

A Study on Teaching Reform of Higher Vocational Courses Based on Constructivism

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Abstract—The constructivism learning environment is a new type based on information technology. Under the current environment – rapid change in the conditions of higher vocational students, the four major elements of the constructivism learning environment such as “situation”, “collaboration”, “conversation”, and “meaning construction” are adopted. Through the design and verification of concrete examples of the “motor drive”, the students’ central position is emphasized in the teaching process, constructivism is combined with online teaching, and a learner-centered online teaching is established. The model is an important direction for the reform of vocational education majoring in information technology.

Keywords—Constructivism; Higher Vocational Education; Network Teaching; Teaching Reform

I. INTRODUCTION

At present, with the exception of traditional high school graduates, the proportion of registered students in the college entrance examination, the single-job in the middle school or “3+3” middle and higher vocational education are also increasing rapidly in Jiangsu Province. The complex source of students determines the diverse characteristics of higher vocational students. High school students have relatively good basic cultural knowledge and a relatively high comprehensive quality. However, the psychological gap caused by the frustration in the college entrance examination is relatively large. If the gap is not handled properly, those students are prone to feel inferior and self-abandoned[1][2]. Although students in secondary vocational schools have acquired professional knowledge and skills, they are relatively poor in terms of cultural foundation, foreign language ability, comprehensive quality, etc., their learning methods are also very simple[5]. At the same time, the proportion of students who apply for science in Jiangsu Province has dropped significantly in recent years. Therefore, how to effectively train and cultivate those students under the current new situation and carry out effective teaching reforms is an urgent task for us.

II. ANALYSIS OF LEARNING FEATURES OF HIGHER VOCATIONAL STUDENTS

Through many years of work as class advisers and analysis of teaching effects, I have found that most students are weak in self-learning and self-restraining skills, and they are not able to form more scientific self-learning methods. When the new curriculum starts, they have high curiosity and participation,

but hindered by the difficulty of acquiring professional knowledge and skills, especially in terms of professional skills courses on information technology. There is a law in IT industry: “One thousand lines of code mean the threshold of entry into programming, ten thousand lines mean the basic qualifications of a programmer, and 100,000 lines represent the requirement of being senior programmers[4].” This law means that a large amount of active learning and practice are required after class, but it is difficult for students to persevere in related professional courses, so the teaching effect is difficult to be guaranteed. Therefore, analyzing and studying the characteristics of higher vocational students’ learning is helpful to achieve the purpose of teaching in vocational colleges, teach students according to their aptitude, and train high-skilled and compounded talents who can meet the needs of the society. Through analysis, the learning characteristics of current vocational students are summarized as follows:

1) The contradiction between students’ demand for independent learning and lack of self-learning methods. Over the past few years, we have discovered that the outstanding problems of students are involved in how to effectively examine themselves and how to do things, how to effectively use the college’s learning and available resources, how to master methods of rationally arranging learning, living, and community activities, how to find their own learning methods, and how to improve their own competitiveness. This urgently requires schools and teachers to provide effective guidance to students and form good self-management skills[6].

2) The contradiction between students’ strong self-awareness and self-adjusted ability. On the one hand, they are at the stage of preparing for the development of professional life. They have independent personality and active thinking. They attach importance to emotional needs and social practices. They have strong ability to acquire information on the Internet, and expect to experience fresh and colorful university life. On the other hand, due to individual characteristics and differences in growth environment, entrance examination pressures and frustrated psychology, they are weak in self-discipline and balance, and in psychological endurance. They do not understand their own characteristics, merits, disadvantages, expertise and values. They do not recognize the breadth and depth of learning contents at the university level, which requires more active reading and practice[6].

3) The conflict between teachers’ teaching methods and students’ learning methods. At present, the existence of

teaching materials, teachers' teaching methods and teaching methods in micro-classroom teaching is not well-targeted, which leads students to look down at mobile phones in class and play games only after class. Micro classroom teaching reform focuses on how to adapt to student characteristics, stimulate students' learning enthusiasm, potential and self-confidence, and solve the problem that students do not take the initiative in reading studies, learning methods, and problem-solving skills.

III. TEACHING REFORM BASED ON CONSTRUCTIVISM

According to Jonassen and Wilson, the constructivism learning environment is a new type of learning environment based on information technology. Constructivism believes that teachers cannot input knowledge, beliefs, and skills directly into students' brains, nor can they allow students to maintain an empty cup of mind to accept everything taught by the lecturer because each student will use his or her own past cognitions, experiences and values to interpret what they see. Therefore, what teachers can do in class is to provide students with information and scenes. Students combine with their past experience and knowledge so as to construct information and scene, thereby forming new ones. Students are the main body of learning, and knowledge is the result of students' initiative construction. In the classroom, teachers need to create an environment and atmosphere that are convenient for students to construct. Under such a constructivism learning environment, students can use a certain context, and combine with their own knowledge, experience, and psychological structure by collaboration and conversation, and achieve meaningful construction of knowledge so as to learn and master new skills[3].

The emphasis upon students' central position in the teaching process has been recognized by most teachers. However, how to implement the curriculum teaching and how to construct an effective learning environment are issues that we have been thinking about. The current method adopted by us is to actively promote online teaching methods such as online classrooms, MOOCs, and flipping classrooms by means of work-study combination and project teaching, thereby actually changing the traditional way of classroom teaching—teacher-centered teaching mode. Therefore, we can consider the four elements of the constructivism learning environment, such as "context," "collaboration," "conversation," and "meaning construction."

A. Context

Create a context related to the current learning topic as realistic as possible. The teaching content in the classroom should reflect the real social life and it should be drawn from life. The source drawn from life is conducive for students to apply the knowledge they have learned in a real way. It is also helpful for students to recognize the usefulness and significance of learning and maintaining their enthusiasm for long-term learning.

B. Collaboration and conversation

Collaboration and conversation are important means of constructivism learning. Under the constructivism learning environment and with teachers' guidance, learners work together to discuss and communicate, to search information,

analyze data, make assumptions and verify information on a particular issue and jointly discuss and share learning outcomes. In this way, the wisdom of each learner is shared by the learning community, which helps students to view knowledge and information from multiple viewpoints. Thus, students can have a comprehensive understanding of knowledge and information.

C. Meaning Construction

Meaning construction is the ultimate goal of constructivism learning, which is based on one's own experience. Learners learn through their own efforts to digest and absorb new knowledge, and realize the meaning construction of knowledge.

Based on the constructivism learning theory, there are currently three mature teaching methods that have been developed: scaffolding teaching, anchored teaching, and random teaching. Each teaching method is designed based on the basic characteristics of constructivism learning. The following takes the "motor-driven" course as an example to discuss its teaching exploration and attempt under the guidance of constructivism theory.

IV. TEACHING REFORM BASED ON CONSTRUCTIVISM

Anchored instruction requirements are based on infectious real events or real problems. The identification of such real events or problems is vividly described as "broken down" because once such events or problems have been identified, the entire teaching content and teaching process are determined (as if the ships were anchored). Constructivism believes that if learners want to complete the meaning construction of the knowledge they have learned, that is, to achieve a profound understanding of the nature, the law and the connection among things reflected by the knowledge, the best way for learners is to learn and experience in the real world (that is, learning through direct experience) rather than just listening to other people (such as teachers) to introduce and explain the experience. The following describes the main process of anchored instructional design using the example of "rotating magnetic field" in the course of "Motor Driven":

A. Designing the "anchor" in real "macro situation"

The rotating magnetic field is the difficulty in learning AC motors. Its concept and content are very abstract and intuitive, and it is difficult for teachers to describe in words, which causes students to have difficulty in learning. Taking into account the students' basics, we decided to design an "anchor" for students through demonstration experiments to stimulate students' interest and motivation in exploring new knowledge and provide a good context for breakthrough difficulties. We divide the "anchor" into three steps: (1) a small magnetic needle is placed between the poles of the rotating hoof magnet. Students should observe that to make the small needle rotate, the hoof magnet must be rotated around the small needle. When the hoof-shaped magnet rotates around the small magnetic needle, the small magnetic needle also rotates. This principle is easily understood by students. (2) Then we replaced the small magnetic needle in the middle with a freely rotatable mouse cage rotor. We told the students to observe that there was no mechanical connection between the magnet and the rotor. Then we turned forward and reversed the test device.

The slow-rotating demonstration prompts students to observe and observe the phenomenon; after the teacher completes the demonstration, students are allowed to summarize the experimental phenomena. Through careful observation and cooperative discussion, the students conclude that when the magnet rotates in the forward direction, the cage will follow the positive direction. When the magnet is reversed, the squirrel cage will reverse, and when magnets will turn faster and the squirrel cage will turn faster, otherwise it will slow down. (3) Finally, we took out the purchased rotating magnetic field demonstrator. The difference of this demonstrator from the previous experimental apparatus only lies in that the outer shoe magnet was replaced by a three-phase symmetrical winding, and the inside was also a rat without any mechanical connection. In the cage rotor, we energize the three-phase windings so that students can observe the phenomenon. Students will be surprised to find that the squirrel cage rotor has also rotated. Thus, the teacher throws the "anchor": Why does the rotor rotate? Through three demonstration experiments, students' knowledge transfer ability is well developed, they learn analog thinking, and then they learn a new lesson. Students are more likely to rise through perceptual knowledge. Theoretical understanding introduces students to a situation of seeking knowledge and exploration.

B. Organize teaching based on "anchors"

After the "anchor", the teacher organized teaching based on "anchor", he or she did not directly tell the students how to solve the problems they faced, but the teacher provided students with relevant clues to solve the problem. We provided students with waveforms, profiles, winding wiring diagrams, and rotating magnetic field CAI courseware on the subject. With these materials and by combining with three demonstration experiments, students gradually realized that the reason why the squirrel cage rotor turned up was the existence of the generation of "rotating magnetic field", which can help students understand the connection relationship of three-phase windings in space, and have a three-dimensional understanding of the structure of the motor from multiple levels, laying a foundation to learn the structure and winding of three-phase asynchronous motors. The entire teaching process is carried out in the process of students' self-study and cooperative learning. We encourage students to find solutions to problems through demonstration experiments, to collect information and discuss cooperation. Finally, students summarize the "conditions of rotating magnetic fields". At the same time, the teacher can further expand the "anchor": how to change the direction of the rotating magnetic field? What factors does he speed of the rotating magnetic field depend on? "Anchor" enables students to learn in the process of solving problems and learn in hands-on practice, at this stage, we consciously guide students to generalize, summarize, and evaluate solutions to problems, that is, to carry out "meaning construction", to find out the internal links between knowledge, and to "generate" their own knowledge through the interaction between old and new knowledge.

C. Digest specific "anchors"

Teachers interact with students and evaluate correction. The teacher evaluates and dispels inquiry results of the "anchor" problem and its expansion problems derived from students'

independent learning and collaborative learning. This process can directly reflect the student's learning effect. It often does not require specialized tests that are independent of the teaching process. It is only necessary to observe and record student performance at any time during the learning process. Anchored instruction is not only designed to enable students to solve the problems in the "anchor", but more importantly, students are required to independently complete learning objectives through teaching, to autonomously solve real problems in complex backgrounds, and independently cooperate and communicate with others.

Anchored instruction focuses on guiding students through observation, motivating students to think positively, and allowing students to use the knowledge of electricity and magnetism they have learned to actively solve new problems. Teachers can inspire, combine, induce and generalize when it is appropriate. Through the design and development of the "anchor", the teaching priorities and difficulties are effectively solved. Practice has proved that such a teaching model is not only conducive for the students to actively build new knowledge, but also conducive in terms of students' thinking ability (critical thinking, problem solving, decision-making ability and innovative capabilities).

V. REFLECTION ON TEACHING UNDER INTERNET + ENVIRONMENT

With the maturity of network and multimedia, modern education technology has quietly transitioned to the third stage --online teaching. Compared with the traditional classroom teaching, the features of online teaching can be summarized such as rich information resources, advanced information presentation methods, wide openness of time and space and extensive interactivity. These characteristics provide ideal conditions for creating a constructivism learning environment. Combining constructivism with online teaching and establishing a learner-centered online teaching model is rapidly developing. "Random-entry teaching" means that learners learn different contents of the same learning content and take different approaches with different purposes at different times and environments, in this way, they can obtain a variety of understanding. Obviously, learners can achieve a more comprehensive and in-depth grasp of this knowledge content through multiple methods. This kind of multiple entries is not like traditional teaching, but it is implemented to consolidate general knowledge and skills. The simple repetition of each entry here has a different purpose for learning and has a different focus on issues, so the result of multiple entries is much more than just a simple repetition and consolidation of the same knowledge, it helps gain a leap in the understanding and recognition of the whole picture of things. The basic idea of random-entry teaching comes from a new branch of the constructivism learning theory—"elastic cognitive theory." The purpose of this theory is to improve learners' understanding ability and their ability to transfer knowledge (i.e., the ability to use knowledge flexibly).

The random-entry teaching is student-centered, emphasizing situational teaching and students' self-learning, emphasizing the design of learning environment rather than teaching environment, and emphasizing the use of various

information resources so as to support “learning” rather than “teaching”. We take the “New Type Motor” in the course of “Electrology” as an example to introduce the random-entry teaching design under the network environment.

Traditionally, the teaching of “Electrology” often focused only on explaining the principles while ignoring the specific application of various motors and the understanding of new and special motors. In recent years, with the development of power electronics, some new types of motors have appeared one after another and are rapidly used in industrial and civilian products, such as brushless DC motors, switched reluctance motors, linear motors, and ultrasonic motors, etc. In the previous teaching, we hardly touched on these new technologies. Therefore, the trained students are often restricted in the theoretical category and unable to keep up with the development of the frontiers of science and technology, and unable to adapt to the needs of society. We intend to make up for the inadequacies of this classroom teaching by random-entry teaching. The specific steps are:

A. Present the basic situation (demonstration)

After the explanation of various common motor principles is completed, the students are presented with the context related to the basic content of the current learning theme such as “various new motors”. The teacher uses a short period of time to play some new motors used in the industrial and agricultural field. The video materials randomly and naturally introduce students into the field of professional knowledge and arouse students' interest in learning. Students' learning inquiries will deepen step by step and can't wait to understand the truth.

B. Random- entry learning (network type)

Through the Internet, students can choose a new type of motor and enter the learning content. A “new motor” learning column has been established on the teaching website where there are a large number of related new types of motor images and links. The content that interest students is viewed and studied, and students' autonomous learning ability is developed during this process.

C. Develop thinking training

In the setting of “New Motor” column on the website, attention should be paid to the development of students' thinking ability, especially students' divergent thinking. For example, in the setting of website content, adopt a problem-based system: Do you know the applied field of this new type of motor? Do you know the difference from traditional motor in principle? Do you know where their structure is special? The pictures posted on the website are basically about the application fields of this new type of motor, and the linked website describes its principle and structure. Students learn through these materials and find relevant information on the Internet by themselves. Take these “problems” as the main line, many disorganized materials will be organized in mind and understanding of knowledge will be formed. Every time you enter a new context related to motor, your interest will be stimulated. The power lies in exploring the principle and structure of the new motor, and the differences from traditional motor. The related knowledge of the traditional motor is not

only reinforced f, but also new knowledge about motor is acquired.

VI. CONCLUSION

Emphasis upon applying constructivism to guide teaching design and teaching process, and upon student-centeredness do not deny and ignore the leading role of teachers. Constructivism assumes that the teacher's role is to help students construct knowledge, help students form and inspect their point of view, and make their conclusion. Knowledge is collected and transmitted in the cooperative learning environment, so the teacher is transformed from being the “information promulgator” to the assistance of “meaning construction”. The teacher should be able to stimulate the students' study interest, help them form the study motive and help them construct the meaning of the current knowledge by creating a clue that meets the requirements of the teaching content and links the old with new knowledge.

It can be seen that under the context of Internet+, teachers' responsibilities are not reduced but aggravated. Its leading role emphasizes the organizing, arranging, guiding and controlling of teachers throughout the entire learning process. Student-centeredness, situational teaching and students' self-learning are emphasized. Emphasis upon design of the learning environment rather than the teaching environment, upon the use of various information resources to support “learning” rather than “teaching” are attached. As long as we are fully aware of this and coordinate the relationship between “subject” and “dominant”, we can give full play to the enthusiasm of teachers and students, and truly reflect the idea of meaning construction.

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