, in order to better cultivate students' ability to comprehensively use various knowledge to solve practical problems, it also cannot be separated from reality. Attention should also be paid to how to guide students to achieve satisfied learning goals, so that students can gain a sense of achievement in the learning process. These all reflects the hard work and creative design of the teachers [9].

3.2 Promoters of the Teaching Process

Although PBL is a student-centered teaching method, teachers cannot allow students to discuss randomly. And they need to interact moderately with students during the teaching process. Teachers should give appropriate guidance when students' discussions are unable to make progress, and they may issue prompts to correct the student when their discussions deviate from the problems to be addressed [18]. Teachers should only guide students' discussions in due course and correct the mistakes in them, rather than giving correct answers directly [16]. Teachers should also pay attention to ways and means when making suggestions, preferably moderating and unsalted.

Teachers' encouragement to students is also important. Attention should be especially paid to the details of students' learning progress. Students are encouraged to understand the relationship between problem concepts and problems themselves, to think deeply about problems, and to look for gaps between learning objectives and learned knowledge. Teachers should also motivate students to integrate knowledge, to use different learning resources to explore learning goals from multiple angles, to find a variety of solutions to problems, and finally produce learning outcomes with certain academic significance [6].

3.3 Organizers of the Teaching Atmosphere

PBL is mostly practiced in small groups, searching for relevant materials and information on problems, displaying and the statement of final course results, etc., all require the joint efforts of group members to complete. Teachers need to ensure that all team members have a sense of active learning, and always pay attention to whether students maintain good relationships and close teamwork, which are the prerequisites for PBL to proceed smoothly and the key for teachers to create a good teaching atmosphere in the future. In the teaching process, teachers should pay attention to students who are enthusiastic and should not neglect students who are less motivated to participate in discussions. Li pointed out that in the teaching process (discussion session), teachers should pay attention to grasp the overall time, balance each person's speaking opportunities, make euphemistic suggestions to overactive students, and indirectly guide relatively quiet students. Promoting interaction among students and stimulating each student's interest in learning is the role of teachers [15].

It is necessary to create a scientifically rigorous, relaxed and lively C, but teachers should pay attention to grasp the scale. As for the rigorous level, teachers should correct

students' mistakes in a moderately real-time manner, but avoid overly dominating and rushing to interrupt them. Teachers need to learn that giving students the opportunity to make mistakes will help them deepen their understanding of knowledge after being corrected. And also the lesson is avoided falling back into the past traditional teaching mode. As for the relaxed level, teachers should mobilize students' subjective initiative as much as possible, encourage students to show the highlights of their thinking, promote students to form a lively and enthusiastic discussion atmosphere and increase students' desire for knowledge.

3.4 Assessors of Teaching Outcomes

The effectiveness of PBL teaching outcomes is reflected in the improvement of students' learning attitude, learning spirit, self-learning ability, critical thinking ability, knowledge application ability, case reasoning ability, and interpersonal communication ability. Assessment, on the other hand, aims to provide constructive feedback on students' learning process in order to strengthen their motivation to learn. Given that the problems set in the PBL teaching mode are open-ended, the learning requirement for students is to acquire the ability to solve problems and to explore the essential laws behind the problems. If the assessment is done by traditional and uniform standards, it is contrary to the concept of PBL teaching. Therefore, PBL teaching needs to have assessment methods that are compatible with that, and the assessment of teaching results should be diversified and open, and a new assessment system can be considered to assess the effect of PBL teaching when conditions are available. As Li argued, 'The most important thing is that teachers summarize and comment on students' methods and abilities of clinical evidence analysis and problem solving.' At the same time, since students' learning behaviors are often influenced by the assessment methods and results, the assessment methods in the PBL teaching model should motivate students to learn independently [19].

Li believed that in order to make the assessment criteria fit with the teaching results, firstly, the assessment content should be reformed so that the assessment of teaching changes from the original assessment of the mastery of specific knowledge points to the assessment of the effectiveness of students' competence development and the improvement of teachers' professional attitudes. Secondly, the assessment method should be explored so that the assessment of teaching expands from the original one-way summative assessment to the multi-process assessment [20].

The purpose of process assessment is to provide students with stage-by-stage feedback and suggestions through teachers' regular collection of students' learning outcomes, so that students can deepen their understanding of the content involved in the problems and strengthen their memory of the knowledge involved in the problems during the learning process. Teachers can provide timely feedback and tests at different times and using different assessment methods to enhance the effectiveness of students' learning. Since the questions set have different forms of content, teachers should be flexible in the way they assess, and they can refine the measurement criteria based on communication and discussion with students to effectively assess multiple dimensions of students' knowledge, skills, and values.

Yu made a similar point, emphasizing that both teaching and assessment are for the benefit of students. 'The assessment of students' PBL learning usually uses a combination of formative assessment in problem-solving situations and summative assessment at the end of the PBL activity when the results are reported. The purpose of formative assessment is to give teachers a better understanding of students' dispositional tendencies, thinking skills and learning status, and is to provide teachers and students with timely feedback information to help them make timely adjustments to achieve optimal teaching and learning. The purpose of summative assessment is to provide information to inform instructional planning and programs and is to give students an outcome orientation to motivate them [21].'

Zhen and Liu's article had discussed process assessment and whole process reflection in detail. From the perspective of process assessment. They suggested that process assessment should take a variety of forms, 'such as checks, observations, conversations, quizzes, exams, task assessments, group reports, individual reports, documentation of work, and so on [14].' Kong had made similar suggestions, 'e.g., designing written tests, practice tests, oral tests, submitting mini-essays, etc. [18]'

From the perspective of holistic assessment, Zhen and Liu believed that teachers should help students sort out the logic of their thinking about problems, summarize their experiences and lessons learned in the problem-solving process after the course, help students clarify the internal logic of the work they have done throughout the process, and deepen their understanding of the learning objectives and content [14].

Teaching and learning are two complementary activities, so teachers should not only instruct and evaluate students, but also listen to the suggestions students make to the teachers in order to continuously improve their teaching methods and ensure the smooth implementation of the PBL teaching model, and ultimately achieving a win-win situation in which teachers' level are improved and students' ability are strengthened [6].

4 Problems of Teachers in Practicing PBL Teaching Model

4.1 Selection of Teaching Cases

Teachers whether to use real cases or teaching cases in teaching [15, 22]. Real cases come from real situations, which can effectively exercise students' ability to solve practical problems, while the essential problems presented by cases in different situations do differ greatly, and the planned teaching objectives may not be completed within the specified class time. Teaching cases are carefully designed by the faculty, which can guarantee the consistency of teaching quality and teaching objectives of each group, but they are less effective than the former in helping students to deal with real problems.

4.2 Requirements for Teachers' Academic Ability

Because of the great uncertainty in the various aspects of the PBL process, the breadth of the learning content involved leads to the possibility that students may ask questions beyond the teacher's expertise. The open-ended nature of the answers that emerge from internal student discussions also requires teachers to consider the criteria by how to judge

whether students have acquired knowledge. All of these require extensive expertise and a high level of academic sophistication in order for teachers to better instruct their students. Teachers themselves should also continue to learn and improve to actively adapt to the higher requirements of their new roles [18, 21].

4.3 Insufficient Teaching Resources

The PBL teaching mode requires a high level of teaching resources. Under the present situation that universities are expanding and the number of the teacher is insufficient, PBL may be more suitable for higher education, and the scope of the course is also more applicable to disciplines with more practical links, and it is not easy to ensure the teaching effect with large area and multiple disciplines.

5 Conclusion

PBL is a student-centered education model, and the teacher plays the role of guidance in the teaching practice of this model, the role of the teacher is no longer to teach a good lesson, but to participate in all aspects of the course, and to discuss with students the core issues of the course. The criterion for judging whether the teaching task has been accomplished is no longer how much knowledge has been taught to the students, but whether the students' independent learning ability has been developed. In the process of PBL teaching, teachers are involved in the design of PBL questions. In order to achieve the purpose of PBL teaching, teachers need to select appropriate cases and organize students' discussions based on a deep understanding of PBL concepts. During the learning process teachers should encourage and assist students to create a good learning atmosphere, give guidance to students in the right amount and at the right time, give them opportunities to make mistakes, and ultimately assess students' learning outcomes in an appropriate and multi-dimensional way.

In summary, the practice of PBL is actually a challenge for teachers. The comprehensive capacity of teachers' team needs to be strengthened as well. Schools should play the role of resource integration, provide policy support and development platform for teachers, organize standardized and orderly training activities, invite experts in PBL education to give lectures, organize teachers to observe schools that have successfully practiced PBL method, encourage teachers to supervise each other, help teachers understand PBL teaching concepts, master teaching methods and change their teaching roles, so as to continuously improve their teaching ability and academic quality and achieve mutual progress with students. Schools should also decide whether to open PBL courses by taking into account the teachers' strength and students' learning situation, and choose the teaching method that best suits the actual situation.

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