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By Qi Tian, Zhi-Xin Huang, Wei Li, Ming-Hai Wu & Yu-Jie Chen

Central China Normal University

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RESEARCHONTHEAPPLICATIONOFPBLTEACHINGMETHODINPHYSICSEXPERIMENTTEACHING

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Research on the Application of PBL Teaching Method in Physics Experiment Teaching

Qi Tian [α], Zhi-Xin Huang [σ], Wei Li [ρ], Ming-Hai Wu [Ω] & Yu-Jie Chen[¥]

Abstract- Discuss the method and effect of problem-based teaching method (PBL) in the teaching of physics experiment in junior high school. Method: A total of 92 students in two junior high school classes were selected, and one of them was randomly set as the experimental group (46 students) and the other one was the control group (456 students). The experimental group added PBL teaching on the basis of traditional teaching methods. Methods, the control group was taught according to the traditional teaching method only, and finally the teaching effect of the two groups was compared. Results: The physics performance of the experimental group was significantly higher than that of the traditional teaching group (P<0.05). The students in the experimental group were better than traditional teaching in subjective evaluations such as learning initiative, learning interest, thinking ability training, practical ability, and innovation ability. Conclusion: The PBL teaching model is more adapted to the development of the times, and the effect is better than traditional teaching. It can combine the learning and practical skills of students, and the comprehensive ability can be greatly improved.

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I. Introduction

Physics experiment class is an important link for students from studying physics theory to sublimation to social life. Familiar with the purpose of experiment, experiment principle, mastering the experiment process, and understanding the physical methods used are the main content of physics experiment teaching. It is for students to master physics knowledge and deepen Physical knowledge, an effective means of using physical knowledge. In our physics experiment teaching, on the basis of the traditional teaching method, we also adopt the current internationally popular "problem based learning" (problem based learning, PBL) method, which emphasizes the active learning of students. , Teachers carry out targeted enlightenment and guidance education, stimulate students' interest in learning, cultivate and improve students' ability to analyze and solve physical problems, and improve students' practical ability and innovation ability.

Author α σ ρ Ω ¥: College of Physical Science and Technology, Central China Normal University, Wuhan, China. e-mails: 879750624@qq.com, huangzx@mail.ccnu.edu.cn, 20018307@qq.com, 672362566@qq.com,1184557939@qq.com

II. Method

a) Physics textbook of People's Education Press

I selected 92 junior high school students from 2 classes in the ninth grade of junior high school I teach, and randomly selected 1 class as the control group (46 students) and 1 class as the control group (46 students). The control group uses traditional teaching methods At the same time, the "problem-based teaching method" was adopted on the basis, and the control group was taught according to the traditional teaching method. Before the experiment, there was no significant difference between the two groups of students in terms of age, grades, gender, course progress, class hours, teaching materials and other basic conditions (P>0.05). In the textbook, I chose the ninth grade junior middle school physics textbook published by the People's Education Press as the textbook.

b) Teaching process and Methods used

Control group: The traditional teaching method is adopted, that is, the teacher's teaching is the center. The teacher leads the classroom throughout the whole process and explains the entire physics experiment. The students listen carefully and take notes. After class, I organize the students to review and consolidate. Experimental group: Based on the traditional teaching method, the PBL teaching method is also adopted. The instructor compares the requirements of the syllabus, carefully consults the materials related to the teaching content, and prepares the lessons carefully, and finally draws up a teaching plan. One PBL class hour is one Experimental topic. Specific implementation methods: ① Based on the problems encountered in life or study, a problem is proposed, and the teacher compiles a PBL lesson example (highly related to the experimental content of the textbook), and formulates the problems that students need to solve during the experiment, Provide cases to students, determine clear learning goals, teach students how to analyze scenarios and solve problems before the experiment, and provide students with various learning paths (tablets, teaching reference, computers, library materials, teachers, Companions, etc.). ②Form a PBL teaching group with 5-6 people in each group. A suitable group leader shall be established, and the group leader shall carry out division of labor and cooperation. Each member needs to undertake corresponding tasks. ③ In the self-study stage, leave 2-3 days for students to study

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independently, and finally write a good report and experience. ④In the communication and discussion stage, each group selects a representative to speak and explain the group's problem-solving plan; teachers participate in the discussion in a small amount, and guide and inspire students to analyze, think, and solve problems, aiming at the shortcomings of students in the process of problem-solving , Carry out a comprehensive and systematic explanation to each group, and fill in the knowledge loopholes. Finally, select the discovered problems again according to the needs, and once again combine the experimental requirements of the textbook with the reality of life, so that the students' knowledge can be consolidated.

c) Effect Evaluation

After the end of the semester, the relevant staff of the teaching and research team will design the test papers and analyze the test scores. After the end of the semester, the team will design the corresponding test papers and analyze the test results. Finally, we will distribute to the experimental group. The PBL teaching questionnaire and the students in the experimental group conducted an anonymous questionnaire survey. A total of 46 questionnaires were distributed, and 45 valid questionnaires were returned, with an effective recovery rate of 100%.

d) Statistical Methods Used

During the experiment, the author used SPSS22.0 statistical software to perform statistical analysis on the data. The measurement data is expressed by (x±s), and the analysis of variance is used. P<0.05 indicates that the difference is statistically significant.

III. Results

a) About the Comparison of Test Scores

There was no statistically significant difference in the scores of basic physics knowledge between the two groups of students (P>0.05), and the test scores of experimental questions in the experimental group were significantly higher than those in the traditional teaching group (P<0.05). It shows that the PBL teaching mode is significantly better than the traditional teaching mode in improving the ability of students to analyze, think and solve practical problems in physics in life, and it will not affect the students' mastery of the basic knowledge, key points and difficulties of physics. Results see Table 1

Table 1: Comparison of test scores between two groups of students (x±s)

Group	n	Basic knowledge questions	Experimental questions
Traditional teaching group	46	45.6±5.11	43.09±3.57★
PBL teaching group	46	46.4±6.06	46.78±3.51

Note: ★Comparison of the two groups P <0.05

b) Questionnaire Survey Content and Results

More than 87% of the students in the control group believe that the PBL teaching method can stimulate their interest in physics learning, improve learning motivation, cultivate the ability to find, think, and solve problems, and enhance the connection and application of physics knowledge and real life. See

Table 2: The evaluation of the control group students on the teaching effect of PBL teaching method [n(%)]

Survey Options	Significant	General	Invalid
Stimulate interest in physics learning	40 (87.0)	4 (8.7)	2 (4.3)
The ability to find physics-related problems in life	38 (82.6)	5 (10.9)	3 (6.5)
The ability to analyze physics-related issues in life	35 (76.1)	6 (13.0)	5 (10.9)
The ability to solve physics-related problems in life	42 (91.3)	3 (6.5)	1 (2.2)
Improve cooperation ability	43 (93.5)	2 (4.3)	1 (2.2)
Cultivate innovation	37 (80.5)	6 (13.0)	3 (6.5)
Improve knowledge transfer ability	38 (82.6)	4 (8.7)	4 (8.7)
The connection and application of physics knowledge and life	40 (87.0)	4 (8.7)	2 (4.3)

IV. Discussion

Traditional teaching pays more attention to the teaching of theory and the system of knowledge, and gradually forms a teaching model with teacher teaching as the main body, classroom professors as the center, and students' listening as the auxiliary. Teachers are responsible for teaching, while students passively participate in "cracking duck" teaching. This mode stifles students' interest in learning, hinders their motivation to learn, and is not conducive to cultivating students' innovative and practical abilities. In recent years, the use of PBL teaching mode has gradually become the trend of education and teaching reform in many disciplines in

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the world today, and more and more physics teachers and researchers have begun to accept and improve PBL teaching. Research shows that PBL can focus on students' learning, inspire the thinking of group members through group discussions, and put more emphasis on students' active learning and hands-on practice. Mainly, the teacher only guides and inspires at the critical moment, the whole learning activity becomes more interesting and vivid, and can easily grasp the key and difficult points of the experiment. Students have a deeper understanding of the experimental process, and their hands-on ability and ability to solve problems in real life have also been improved.

The practice of applying the PBL teaching method in physics experiment teaching at this stage shows that the PBL teaching method applied to junior high school physics experiment teaching has achieved relatively good teaching effects. The scores of the control group are significantly higher than those of the traditional teaching method. Research shows that PBL teaching It is significantly better than the traditional teaching mode in improving students' ability to discover physical problems in life, analyze problems and solve problems by hand, and PBL teaching does not affect students' mastery of basic physics knowledge and key points and difficulties. According to the questionnaire survey, more than 86% of the students in the control group felt that adopting the PBL teaching method could stimulate their interest in physics learning and enhance their motivation in physics learning. PBL teaching can train them to discover physics problems in life, analyze and solve problems, and enhance the connection and application of physics knowledge and real life. The investigation shows that PBL also has some advantages in transferring physics knowledge and cultivating innovation ability in physics experiment teaching.

From the perspective of teaching effect, PBL teaching method is superior to traditional teaching: First, PBL teaching adopts a student-centered discussion teaching model, students can devote themselves to learning in an environment where they want to be relaxed and autonomous, and can use the form Diversified resources (network, books, peers, teachers) to solve problems are conducive to the improvement of practical ability and coordination and cooperation ability. The second is to strengthen the connection between theoretical knowledge and real life, so that the physical theory and experiment are more closely connected with real life, and the form of learning is more interesting; the third is to enhance the initiative and enthusiasm of learning, and students will review related knowledge more actively. And to solve problems by consulting materials and the latest literature on the Internet and in the library; fourth is to strengthen students' understanding and operation of physics experiments, and to improve the learning effect; fifth, to improve their self-study ability, through independent learning and peer discussion, students The reliance on teachers has gradually weakened, and the ability of self-learning has been greatly improved. In the process of analyzing and solving problems, I learned to integrate physics experiments with real life, and cultivated hands-on ability, which is beneficial to the cultivation of creative ability and the development of cooperation ability. The sixth is to improve the comprehensive literacy of junior high school students, strengthen students' ability to look up information and document retrieval, summarize the laws of physics, comprehensively understand the experimental process, logical reasoning, language expression, independent learning, and cooperative learning. Ability, etc., lay a solid foundation for physics experiment learning in high schools and universities focusing on physics experiment problems.

The research at this stage also shows that there are deficiencies in PBL teaching, including the lack of depth and breadth of physics experiment problems; teachers are in the exploration stage and lack of experience; students need to completely change their original learning habits, and the need for coherence of knowledge Reconstruction; insufficient ability to analyze and solve problems, etc. In the physics experiment teaching, PBL also needs to improve more scientific consideration methods to comprehensively examine the teaching effect of PBL teaching. Finally, teachers need to guide students to take the student as the center, realize role switching, and transform from duck-filling learning to autonomous learning. In short, the introduction of PBL teaching into junior high school physics experiment teaching has obvious teaching effects. Teachers can integrate PBL teaching concepts, advantages, and essence into traditional teaching, overcome shortcomings, teach flexibly, and give full play to their advantages.

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