

# Application of BOPPPS Model in the Design of Course Case-based Teaching

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## ABSTRACT

This paper presents a BOPPPS model and case-based teaching integrated method for solving the problems of the poor teaching interaction, unclosed loop of knowledge teaching and teaching effect test, and insufficient teaching ability of comprehensive knowledge application in the traditional professional course teaching. The design of the mixed method is explored from six modules, including bridge in, objective, pre-assessment, participatory learning, post-assessment, and summary. This method can fully stimulate learning interest, lead the active thinking, and improve the ability of using comprehensive knowledge for students. This paper takes the bionic intelligent navigation teaching as an example, discusses the application of BOPPPS model in the case-based teaching design, in order to achieve the teaching effect of interest guidance, deep interaction and comprehensive application, and also provide a useful supplement for the practice of teaching innovation methods.

**Keywords:** *BOPPPS, teaching model, case-based teaching, teaching method*

## 1. INTRODUCTION

American educational psychologist B.J. Bloom divides learning cognitive goals into six levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. These levels comprehensively describe the cognitive model in the process of learning knowledge [1]. This cognitive model puts forward higher demands on teaching methods. The traditional teaching methods focus on propagating knowledge and making students to know and understand the content of the course. These methods lack support for the application, analysis, synthesis and evaluation of knowledge, leading to the initial stage of students' cognitive level. The author believes that we should improve the traditional teaching models, and expand new teaching methods so that students are not limited to mastering existing knowledge, but more importantly, learning innovation and creation with knowledge. Taking the professional course teaching as an example, this paper explores the novel teaching method combining the BOPPPS model and case-based teaching, aiming to improve the teaching effect of professional courses and the cognitive level of students.

The BOPPPS teaching model originated from the Instruction Skill Workshop in Canada and has been implemented in many universities and educational institutions [2]. This model constructs a standardized teaching module with three characteristics. The first one is to stimulate the initiative of students, highlight the teaching center of students, and emphasize students' all-round participatory learning. The second feature is to

emphasize the closed loop of knowledge teaching and student feedback. The third feature is oriented by ability goals, focusing on cultivating students' comprehensive knowledge application ability and practical ability. The BOPPPS teaching model decomposes classroom teaching into six modules: Bridge in, Objective, Pre-Assessment, Participatory Learning, Post-Assessment, Summary. Each module has clear teaching goals and is easy to practice. It can effectively integrate classroom teaching effects with expected teaching goals, improve the output ratio of teaching input and teaching effects, and realize the organic unity of teaching goals and ability training [3].

Case-based teaching is a new teaching method that emphasizes interaction and application [4]. The first situational case teaching course originated from Harvard University, which usually combines theoretical teaching content with practical application cases to improve students' interest in active learning, and can improve students' knowledge understanding and practical application ability. Case-based teaching requires teachers to prepare specific teaching cases before class. Teaching cases are used throughout teaching practice in class, which can guide students to conduct discussions or exchanges, and abstract teaching knowledge points through practical cases to achieve the purpose of enlightening theories and enlightening thinking [5]. Compared with traditional teaching methods, the feature of case-based teaching is visualization, which can integrate teaching content with specific cases and achieve a dual-core-driven teaching of theory and practice.

The teaching of college professional courses plays a role as a bridge between theoretical knowledge and practical application, and can provide a foundation for applying

knowledge. At present, the professional courses are generally compressed in the science and engineering colleges and the students' interest in learning professional knowledge is reduced, which causes some problems in the university professional teaching.

Firstly, the classroom teaching is not interactive. As professional courses require certain relevant theoretical foundations, the knowledge points of the courses are abstract and difficult to understand, and lack visual presentation. The traditional teaching mode often ignores the classroom interaction between students and teachers. Students' participation is not high and learning interest is low. The enthusiasm of active thinking is difficult to be fully mobilized, resulting in low classroom learning efficiency.

Secondly, knowledge teaching and effect testing are not closed loop. The traditional teaching mode focuses on the teaching of theoretical knowledge. The lack of classroom teaching effects and teaching goals has not formed a closed loop, and the lack of timely inspection and evaluation makes it difficult for teachers to grasp the students' understanding of key and difficult knowledge. Actual classroom effects are different from expected teaching goals.

Thirdly, the teaching of comprehensive practical ability is insufficient. Professional courses have a strong background in practical application and require students to be able to apply the professional knowledge for solving practical problems. However, the drawbacks of emphasizing theory and neglecting practice in traditional teaching still exist, making it difficult for students to integrate professional knowledge with practical applications.

How to ensure that the quality of professional course teaching does not decline under the current limited class hours is a common problem faced by many college professional course teachers. The author believes that an effective way is to follow the level of learning and cognitive development, improve traditional teaching models and expand new teaching methods. Combining BOPPPS teaching models with case-based teaching is an effective way to solve this problem. The key point is how to realize the design of typical teaching cases based on the standardized modules of the BOPPPS model. As a new type of navigation technology, bionic intelligent navigation is an important part of the navigation engineering professional curriculum system. This course is highly professional, with relevant knowledge points from the front line of scientific research, and has a strong application background. The content of the course involves the intersection of multiple disciplines, and the knowledge points are difficult to understand. The traditional teaching model is difficult to achieve the expected teaching purpose, so this course is selected as an example to explore the application of the BOPPPS model in the case-based teaching design.

## 2. BOPPPS MODEL

The BOPPPS model emphasizes classroom interaction and detection feedback and has been used in more than 100 universities and training institutions. This model has been fully verified and applied, and the results show that it can effectively improve the teaching effect, guide students to think actively, and strengthen classroom teaching interaction. The BOPPPS model decomposes teaching content into six modules: Bridge in, Objective, Pre-Assessment, Participatory Learning, Post-Assessment, and Summary. Each module has a clear teaching goal and is mutually inherited to form a complete and unified teaching process. The content covered by each module is as follows.

(1) Bridge in, which refers to the introduction or foreshadowing before entering the classroom content. The interesting example, problem guide or describe unusual facts can be used in this stage. The main purpose is to connect students' existing knowledge points with classroom teaching content, and fully stimulate students' interest and desire to learn.

(2) Objective, which establishes the teaching goals expected to be achieved. These goals are clear and evaluable, and stipulate the content that students need to master or tasks that can be completed at the end of the course. The learning objectives include three elements: the content to be completed, the evaluation method and the evaluation standard, and strive to accurately convey to the students who, what will be learned, under what circumstances and how to learn and other core issues [2].

(3) Pre-Assessment, which refers to a preliminary understanding of the knowledge base and learning interest of students after clarifying the learning objectives and content scope. In this way, it is convenient for teachers to adjust the teaching progress and difficulty reasonably according to the students' situation, so as to teach students in accordance with their aptitude. The implementation mode can be realized by brainstorming in groups and asking students to speak certain specific terms or details. The purpose is to fully demonstrate the students' foundation and learning interest.

(4) Participatory Learning, which realizes interactive learning of course content through the interaction of teachers and students. Participatory teaching is the core part of the BOPPPS model. It can be realized in flexible and diverse forms, such as group discussions, case studies, and practical experiments. The purpose is to guide students to actively think and participate in classroom teaching, and deepen their understanding of course knowledge. Teachers need to have a certain degree of adaptability and the ability to master classroom teaching. The development of participatory teaching is also related to the maturity of students, that is, students who have strong learning ability or have mastered relevant content can help teachers share the teaching burden in this part.

(5) Post-Assessment, which mainly inspects and evaluates students' learning conditions, so that teachers can grasp the students' learning effects in time, which not only allows students to have an accurate understanding of their own learning conditions and learning effects, but also it is

the basis for teachers to design, improve and perfect the teaching process, and realize the closed loop of knowledge teaching and teaching effect inspection. It is worth noting that a well-designed post-test should match the learning goals established at the beginning of the course.

(6) Summary refers to the teacher guiding students to sort out and summarize the knowledge points of this lesson. It can be summarized through the main points, review content, and giving feedback to further consolidate the learning goals. In addition, through appropriate knowledge extension, students are inspired to think after class, and can also be used as an announcement of the content of the next class and requirements for the preparation of new content.

### **3. DESIGN OF THE CASED-BASED TEACHING**

#### ***3.1. Teaching Case***

The teaching case is that desert ants can use the sky polarized light for the navigation. Biological studies have shown that desert ants search for food away from the nest hundreds of meters, and can return to the nest along an approximate straight line. There are two reasons for choosing this case: one reason is that this case is highly attractive and can mobilize students' interest in learning; the other one is that this case is closely connected with the teaching content and can cover the main content of this lesson.

#### ***3.2. Teaching Design based on the BOPPPS***

According to the BOPPPS model, the design of the case-based teaching is proposed. We can also make real-time adjustments based on the actual teaching effect. The specific design process is shown in the Table 1.

##### ***3.2.1. Bridge in***

The bridge in is proposed through examples that humans can use smart phones to navigate, while animals mainly rely on information from the natural world for navigation. Based on this phenomenon, the teacher can guide the students to think about how animals navigate. By asking the available navigation information sources in the desert environment, students can focus their thinking on the desert ant navigation and stimulate their interest in learning.

##### ***3.2.2. Objective***

Combined with the case, the teacher can briefly describe the process of desert ant navigation, and utilize the

heuristic teaching method to guide students for thinking about the feasibility of desert ant navigation using sky polarization information from the perspective of information acquisition and utilization. On the basis of fully mobilizing students' interest in learning, the teaching goal of this lesson is extracted with revealing the mystery of desert ant navigation.

##### ***3.2.3. Pre-Assessment***

The pre-assessment can be achieved through online questions. Starting from the source of the sky polarization information, the Rain Classroom is used to ask questions online to enhance classroom interaction. By setting the question of why the sky is blue, the teacher can guide students to review the relevant basic knowledge of physics, and grasp the students' basic knowledge in time according to the statistics of the rain class, so as to determine the progress and depth of the lecture.

##### ***3.2.4. Participatory Learning***

The participatory learning is the core of the design and requires the strong interaction. Focusing on the teaching objectives, the participatory learning is divided into three parts. Firstly, the teacher can use picture to show the process of atmospheric polarization and inspire the students to summarize the distribution characteristics and laws of the sky polarization information. Secondly, the teacher can guide students to think about the polarization information processing of the desert ants, establish the polarization measurement equation and derive the solution process of the polarization information. This process can strengthen the students' mastery of the key knowledge of the lesson. Finally, the teacher can organize students to discuss the specific methods of desert ant navigation, summarize and evaluate the discussion results of each group, and teach relevant knowledge points.

##### ***3.2.5. Post-Assessment and Summary***

The purpose of the post-test is to master students' understanding of key knowledge points, which can be achieved through interactive question and answer. In this design, the teacher can raise the issue of moon polarized light navigation, guide students to summarize the key knowledge points in the class, and further deepen students' understanding of teaching knowledge. In the summary session, the teacher can briefly describe the navigation process of the desert ants again, review the knowledge points with the students together, and provided relevant reference materials to expand the students' knowledge. At the same time, the teacher can lead the main content of the next class by setting up questions.

#### 4. CONCLUSION

With the continuous deepening of teaching reform, advanced teaching models and methods have been continuously introduced into course teaching. The BOPPPS model and case-based teaching have been widely used in related fields individually, but there are few articles on integrating the BOPPPS and case-based teaching for utilizing in the professional course teaching. Combining teaching experience and taking the desert ant

navigation as a teaching case, this paper has presented the design and implementation of case-based teaching with the BOPPPS model. From the actual teaching effect, the combination of BOPPPS model and case-based teaching can fully stimulate students' interest in learning, improve teaching interaction, achieve a closed loop of teaching and testing teaching effects, and effectively improve students' comprehensive knowledge using ability.

Table 1 Cased-based teaching design of the desert ant navigation case on the BOPPPS

<i><b>BOPPPS</b></i>	<i><b>Time(min)</b></i>	<i><b>Teaching Case</b></i>	<i><b>Teaching Design</b></i>
Bridge in	2	The phenomenon of the desert ant navigation	Using example pictures and video, comparing the navigation skills of humans and animal, guiding students to think about how animals navigate, proposing questions to focus students' attention on desert ant navigation.
Objective	3	The process of desert ants foraging and returning nest with the sky polarization information	Analyzing the phenomenon of desert ant navigation, inspiring students to think from the perspective of information acquisition and utilization, using the method of revealing secrets to mobilize students' enthusiasm and exporting the teaching goals.
Pre-Assessment	3	The physical phenomena of the sky polarization produces	Using the rain classroom to ask questions online, and mastering the students' basic knowledge through answering feedback.
Participatory Learning	10	Atmospheric polarization	Explaining the scattering process of the sun passing through the atmosphere, and inspiring students to describe the distribution characteristics of the sky polarization information together
	10	The principle of measuring polarization information by the desert ants	Guiding students to think about the processing polarization information of desert ants, establishing the polarization measurement model and derive the polarization information solution process together
	10	The navigation of desert ants with the polarization information	Using the actual polarization data, guiding students to observe and summarize the changes and characteristics, and discussing the implementation of polarization navigation in groups
Post-Assessment	5	The feasibility of moonlight polarization information navigation	Inspiring students to think about whether moonlight polarization information can be used for the desert ant navigation
Summary	2	The mind map of desert ant navigation	Using the mind map of desert ant navigation, guiding students to summarize the knowledge points of this lesson, providing references to expand students' thinking, and exporting the content of the next lesson

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