Research on the Application of AEEA Teaching Model in the Specialized Curriculum Teaching

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Abstract. In order to solve the key and difficult problems existing in the teaching process of specialized curriculum, combining with the investigation and analysis of learning situation for students, the AEEA teaching mode integrating attraction, exploration, explanation and application is proposed. Meanwhile, the teaching content of "structure composition and working principle of lubrication system" in the course of automotive construction is taken as an example, AEEA teaching model is adopted to design and apply teaching case according to the online and offline mixed teaching method, moreover, according to the calculation formula of the course goal achievement degree and the course assessment data, the course goal achievement degree is calculated. Results show that AEEA teaching model, which is helpful to the achievement of course objective, can stimulate students' interest in learning and improve classroom teaching effectively.

Keywords: AEEA, teaching mode, teaching design, course objective achievement degree

1 Introduction

In a narrow sense, classroom teaching mode is a teaching method used by teachers in class for students' learning, reasonable construction of it plays an important role in improving the classroom teaching effect. In recent years, with the rapid development of education, more and more new teaching models have emerged, such as 5E, CDIO, BOPPPS, BL and so on. Among them, the 5E teaching mode refers to dividing the teaching process into five phases of elaboration, exploration, explanation, elaboration and evaluation, whose core is centered on student activities and emphasizes students' independent construction. Wang et al. [1] used the 5E teaching model to design five links, the practice shows that the 5E teaching model can improve students' independent learning ability, stimulate learning interest and cultivate engineering ability. CDIO teaching model is an engineering education model originated from Sweden, whose core idea is to divide engineering education into four stages, namely conceive, design, implement and operate. The CDIO acronym refers to engineering practice as conceiving, designing, implementing, and operating real-world products, processes, and systems [2]. Fu et al. [3] carried out the integration of CDIO and professional engineering education certification system, the results showed that CDIO teaching concepts and methods could meet the core requirements of engineering education certification. BOPPPS is a new teaching mode with educational goal as the orientation and student as the center, including six

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teaching links: bridge in, objective, pretest, participatory learning, post assessment and summary. Xie et al. [4] put forward the problem-oriented BOPPPS teaching method and applied it to the teaching practice of engineering courses, the empirical research shows that this method is suitable for the teaching of engineering courses with greater difficulty. Blended learning, which is called BL for short, is the fastest growing teaching modality in North America and much of the world [5]. Wu et al. [6] applied Superstar Learning to conduct BL research and practice on the course "Automobile Engine Construction and Maintenance", the results show that the student-centered mobile teaching mode can promote the improvement of the teaching effect of the course. Li et al. [7] introduced the specific implementation plan of BL teaching mode, the results show that this mode can improve students' learning initiative and enthusiasm.

Based on the above typical teaching mode, the student-centered AEEA teaching mode is put forward, whose general design process is introduced, and the teaching design and application of AEEA teaching mode is carried out by taking automobile construction as an example in this paper.

2 Introduction of AEEA teaching mode

Based on the teaching idea of interest, exploration and application-oriented, the AEEA teaching model divides the whole teaching process into Attraction, Exploration, Explanation and Application. As shown in Figure 1, its implementation is divided into three stages: before class, during class and after class. In other words, industry-specific questions are introduced before class to attract and stimulate learning interest, motivat students to learn independently online and make use of resources and take the initiative to explore and design plans. During class, teachers carry out classroom interactive activities with students. After class, students use superstar learning to expand online-knowledge and apply them to solve new problems.

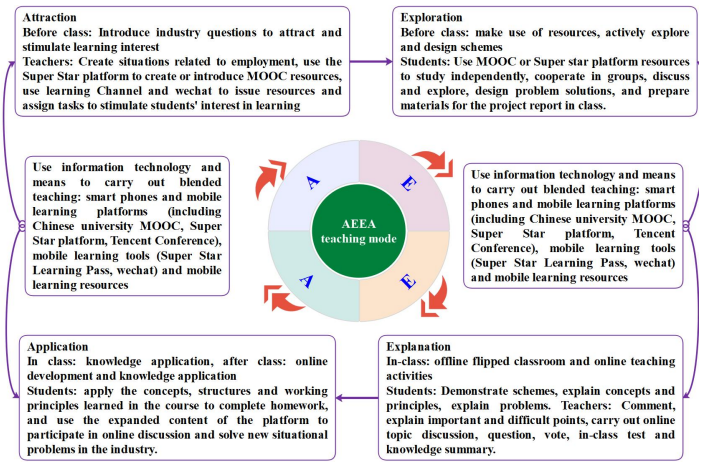

Fig. 1.AEEA teaching model

3 Application of AEEA teaching model

3.1 Student situation analysis

In this paper, the students of automotive service engineering major are selected as the teaching objects, and the questionnaire survey is used to carry out the learning analysis for them. According to the survey results, the students in this class are willing to explore the created problems, strive to solve the problems, and obtain a sense of achievement. In addition, for some topics of interest, they are willing to communicate and discuss online, and like to participate in the topic discussion with wisdom tools, such as super star learning. Moreover, their independent learning ability needs to be strengthened and they lack engineering experience, which requires teachers' guidance and supervision.

3.2 Teaching strategy

The online MOOC, self-built SPOC and super star learning are used to carry out classroom revolution, and the AEEA teaching model is constructed to implement curriculum teaching reform and innovation. The specific teaching implementation is to rely on information teaching tools such as super star learning to carry out three-stage mixed teaching, including before, during and after class.

3.3 Introduction of AEEA

AEEA teaching model divides the teaching process into three stages: pre-class, in-class, and after-class. Before class, teachers introduce industry problems to attract students' interest, and guide students to use the super star learning or the MOOC platform of Chinese universities for independent learning and exploration. General design flow of AEEA teaching mode is shown in Figure 2. In class, teachers carry out discussion-style and lecture-style teaching, and students use the superstar learning screen function to participate in classroom interactive activities such as quick answer, theme discussion, in-class exercises, and use the learned knowledge to explain or solve industry problems. After class, students are guided to expand their knowledge, apply knowledge to solve new problems in the industry, and participate in online interactive exchanges and discussions.

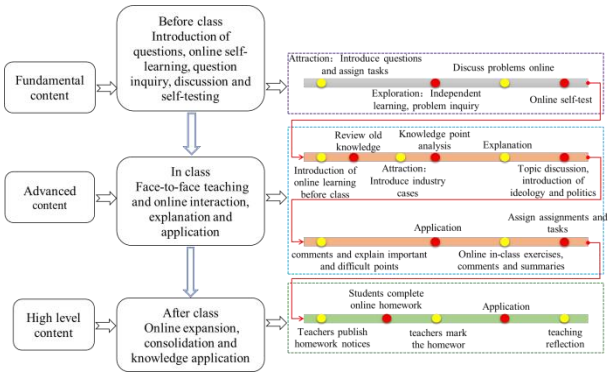

Fig. 2.General design flow of AEEA teaching mode

3.4 Application case

Taking the professional course "Automobile Construction" as an example, "Structural composition and working principle of lubrication department" is selected as the teaching content to carry out the classroom teaching design and application under the AEEA teaching mode, and the whole teaching process is divided into the following three stages.

1.The first stage of teaching: before class

Teachers introduce questions and assign tasks, and students conduct independent learning, carry out online topic discussion and interactive communication, collect information and conduct problem exploration. The specific steps are as follows:

Firstly, introduction of questions: Teachers use wechat to introduce the following questions: Why does the engine need lubrication? How is lubrication achieved? How to choose and change oil correctly? Secondly, assignment of tasks: the teacher informs the students to watch the chapter guidance of the superstar platform of automobile construction course, so that the students can clarify the online learning methods and requirements. Then, the group of students was designated to make PPT, recommend students to teach the concepts and principles on behalf of the class, and explain the questions raised before class. Finally, online independent learning and question inquiry. Students complete the task points, participate in the topic discussion online, and conduct question exploration, moreover, they make PPT to prepare for the class presentation.

2.The second stage of teaching: in the class

It includes the teaching process of face-to-face teaching and online interactive teaching, and the specific steps are as follows:

(1) Learning introduction for students: Introduce the students' independent online watching videos, participating in discussions and completing self-tests before class, then introduce the important and difficult knowledge of this class. (2)Review old knowledge: Use the mind map to introduce the main knowledge points of the last lesson. (3)Case introduction: a customer went to the car 4S shop to reflect the following symptoms to the car maintenance technician: excessive engine noise, weak acceleration, engine power and performance decline, oil and fuel consumption increase, and blue smoke will appear at the rear of the car. (4)Knowledge points analyze: If you are an automobile maintenance engineer, how to analyze and eliminate the fault phenomenon reflected by the customer? What knowledge and skills do you need to master? The above problems mainly involve the following knowledge points: function, lubrication mode, structure composition and oil path analysis of engine lubrication system; Oil action and classification; Correct selection and normative replacement of oil. (5)Explanation of knowledge points: The student representatives used PPT to teach about the functions, lubrication methods, and structure of the lubrication system, and explained two questions: Why does the engine need lubrication? How does the engine lubricate? (6)Introduction of ideology and politics: Watch the video "a drop of oil" case, and carry out online discussion on the Super Star Learning Channel to highlight the ethical quality of honesty and trustworthiness and to guide students to establish a correct outlook on their careers. (7)Explanation of important and difficult points: analyze the oil circuit of the lubrication system. (8)Knowledge application: Students work in small groups to discuss questions: How to choose and change oil

correctly? and collaborate to give solutions to problems and assign student representatives to demonstrate in class. (9)Exercises and comments: Using the function of Superstar learning students are guided to summarize the knowledge points of this class with keywords online. (10)Assignment of homework and tasks: Teachers assign homework after class, publish online topic discussion, and then ask students to use super star learning to learn to expand the content: abnormal oil consumption fault diagnosis, and summarize the general method and process of fault diagnosis. Finally, students are asked to study the next lesson online and complete the task points.

3.The third stage of teaching: After class

In this phase, students complete the online homework, then learn online to expand the content, participate in the topic discussion and preview the next lesson, while the teacher carries out teaching reflection, the specific steps are as follows:

Firstly, teachers urge students to complete online homework and review homework, then students participate in the topic online discussion. Secondly, teaching reflection: From the self-test results of the superstar platform before class and the quality of online homework after class, about 95% of students can log in to superstar learning in time to complete their homework, and the completion quality is good, while about 5% of them need to be reminded and urged to complete online homework, a small number of students have poor completion quality, and these students have not developed the habit of online independent learning, independent learning ability needs to be strengthened.

3.5 Quantitative evaluation of course objective achievement

T_o represents the achievement of course objectives, which is calculated with formula (1) [8-9]:

$$T_0 = \sum_i so_i \times T\omega_i \tag{1}$$

$$\sum_i T\omega_i = 1 \tag{2}$$

In the above formula, $T_{\omega i}$ represents the weight of course objectives, whose sum is 1, as shown in formula (2), while so_i, which is expressed with formula (3), represents the degree of achievement of curriculum sub-goals.

$$so_i = \sum_i so_{ij} \times s\omega_{ij} \tag{3}$$

$$\sum_i s\omega_{ij} = 1 \tag{4}$$

Where, j indicates that the implementation of the teaching process in the course includes discussion, homework, chapter task points, chapter tests, in-class tests, papers and other assessment links. In the formula (3), $s\omega_{ij}$ represents the weight of evaluation link j of course objective i, whose sum is 1, as shown in formula (4), and so_{ij} is the achievement degree of evaluation link j of curriculum objective i, which can be expressed with formula (5), in which S'ij is used to represent the average score in the evaluation section j of course objective i,

while S_{ij} represents the target score of the evaluation section j of course objective i, whose sum is 100 points, as shown in formula (6).

$$so_{ij} = \frac{S'_{ij}}{S_{ij}} \tag{5}$$

$$\sum_{i} s_{ij} = 100 \tag{6}$$

Based on the above curriculum achievement evaluation formulas, combined with homework, class performance, online discussion, chapter test and other links[10], the calculation results of the achievement degree of the automobile construction course goal are shown in Table 1.

Table 1. The result of course goal achievement degree calculation

Course objectives and weights		Evaluation method					So_i
Course objectives i	Weights T_{wi}	Evaluation link j	target score S_{ij}	average score S'_{ij}	Achievement degree $So_{ij}=S_{ij}/S'_{ij}$	Weights Sw_{ij}	
Objective 1	0.5	Assignment	42	36.00	0.857	0.085	0.796
		Classroom Performance	43	37.00	0.860	0.185	
		Chapter Task Point	45	35.00	0.778	0.115	
		Discussion	25	20.00	0.800	0.2	
		Chapter Test	45	34.00	0.756	0.08	
		Mid-Term And Final Exams	62	47.00	0.758	0.335	
Objective 2	0.3	Assignment	38	32.87	0.865	0.085	0.782
		Classroom Performance	40	33.25	0.831	0.185	
		Chapter Task Point	42	30.20	0.719	0.115	
		Discussion	38	33.00	0.868	0.2	
		Chapter Test	38	28.00	0.737	0.08	
		Mid-Term And Final Exams	28	20.00	0.714	0.335	
Objective 3	0.2	Assignment	20	16.00	0.800	0.085	0.769
		Classroom Performance	17	14.23	0.837	0.185	
		Chapter Task Point	13	10.25	0.788	0.115	
		Discussion	37	28.00	0.757	0.2	
		Chapter Test	17	11.32	0.666	0.08	
		Mid-Term And Final Exams	10	7.50	0.750	0.335	
			To				0.786

As can be seen from the above table, the goal achievement degree value of the course is higher than the expected value of 0.75, indicating that the course teaching meets the requirements set by the course goal and AEEA teaching mode is effective.

4 Conclusions

AEEA teaching model is a student-centered teaching model, and teaching practice shows that the introduction of its model and the combination of online and offline teaching in professional courses can greatly improve the teaching effect and stimulate students' interest in independent learning. Compared with the traditional lecturing classroom, the classroom teaching design based on AEEA teaching model can arouse students' enthusiasm, improve the advanced level of course learning, and cultivate students' independent learning ability, at the same time, the course objectives can be achieved.

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