Under the Guidance of Constructivism Learning Theory of Marine Auxiliary Machinery Teaching Reform

Yang Guo, Jun Zhang and Bo Wang

ABSTRACT

The STCW78/95 convention amendment was adopted by the International Maritime Organization contracting state in the city of Manila in the Philippines, in June 2010, and came into force on January 1, 2012. A request was put forward on the development of the professional education program by adding a ship skill assessment. With this objective, the marine auxiliary machinery teaching team analyzed the present situation of marine auxiliary machinery teaching, summarized the teaching experience, clarified the existing problems in the teaching process, and based on the constructivism learning theory, put forward a teaching plan. Constructivism learning theory emphasizes the initiative, social, and emotional aspects of learning. This paper discusses how to construct the knowledge from the integrity knowledge system, set actual teaching situation, carry out the teaching practice and establish the evaluation system.¹

INTRODUCTION

Dalian Maritime University (DMU) is a famous Chinese higher education maritime institute, directly under the Ministry of Communication. The purpose of the Marine Engineering major is to produce ship engineers with a high level of knowledge. The marine auxiliary machinery teaching team was awarded Excellence in Teaching for the Liaoning province. For many years, the teaching team has been committed to improving the quality of teaching and improving teaching methods.

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The teaching reform projects that were undertaken include a marine auxiliary machinery online course in 2015 and a marine auxiliary machinery virtual disassembly course (TABLE I).

In June 2010, the STCW78/95 convention amendment was adopted and came into force on January 1, 2012. The ministry of communications of China has promulgated the domestic laws and regulation about the vessel crew competency examination and certification rules. A request was made to improve the professional education by adding a ship skill assessment program. The marine auxiliary machinery teaching team started from the present situation of marine auxiliary machinery teaching, summarized the teaching experience, clarified the existing problems in the teaching process, and based on the Constructivism learning theory put forward the corresponding reform.

**TABLE I. TEACHING REFORM PROJECTS OF THE MARINE AUXILIARY MACHINERY.**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PROJECTS</th>
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<tbody>
<tr>
<td>2015</td>
<td>Marine auxiliary machinery online course</td>
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<tr>
<td>2014</td>
<td>Marine auxiliary machinery three-dimensional course</td>
</tr>
<tr>
<td>2014</td>
<td>Marine auxiliary machinery virtual disassembly course</td>
</tr>
<tr>
<td>2012</td>
<td>Influence of STCW amendments in Manila on marine auxiliary machinery teaching</td>
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<tr>
<td>2011</td>
<td>Intelligent paperless exam system</td>
</tr>
<tr>
<td>2011</td>
<td>Marine auxiliary machinery excellence course</td>
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**THE COMBINATION OF CONSTRUCTIVISM AND THE CURRENT TEACHING SITUATION**

Constructivism learning theory is based on Piaget's cognitive development theory and learning theory. Constructivism believes that knowledge is not obtained by teachers, but by learners in certain situations, the social and cultural background, with the help of others in the learning process (including teachers and learning partners) [1] and [2]. Since the development of the concept of knowledge construction in the early 1980s, researchers studied the construction principles [3], the criteria supporting knowledge construction of learning conditions [4], and the related research results applied to the teaching practice [5]. The methodology of knowledge construction can lend itself to the teaching reform of the marine auxiliary machinery course.

1) The contents of marine auxiliary machinery include all of the auxiliary machinery. The necessary education includes mechanical drawing, fluid mechanics and so on. This knowledge belongs to different fields. Even though the students have a one-month ship cognition practice, it is still difficult to master.

2) The marine auxiliary machinery course is taught in the third year. During this period, students start making career decisions, many students decide not to have a
career as a marine engineer on a ship, some students don’t want to work on the ship. Plus the marine auxiliary machinery course itself is boring, the students learning enthusiasm is not high.

3) Marine auxiliary machinery course has too much content with too little time. This conflict makes the teachers use strict time control to complete the course material. The students have difficulties in fully digesting the content of the class.

MARINE AUXILIARY MACHINERY TEACHING REFORM PRINCIPLE

Based on constructivism learning theory, combined with the research of the existing shortcomings, there are five principles to guide the teaching reform of the marine auxiliary machinery course (Figure 1).

(1) Authenticity: Provide a real situation for teaching and learning. Constructivism believes that classroom teaching should be used close to the real world. completing real, complicated tasks helps students realize their knowledge in relevant and meaningful ways.

(2) Originality: Emphasize the influence of prior knowledge to develop learning. The essence of teaching is not imparting knowledge, but lies in the teachers and students jointly building and developing the students' cognitive structure.

(3) Integrity: Put the specific learning tasks in the overall teaching. It’s necessary to introduce the whole framework to the students to ensure the students can establish the connection between each specific learning task and the overall teaching goal.

(4) Initiatively: Encourage and use the initiative. Traditional teaching emphasizes learning goals, but unfortunately the students only care about the exam. The reason for this is that the instructors doesn’t encourage initiative in the students’ learning environment. So teachers can stimulate students learning motivation and initiative.

(5) Diversity: With different content, use different teaching and learning methods. Education can be adopted by considering the nature of teaching materials.
and the individual differences of students. Therefore, a mixture of these two methods is the most appropriate teaching practice [6].

MARINE AUXILIARY MACHINERY TEACHING PRACTICE

An example teaching unit for the centrifugal pump was developed using the teaching practice under the guide of constructivism learning theory:

(1) Set clear teaching goals. Consider the students’ original knowledge structure, find the entry point. Clarify the logical relation of the knowledge (Figure 2).

![Knowledge structure graph of the centrifugal pump.](image)

(2) Set up a real teaching situation and lead to the research problem. First, the teacher shows the single stage volute centrifugal pump pictures, then guides the student to describe the fluid flow in a centrifugal pump. Stimulate students' interest in learning and establish the understanding of the knowledge system of the entire chapter.

(3) Based on the content, identify the teaching methods. Within the section on the single stage volute centrifugal pump structure and working principle. The instructor should use video or physical device(s) to explain. The lift formula, working conditions should be explained in the form of a combination of theory and experiment.

(4) Improve evaluation system. The teaching evaluation should be applied to both the teachers and the students.
CONCLUSIONS

Constructivism learning theory emphasizes the initiative, social and emotional of learning. Learning is a process that constructs students’ knowledge and is a two-way interaction process between old and new experiences. Combining the constructivism teaching view and marine auxiliary machinery course, a basic reform was proposed under the guidance of constructivism learning theory. Based on this, this plan suggests constructing the knowledge from the integrity knowledge system, setting up an actual teaching situation, carrying out the teaching practice and establishing the evaluation system. These are the four important aspects of the marine auxiliary machinery course teaching reform under the guide of constructivism learning theory.

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