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Research on the Application of "BOPPPS + Xuexitong" Blended Teaching in Mechanical Courses of Higher Vocational Colleges: Taking Fundamentals of Mechanical Design as an Example

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Abstract: Aiming at the problems existing in the teaching of the higher vocational course Fundamentals of Mechanical Design, such as low student participation, insufficient learning interest, and abstract teaching content, this study constructs a "BOPPPS + Xuexitong" blended teaching model. This model deeply integrates the six links of the BOPPPS teaching model (Bridge-in, Objective, Pre-assessment, Participatory learning, Post-assessment, Summary) with the functions of the Xuexitong platform, runs through the three stages of pre-class, during-class, and after-class, and realizes the organic connection between online and offline teaching. Taking "Composition and Classification of Hinge Four-bar Mechanisms" as an example, this paper elaborates on the teaching design process and implementation based on this model in detail. Teaching practice shows that the "BOPPPS + Xuexitong" blended teaching model effectively stimulates students' learning interest, improves classroom participation, promotes students' understanding and mastery of abstract knowledge, and enhances teaching quality. This study provides a referable practical path for the teaching reform of engineering courses in higher vocational colleges.

Keywords: BOPPPS; Xuexitong; Blended teaching; Higher vocational education; Fundamentals of Mechanical Design

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1. Introduction

Since 2017, the state has issued a series of documents such as *Guiding Opinions on Further Promoting the Informatization Development of Vocational Education*, *Education Informatization 2.0 Action Plan*, and *National Vocational Education Reform Implementation Plan*, which clearly put forward the requirement to promote the deep integration of information technology and vocational education teaching, innovate teaching

models and methods, and improve classroom teaching quality [1–4]. Against this background, exploring the teaching reform of higher vocational courses empowered by information technology has become an important direction for the current development of vocational education.

As a core course of mechanical manufacturing and automation major in higher vocational colleges, Fundamentals of Mechanical Design aims to cultivate students' mastery of basic knowledge and design capabilities of common mechanisms and general mechanical parts [5]. However, the traditional teaching mode is dominated by teachers' lectures and students' passive acceptance, with the problems of "valuing theory over practice and instillation over participation." Students generally report that the course content is abstract, learning interest is low, and participation is insufficient, which is difficult to meet the needs of cultivating high-quality technical and skilled talents. The BOPPPS teaching model divides the teaching process into six links: Bridge-in, Objective, Pre-assessment, Participatory learning, Post-assessment, and Summary, emphasizing students' active participation [6]. The Xuexitong platform has functions such as course construction, interactive discussion, and data statistics, providing technical support for blended teaching [7]. Based on this, taking the course Fundamentals of Mechanical Design as an example, this paper constructs and practices the "BOPPPS + Xuexitong" blended teaching model, so as to provide a reference for the teaching reform of mechanical courses in higher vocational colleges.

2. Overview of BOPPPS model and Xuexitong platform

2.1. Connotation of BOPPPS teaching model

Originating from Canada, the BOPPPS teaching model divides the teaching process into six links: Bridge-in, Objective, Pre-assessment, Participatory learning, Post-assessment, and Summary, forming a complete teaching closed loop [8–11]. Among them, the Bridge-in stimulates learning interest through cases or questions; the Objective informs students of the learning direction of this class; the Pre-assessment checks students' mastery of preparatory knowledge; Participatory learning, as the core link, lets students "learn by doing" through group discussion and practical operation; the Post-assessment tests whether the learning effect is achieved; the Summary guides students to review knowledge points and assign after-class tasks. Student-centered, this model emphasizes the integrity of the teaching process and students' active participation, which can effectively improve the effectiveness and pertinence of classroom teaching [12].

2.2. Functional characteristics of Xuexitong platform

Xuexitong is an intelligent teaching platform with functions such as course construction, learning management, interactive teaching, test homework, and data analysis [13,14]. Teachers can build a course framework on the platform, upload teaching videos, courseware, question bank, and other resources to form a systematic online course resource library. The platform automatically records students' learning duration, task completion, interaction times, and other behavioral data, providing support for process evaluation. At the same time, it supports a variety of interactive forms such as sign-in, voting, quick answer, group task, and themed discussion, activating the classroom atmosphere. The online test system can automatically correct objective questions and provide feedback scores in real time, helping students understand their learning status in time. The platform can also statistically analyze learning data and generate learning reports to help teachers adjust teaching strategies.

3. Analysis of the current teaching situation of Fundamentals of Mechanical Design in higher vocational colleges

Through in-depth investigation and analysis of the teaching situation of Fundamentals of Mechanical Design in our college and visits to similar higher vocational colleges, the following prominent problems are found in the current course teaching.

(1) Students have a weak foundation and low learning interest. Higher vocational students generally lack basic knowledge such as mathematics and mechanics, while Fundamentals of Mechanical Design involves a lot of force analysis, dimension calculation, and other content, with strong theory and numerous formulas. Students are prone to learning difficulties and lack learning motivation.

(2) Teaching content is abstract and difficult for students to understand. The course involves a large number of mechanical structures and motion principles, such as the evolution of four-bar hinge mechanism and gear meshing principle, which are abstract and require high spatial imagination. It is difficult for students to establish an intuitive understanding only through classroom lectures and static pictures.

(3) Single teaching method and low student participation. The traditional teaching mode is dominated by teachers' classroom lectures, with students listening passively, few teacher-student interactions, a dull classroom atmosphere, and students lacking opportunities for hands-on practice and independent inquiry.

(4) Single evaluation method, emphasizing results over process. The traditional course evaluation is mainly based on final examination scores, with a low proportion of usual scores, which cannot fully reflect students' learning process and real level [15].

4. Construction of "BOPPPS + Xuexitong" blended teaching model

4.1. Overall framework of the teaching model

Based on the BOPPPS teaching model and the functional characteristics of Xuexitong platform, the "BOPPPS + Xuexitong" blended teaching model is constructed. This model runs through the three stages of pre-class, during-class, and after-class, realizing the organic integration of online and offline.

Pre-class stage (online): Students complete the preview tasks issued by teachers through Xuexitong platform, including watching teaching micro-videos, reading electronic lesson plans, and finishing pre-test exercises, so as to prepare for classroom learning. Teachers check students' preview status through Xuexitong platform, understand the learning situation, and adjust classroom teaching strategies.

During-class stage (offline + online): Classroom teaching takes the six links of BOPPPS as the main line, and is carried out in the way of "online + offline." In the Bridge-in, cases or questions are issued through Xuexitong; in the Objective, students are clearly informed through PPT display; in the Pre-assessment, the preview effect is quickly tested through Xuexitong; in Participatory learning, group discussion, teaching aid assembly, case analysis and other methods are combined with the screen projection interaction and quick answer functions of Xuexitong to improve students' participation; in the Post-assessment, test questions are issued through Xuexitong to test the learning effect in real time; in the Summary, the discussion area and homework release function are used to guide students to review and summarize.

After-class stage (online): Students complete after-class homework, watch expanded resources, and participate in online discussions through Xuexitong platform. Teachers correct homework, answer questions, and issue notices through Xuexitong platform.

4.2. Teaching design based on six links of BOPPPS

Taking "Composition and Classification of Hinge Four-bar Mechanisms" in "Module 3: Analysis and Application of Common Planar Mechanisms" of Fundamentals of Mechanical Design as an example, the six links of BOPPPS are integrated into the whole teaching process. The specific teaching design is shown in **Table 1**.

Table 1. Teaching design based on six links of BOPPPS

BOPPPS link	Time	Teaching activities	Xuexitong function support	Design intention
B (Bridge-in)	Pre-class / Beginning of class	Release production case videos: working process of excavator, movement of car wiper, sewing machine pedal mechanism, ask "What are the common characteristics of these mechanisms?"	Notice, course resources, discussion area	Stimulate students' learning interest and connect new knowledge with life experience
O (Objective)	Beginning of class	① Recognize the hinge four-bar mechanism and understand its composition; ② Master the three basic types and motion characteristics of four-bar hinge mechanism; ③ Analyze the application of four-bar hinge mechanism in life and production	PPT display, top post in discussion area	Let students clarify the learning direction and key points
P (Pre-assessment)	Beginning of class	Issue 5 multiple-choice questions to test students' mastery of preparatory knowledge such as "mechanism," "kinematic pair" and "component"	In-class exercise, voting	Understand the learning situation and provide a basis for subsequent teaching
P (Participatory learning)	During class	Activity 1: Group assembly of teaching aids. Each group receives rods of different lengths, tries to assemble three types of hinge four-bar mechanisms, observe motion characteristics, and upload photos	Group task, themed discussion, screen projection interaction, quick answer	Let students "learn by doing", participate deeply in learning, cultivate observation and analysis ability, and cooperative learning ability
		Activity 2: Explore the conditions for crank existence. Each group finds the law of crank existence by changing rod length and summarizes		
P (Post-assessment)	End of class	Issue 5 test questions to test students' mastery of type judgment and motion characteristics of four-bar hinge mechanism	Online test	Feedback learning effect in real time and judge whether teaching objectives are achieved
S (Summary)	End of class	Student representatives share the harvest of this class, teachers supplement and summarize, assign after-class tasks: finish platform homework, find application examples of hinge four-bar mechanism in life	Discussion area, homework release	Consolidate learned knowledge and expand the depth and breadth of learning

5. Practice and effect analysis of "BOPPPS + Xuexitong" blended teaching

5.1. Teaching practice design

To verify the teaching effect of the "BOPPPS + Xuexitong" blended teaching model, multiple parallel classes of mechanical manufacturing and automation major were selected as research objects. The experimental

group adopted the "BOPPPS + Xuexitong" blended teaching model, and the control group adopted the traditional teaching model. The teaching practice lasted for a complete semester, covering all the teaching content of Fundamentals of Mechanical Design. The experimental group carried out teaching in strict accordance with the teaching design shown in **Table 1**, and the control group adopted traditional lecture teaching. The two groups were consistent in teachers, textbooks, and class hours arrangement.

5.2. Evaluation of teaching effect

Classroom observation shows that after adopting the "BOPPPS + Xuexitong" blended teaching model, the classroom atmosphere of the experimental group is significantly more active, and student participation is greatly improved. After the teaching practice, a questionnaire survey was conducted among students, and the results show that the vast majority of students hold a positive attitude towards the "BOPPPS + Xuexitong" blended teaching model. They think that this model can promote pre-class preview, help understand abstract concepts, improve learning interest and independent learning ability, especially in promoting group cooperation and communication, and improving the ability to analyze and solve problems, which is highly recognized by students. At the same time, the final examination scores of the experimental group and the control group were compared and analyzed. It is found that the average final score of the experimental group is significantly higher than that of the control group, especially in the subjective questions involving mechanism analysis and design calculation, the scoring rate of the experimental group is obviously better than that of the control group. This indicates that the "BOPPPS + Xuexitong" blended teaching model plays a positive role in improving students' academic performance.

6. Conclusion

Taking the higher vocational course Fundamentals of Mechanical Design as an example, this paper constructs the "BOPPPS + Xuexitong" blended teaching model and verifies its effectiveness through teaching practice. The results show that this model can effectively stimulate students' learning interest, improve classroom participation, promote students' deep learning, and enhance teaching quality. This model is not only applicable to Fundamentals of Mechanical Design, but also provides a reference for the teaching reform of other engineering courses in higher vocational colleges. Next, the research group will continue to deepen the research on the "BOPPPS + Xuexitong" blended teaching model, further improve online teaching resources, optimize teaching design, expand the application scope, and strengthen data analysis of teaching effects, so as to provide more theoretical and practical support for the teaching reform of higher vocational education.

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Disclosure statement

The authors declare no conflict of interest.

References

[1] Ministry of Education, 2017, Guiding Opinions on Further Promoting the Informatization Development of Vocational Education.

[2] Ministry of Education, 2018, Education Informatization 2.0 Action Plan.

[3] General Office of the State Council, 2019, Notice of the State Council on Issuing the National Vocational Education Reform Implementation Plan, The Central People's Government of the People's Republic of China.

[4] General Office of the CPC Central Committee, General Office of the State Council, 2021, Opinions on Promoting the High-quality Development of Modern Vocational Education, The Central People's Government of the People's Republic of China.

[5] Zheng J, Long XY, Wu SZ, 2023, Teaching Reform of Fundamentals of Mechanical Design for New Engineering Talent Training. Journal of Higher Education, 9(05): 117–120.

[6] Liao YX, Wei WT, Li M, et al., 2022, Design and Research of Teaching Plan of Undergraduate Organic Chemistry Experiment Course Integrating OBE Concept and BOPPPS Teaching Model — Taking the Experiment of Preparation of Acetylsalicylic Acid as an Example. Guangdong Chemical Industry, 49(13): 205–207.

[7] Liu Q, Peng N, 2020, Online Teaching Demonstration Based on "Chaoxing Live + Xuexitong." University Chemistry, 35(05): 38–43.

[8] Cao DP, Yin XY, 2016, Canadian BOPPPS Teaching Model and Its Enlightenment to Higher Education Reform. Research and Exploration in Laboratory, 35(02): 196–200 + 249.

[9] Dong GW, Zhao GQ, Guan YJ, 2020, Exploration of Effective Teaching Model Based on Rain Classroom and BOPPPS Model—Taking the Course Physical Chemistry of Materials as an Example. Research in Higher Engineering Education, (05): 176–182.

[10] Zhang P, Zheng JM, Liu JQ, 2022, Practice of Blended Teaching Model of Xuexitong and BOPPPS. Automobile Practical Technology, 47(24): 167–172.

[11] Zhu LN, Yao AC, Zhang CC, 2024, Application of 5G+ Intelligent Classroom Based on BOPPPS Model in Clinical Nursing Teaching. Journal of Nursing Science, 39(05): 14–17.

[12] Jin X, Li LJ, Du J, 2022, Innovative Teaching Design Based on BOPPPS Model—Taking the Course Mechanical Design as an Example. Research in Higher Engineering Education, (06): 19–24.

[13] Shi JS, Wang LF, 2021, Investigation on Online Chinese Teaching for International Students in Colleges and Universities under the Background of COVID-19. Language Teaching and Linguistic Studies, (04): 23–33.

[14] Feng XY, 2020, Design and Application Research of Blended Teaching Mode in Colleges and Universities Based on Mobile Learning Platform, dissertation, Liaoning Normal University.

[15] Zhao XL, Zhao MZ, Lu P, 2020, Exploration and Practice of Course Teaching Based on Process Management. Software Guide, 19(12): 104–107.