Application of Five-point Teaching Method of BOPPPS in Building Materials and Testing

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Abstract: The application effect of the teaching mode of BOPPPS combined with the five-point teaching method of informatization in the teaching of *Building Materials and Testing* is discussed in this paper.The results show that the theoretical test scores，including the total scores，theoretical test scores and case analysis scores of the innovation group are better than those of the traditional group， and the differences are of referential value.The results of questionnaire survey show that compared with the traditional teaching method of multimedia teaching in fixed places， the teaching mode of BOPPPS combined with information-based five-point teaching method is more accepted by students in terms of "helping to improve learning enthusiasm"， "making knowledge points more intuitive and easy to understand and remember"and "helping to improve the ability of comprehensive problem analysis in engineering"，and the differences are all of referential value.This teaching method is conducive to the students' mastery of the basic knowledge of building materials and the improvement of comprehensive analysis ability，which is worth further research and promotion.

Keywords: Teaching Mode of BOPPPS; Five-Point Teaching Method of Informatization; Building Materials and Testing

1. Introduction

BOPPPS teaching mode is a teaching mode known for its effective teaching design advocated by university teaching skills training institutions in North America (instructional skills workshop, ISW). On the basis of fully considering the characteristics of teachers"teaching" and students'"learning", the teaching mode especially emphasizes the students' comprehensive participatory learning and the teaching feedback mechanism between teachers and students, which fully embodies the educational concept of "taking students as the main body and teachers as the leading". According to the characteristics of human attention maintenance, the BOPPPS teaching mode divides the classroom teaching process into six teaching links, B (Bridge-in), O (Objective,), Pl (Pre-assessment), P2 (Participatory learning), P3 (Post-assessment), S (Summary). The above six interconnected links constitute an effective, efficient and effective classroom teaching process. Among them,"student-centered"participatory learning (P2) is its core link. In the teaching process, we must master the characteristics of the subject, key points, difficult points, teaching and blind spots in the five points. The information teaching platform has powerful background data statistics and analysis functions, which can easily group students at any time, so that students can realize fragmented learning anytime and anywhere. Combined with BOPPPS teaching mode and five teaching requirements, it will achieve learning goals, levels and logic. In the specific implementation process, the research object is randomly divided into experimental group and control group. The experimental group adopts five information teaching method under BOPPPS mode, based on the material, the five key points in the teaching of*"building materials and testing*"， namely, clarifying the material, establishing the characteristics of the key points based on the material, overcoming the difficulty, covering the material, and summarizing. We try to combine the five-point teaching method with BOPPPS teaching mode, take its advantages and apply it to the teaching of"*building materials and testing*"course of civil engineering major, and achieved good teaching results.

2. The Question Raised

"Building Materials and Testing"is a basic course of civil engineering major, which covers the basic properties of building materials, building stone,cementitious materials, concrete, building mortar, reinforcement, waterproof materials and other teaching contents. As a professional basic course of civil engineering major, this course aims to cultivate students' thinking mode,

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comprehensive engineering analysis ability and the ability to solve practical engineering problems by introducing the basic properties, use conditions, advantages and disadvantages of building materials.currently, The course teaching of"*building materials and testing*"mainly focuses on the traditional classroom teaching combined with multimedia teaching methods, This "teacher-centered"teaching model has the following problems: the course involves a variety of materials, strong comprehensive, And is closely related to the actual project, However, the engineering knowledge is relatively weak, at the same time, Since there are relatively few practical links of engineering site practice and internship, Students' lack of perceptual knowledge of the use of actual engineering materials, The traditional theory teaching based on indoctrination classroom teaching is not conducive to students' understanding and mastery of knowledge points, It is also difficult to stimulate students' interest in learning, Not to mention the cultivation of their engineering thinking and practical ability. Therefore, it is urgent to introduce more effective teaching methods and teaching modes to organize the classroom teaching of "*building materials and testing*", so that teachers can teach more strategically and students can learn more efficiently.

3.Research Design

3.1 Research Subjects

50 students from two classes of 2023 in a university in Lanzhou were random selected as the research subjects, and all the research subjects have given informed consent for this study.

3.2 Research Methods

Experimental comparison method is planned to be used in this project. Fifty students were randomly divided into experimental and control groups, with 25 students in each group. The differences in gender, professional knowledge mastery and intelligence level (all $p > 0.05$) were comparable. Both groups of students are edited by Zhang Chenxia, using"*Building Materials*" (5th edition) published by China Machine Press in 2023 as the textbook, and the same teacher conducts theoretical teaching. Among them, the students in the experimental group adopt the BOPPPS teaching mode combined with the informationization five-point teaching method, and the students in the control group adopt the multimedia teaching in fixed places combined with the traditional teaching methods.

3.3 Teaching Implementation

Students in the experimental group adopt BOPPPS teaching mode combined with informatization five-point teaching method. The specific steps are as follows: 1) Bridge-in (B): Through the cloud platform, knowledge review of small cases and stories, and academic arguments and other forms, to arouse students' resonance, and encourage them to pay attention to and think about the core teaching content to be learned, that is, learning characteristics.2) Learning goal (O): Tell the students about the learning goal, let them make clear what the core content of this chapter is, where its value is reflected, where the learning difficulties are, and how it should be used in practice.3) Pre-assessment (P1): choose to match the previous knowledge and the difficulty of the moderate test content, through random small test, discussion, questions and answers form fully understand the students early knowledge and ability reserve, in order to quickly adjust the teaching content and teaching progress, fully understand the students in the possible blind spots in the process of learning.4) Participatory learning (P2): in the form of group discussion, according to the teaching content choose typical engineering case, before class will need to discuss the students case and questions to discuss students according to discuss the problem from disease characteristics, causes, how to prevent fully summarizes the case, access to relevant information, ready to report the outline. In the class group discussion, students are required to fully explore the relevant materials and detection problems in the case around the problems discussed problems, and guide students to connect the relevant knowledge points, so that students can have a deeper understanding of the characteristics of relevant chapters.5) Post-assessment (P3): Adopt diversified teaching evaluation methods (simple tests, exams, brainstorming, etc.) to understand students 'learning effect and teachers' teaching effect, so as to provide feedback and reference for the teaching of subsequent chapters.6) Summary (S): Adopt a variety of ways, such as drawing knowledge framework map, mind map or knowledge tree, to summarize the classroom teaching content, help students integrate the knowledge points they have learned, guide students to reflect on learning, find the missing points in the learning process, and arrange subsequent extended learning. Students in the control group adopt the traditional teaching method of multimedia teaching in fixed places, namely independent preview before class; teachers mainly teach the knowledge points; and assign

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homework after class to consolidate the learning effect.

3.4 Teaching Effect Evaluation

After the course, the teaching effect of the two groups was evaluated by voting questionnaire and information test. Among them, the two groups of students mainly includes two parts: theoretical knowledge and case analysis. At the same time, the self-made teaching evaluation scale was used to ballot the two groups of students to understand the students' evaluation of the teaching mode and teaching methods used. The Cronbach α coefficient (Cronbach's α) of the teaching evaluation scale is 0.748, and its internal consistency and reliability are high. The answers are selected as“yes”or“No”. The main contents are shown in Table 1.

3.5 Data processing

Statistical analysis of the relevant data was performed using SPSS 19.0 software. The results of the questionnaire survey were expressed as percentage, χ 2 test for comparison; theoretical test results as mean ± standard deviation (mean ± sd), t-test; p <005 as reference value.

4. Research Results

1) Questionnaire survey results of the two groups. In this study, 50 voting questionnaires were issued, and 50 valid questionnaires were collected, and the recovery rate of valid questionnaires was 100%. According to the survey results, the proportion of students in the experimental group that their teaching methods are“helpful to improve learning enthusiasm”, “the understanding of knowledge is more intuitive and easy to remember” and “increasing the ability of practical engineering problem analysis”are significantly higher than those of students in the control group, and their differences are of reference value. At the same time, 92% (23 / 25) of the students in the experimental group believed that their teaching method leads to the course “fragmented learning and richer knowledge”compared with the control group; only 68% (17 / 25) of the experimental group believed that“sufficient classroom learning time”was significantly lower than that of the students in the traditional group, and the difference had statistical significance. In addition, in terms of “clear learning objectives”and “clear priorities and difficulties”, the recognition difference between the two groups was not statistically significant. Detailed results are shown in Table 1.

Table 1. Evaluation of the Implementation Effect

Evaluation content	Experimental group (n = 25)	Control group (n = 25)	χ^2 value	P value
Improve learning enthusiasm	22(88)	18(72)	6.325	0.011
Learning objectives are clear	23(92)	20(80)	1.386	0.163
Key and difficult points are clear	23(92)	21(84)	3.432	0.042
The understanding of knowledge is more intuitive to remember	21(84)	16(64)	4.231	0.036
Enough classroom learning time	17(68)	24(96)	4.340	0.027
Fragmented learning, more rich knowledge	23(92)	15(60)	4.230	0.038
Increase the actual engineering problem analysis capability	21(84)	13(52)	4.125	0.015

2) Theory test results of the two groups of students. In this study, the total scores of basic knowledge and the case analysis of the experimental group were better than those of the control group, and the differences were statistically significant. Detailed results are shown in Table 2.

Table 2. Comparison of Theoretical Test Scores

Group	Number	Total score of participants (100 points)	Basic memorization (80 points)	Case analysis (20 points)
The experimental group	25	78.49±7.61	64.37±5.45	14.12±2.16
The control group	25	66.83±12.52	54.48±10.36	12.35±2.16

5.Implication and Discussion

5.1 Goal-Oriented and Improving Students' Learning Effect is the Advantage of BOPPPS Teaching Mode Combined with Informationization Five-Point Teaching Method

The results of this study show that compared with the traditional classroom teaching combined with multimedia teaching method,BOPPPS teaching mode combined with informationization five-point teaching method significantly improves the learning effect of students. The theoretical examination scores of the students in the experimental group, including the total score, theoretical knowledge score and case analysis score, were significantly better than those in the

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control group. The reason is that the experimental group teaching method greatly “improves students' learning enthusiasm” and enables them to participate in the teaching activities, and the classroom atmosphere is active. Meanwhile, through the“pre-assessment” link (P1), it can help them to connect the relevant knowledge points. By participating in interactive case analysis to simulate the actual engineering construction process, students are guided to connect theoretical knowledge with engineering practice and integrate it. Therefore, the vast majority of students think that this teaching method can help them to better understand and remember the theoretical knowledge points, and to establish the engineering practical thinking mode and improve the field comprehensive analysis ability.

5.2 Student-Centered Is the Key to the Rational Implementation of BOPPPS Teaching Mode Combined with Informationization Five-Point Teaching Method

This study found that due to the application of BOPPPS teaching mode combined with informationization five-point teaching method, the classroom teaching time arrangement is relatively tight, leading to some students in the experimental group think that “classroom learning time is insufficient”. Therefore, we should adjust the teaching method appropriately according to the specific content of different chapters and the knowledge reserve of different teaching objects, and implement differentiated teaching. In particular, the six teaching links of BOPPPS teaching mode are not indispensable, and its order is not unchanged, and the time allocation of each link should be flexibly mastered, and should not be applied mechanically. For some complicated chapters, due to the many knowledge points to be taught, which cannot be completed in a BOPPPS teaching design, the teaching content can be redivided into smaller knowledge units, or the BOPPPS design is used together and recycled. For example, in the teaching process of the concrete “mix ratio” chapter, “calculating the mix ratio”, “laboratory mix ratio” and “construction mix ratio” are the focus of teaching, but it involves many knowledge points, and it is difficult for students to understand and master. Therefore, it can be divided into “water glue ratio”, “sand rate” and “water” three small knowledge unit and design the corresponding BOPPPS, at the same time respectively “concrete honeycomb surface”, “concrete layer” and “concrete crack” three different engineering actual case, guide students to participate in interactive discussion. On this basis, the students are invited to compare the characteristics of the above three common kinds of concrete diseases, and summarize the key points of their identification, and report in groups as a unit. Finally, the teacher will summarize and test the students' learning effect. In addition, learning objectives (O) should be distinguished from “teaching objectives”. For students, the simple use of “mastery”, “familiarity”or “understanding”to correspond to key and non-key knowledge is too abstract and low operability, which is easy to cause some students to think that“the key and difficult of learning content are not prominent”.

5.3 The Combination of Knowledge Points And Appropriate Cases is the Key to the Effective Implementation of the Informatization Five-Point Teaching Methods of BOPPPS

BOPPPS informatization five-point teaching emphasizes the online and offline teaching interaction between teachers and students, especially in the core link of participatory learning (P2), how to choose the appropriate and effective teaching method is the key in the informatization five-point teaching design of BOPPPS. For students majoring in civil engineering, they have mastered certain architectural knowledge, and have a high interest in practical engineering problems, but they lack relevant theories and the ability to analyze, judge and solve practical engineering problems. In addition, compared with other courses, material courses have the characteristics of trivial knowledge points and are not conducive to memory. The traditional indoctrination classroom teaching method often causes students to not fully understand these knowledge, let alone cultivate their practical ability and comprehensive problem analysis ability.BOPPPS informationization five-point teaching method is essentially the combination of theory and engineering practice interactive teaching method in the teaching process, take the student as the main body, dynamic communication between teachers and students in engineering actual case as the carrier, through the actual engineering discussion and analysis, the theoretical knowledge into cognitive ability and practical ability, so as to effectively cultivate students' practical ability and the ability to comprehensive analysis. At the same time, we also found in teaching that the selection of appropriate engineering cases is not only the key to the implementation of the informationization five-point teaching method of BOPPPS, but also the key to the BOPPPS teaching mode combined with the five-point teaching method to guide students to effective learning.

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Generally speaking, the selected cases in the informatization five-point teaching method of BOPPPS should not only be representative, enlightening, but also be combined with the professional characteristics of the teaching object to make its difficulty moderate. However, at present, there are very few classic cases that are really suitable for the teaching of "*building materials and testing*" course in civil engineering major. As a result, most students often feel difficult, spend more time and study pressure in the process of case preparation before class. In this study, the theoretical test scores of the experimental group students, especially in the cases, were significantly better than those of the control group, which also confirmed the practical effect of this teaching method. However, for teachers, in the future teaching practice, we should continue to explore, enrich and improve the teaching cases suitable for the"*building materials and testing*" course of architectural engineering technology professional students, so that the application of the informatization five-point teaching methods of BOPPPS is more scientific, reasonable and efficient.

In short, BOPPPS teaching mode combined with the informatization five-point teaching method applied to civil engineering major students' "*building materials and testing*" course teaching, effectively improves the teaching effect, stimulates the students 'learning subjective initiative, is advantageous to the students understanding the theory of complex,abstract material knowledge and helps to improve the students' ability of construction site comprehensive analysis, is worthy of further research.

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