

**Reform Scheme of Marine Electrical and Electronic Courses based on Improved Hybrid Teaching Method**Sisi Wang<sup>a</sup> and Lijun Wang<sup>b,\*</sup>

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**Abstract.** By means of network teaching platform, virtual simulation software and flipped classroom teaching mode, the improved hybrid teaching method is applied to the teaching of marine electrical and electronic technology courses, effectively solving the problem of poor teaching effect caused by the limitations of class hours, teaching methods and experimental equipment in the traditional teaching mode.

**Introduction**

Hybrid teaching mode (HTM) was first proposed by foreign training institutions, which combines online teaching with traditional offline teaching and makes use of the advantages of traditional face-to-face teaching to make up for the deficiencies of online teaching [1]. Professor He Kekang of Beijing Normal University believes that the "learning-based" teaching method of online teaching is conducive to the cultivation of students' independent inquiry and innovative spirit, but not conducive to the teaching and mastery of systematic scientific knowledge. The traditional "teaching-oriented" teaching method is exactly the opposite of the former. Therefore, the HTM combining the two can have the advantages of both teaching modes, which is the deepening application of constructivism [2, 3]. At the beginning of this century, when HTM was first introduced into China, it was limited by the network construction conditions at that time, so it was not widely promoted in the field of higher education. In recent years, with the vigorous development of the concept of Internet + education in China, the improvement of Internet infrastructure, and the increasing popularity of mobile Internet terminals, the learning resources and learning platforms on the Internet have become increasingly rich and diversified, which makes it possible to realize the hybrid teaching of offline and online in specific courses. Therefore, more and more teaching reforms have been carried out according to specific courses in the application of HTM, and the implementation effect is good [4-5].

Marine electrical and electronic course (MEEC) is an important basic course in the training program of Marine technical professionals. Through learning this course, students have laid a solid theoretical and practical foundation for the following specialized courses such as navigation instruments, ship navigation radar, GMDSS comprehensive business. This course is listed as one of the compulsory general education courses in the marine academic credit system in Guangdong Ocean University (GDOU). Therefore, the teaching effect of this course will directly affect the training quality of navigation technology professionals. However, in the specific course teaching process, there are generally difficult course content, students can not keep up with the pace of teaching and other problems, resulting in the course teaching effect is not ideal. Therefore, this paper firstly analyzes the problems existing in the teaching of this course, and then puts forward some measures to improve the teaching of this course by using the improved mixed teaching model.

**Problems in MEEC**

Take the course assessment results of a class of 2015 navigation technology students of GDOU as an example.

**Table 1.** Performance Statistics on Curriculum Examination of A Certain Class of 36

Performance	90-100	80-89	70-79	60-69	< 60
Number	2	5	9	14	6
Proportion	5.56%	16.67%	25.00%	36.11%	16.67%

It can be seen from Table 1 that the passing rate of the class is about 83%, but the grades of the qualified students are mostly in the middle or lower grades, and the number of students with good grades or above is only 19.4%. There are many reasons for this result, which can be summarized as the following aspects.

- (1) The teaching content is too much and difficult, and the teaching hours are limited. Navigation technology is a special specialty, and its personnel training program should meet the requirements of both the Ministry of Education and the Maritime Safety Administration. Due to the limited total class hours given to the navigation technology major, the professional and public basic courses of the major are inevitably compressed. The schedule of advanced mathematics and university physics courses for the public basic courses is shown in Table 2.

**Table 2.** Course Schedule of Navigation Technology Major  
(Compared with Energy and Power Engineering Major)

Course	Energy and Power Engineering	Navigation Technology
Advanced Mathematics	152 hours	104 hours
University Physics	96 hours	56 hours

As can be seen from table 2, there are relatively few courses in advanced mathematics and college physics for navigation technology majors. Therefore, in the process of teaching, the teacher found that the students had not learned or learned too simple the advanced knowledge involved in many courses, such as the content of Fourier series in advanced mathematics involved in the analysis of sinusoidal AC circuit. On the one hand, because of the weak foundation of mathematics and electricity, students have a slow understanding of the course teaching knowledge. On the other hand, this course has more teaching content, and the total class hours are limited, and the theoretical class hours are only 60. Therefore, the teacher is caught between completing the teaching schedule and caring for students' acceptance. However, it is obviously difficult to overcome the above contradictions with the existing teaching model. Therefore, how to make better use of the limited class hours to achieve a balance between teaching progress and quality is a problem that needs to be solved.

Although the teaching method of PPT and blackboard has been adopted in the current teaching process, in fact, it has not deviated from the teaching-oriented teaching mode. Classroom teaching is still teacher-centered.

(2) Although the teaching method of PPT and blackboard has been adopted in the current teaching process, in fact, it has not deviated from the teaching-oriented teaching mode. Classroom teaching is still teacher-centered. The teacher teaches very tired, but most students can not take the initiative to learn, the teaching effect is not good. How to adjust the teaching mode, stimulate students' interest in learning and give full play to students' subjective initiative is an important problem to be solved to improve the teaching effect.

(3) Experimental teaching is too rigid. The experimental period accounts for about one sixth of the total class hours. The original intention is to make students further consolidate theoretical knowledge in the experimental process through the experimental course. However, in the process of implementation, the experimental design could not stimulate students' interest, and the experimental equipment was outdated and damaged, so the experimental effect was not ideal. At present, students' experiments mainly adopt grouping experiment mode. The original intention of grouping is that experimental equipment is limited on the one hand, and on the other hand, it is to cultivate students' teamwork spirit. However, the actual effect is that only one student in each group does experiments, while other students do things unrelated to the experiment. This obviously deviates from the current state's emphasis on the close combination of engineering education and engineering practice in higher engineering education [6].

### Curriculum Reform based on Improved HTM

The so-called improved HTM means to use the HTM to complete the basic theoretical teaching content, and at the same time, to use the engineering education model for reference to run engineering education and practice through the whole process of course teaching. The following measures are taken to improve the implementation of the HTM.

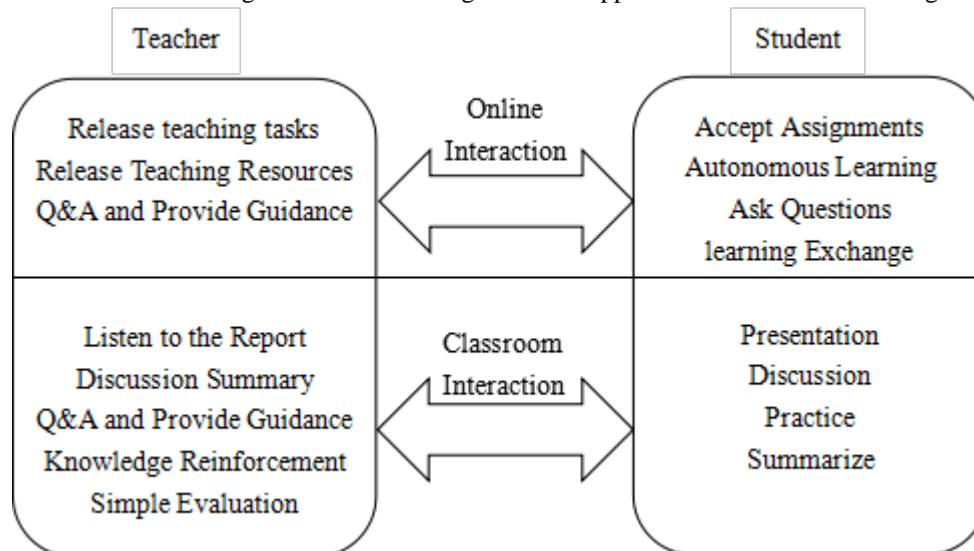
#### (1) Establish the Complete Network Teaching Link of the Course

The network teaching platform has several modules, such as course notice, course document, communication and interaction, course group, homework and exercises, etc. Teachers on the platform of network courses, the teaching courseware, the teaching video, and other forms of teaching information release platform unification, and according to the distribution of knowledge "fragmentation" handling of teaching content, the interpretation of each knowledge point control within ten minutes, so that the students in the limited time fully concentrate, completely subverts the traditional teaching of a lengthy forty-five minutes force-feeding teaching way. The advantages of online learning are that students can arrange their learning time independently and study in a flexible way, and they can even make full use of fragmented time to study. However, the disadvantages are also very obvious, that is, the learning effect cannot be guaranteed. In order to overcome this shortcoming, the teacher will assign homework on the network platform and ask the students to finish and upload the homework after learning the course courseware or video. The teacher will directly correct the homework on the network platform and master the students' learning progress. When the unit learning is completed, the teacher will also publish unit tests on the network platform, requiring students to complete them and assessing their learning effect. Students can interact with teachers through the community discussion or question function of the network teaching platform when they encounter teaching difficulties in the learning process. When network interaction still fails to solve the problem, teachers and students can solve the problem face to face in class. This constitutes a closed loop of online course learning. Taking network teaching as an effective supplement to classroom teaching, we can overcome the contradiction between limited class hours and difficult teaching content to a great extent.

#### (2) Flipped Classroom Mode

Since students have actively learned the basic knowledge and theories of this course through online learning, there is no need to repeat this teaching process in class. Therefore, teachers can use the flipped classroom teaching model to complete classroom teaching. Flipped classroom refers to flipped over the traditional classroom teaching process of

teachers, allowing learners to complete independent learning of knowledge points and concepts in extracurricular time. The classroom becomes an interactive place between teachers and students, mainly used to answer doubts and report and discuss, so as to achieve better teaching effect. The teaching mode of flipped classroom is shown in Figure 1.



**Figure 1.** Flipped classroom teaching model

The classroom teaching part of the flipped classroom teaching model consists of the following teaching links:

- Discussion. In class, students will have group discussions, including the knowledge points they have learned online and the problem-solving ideas, methods and answers to the exercises, so as to deepen their understanding of the knowledge points. Teachers guide and control the process of discussion, and make a final summary. The teacher will summarize all kinds of problems that students have encountered in online learning through students' feedback. If some problems cannot be solved in the discussion session, the teacher will answer them through individual questions.
- Answer questions. Answer questions for individual students, focusing on students with different learning abilities. The q&a time of each class is about 20% to 30% of the class time. Different from answering questions on the network platform, classroom answering emphasizes the face-to-face and real-time interaction between students and teachers. Students can explain the difficult points repeatedly and adjust the way of answering questions according to students' feedback at any time.
- Field experiment. The theoretical knowledge taught in this course is very abstract in circuit analysis, motor theory and number/mode theory. Experiments can visually deepen the understanding of theoretical knowledge. Besides the basic experimental teaching, demonstrative experiments can also be carried out in class. According to the requirements of mastering the knowledge points in class, the virtual simulation software such as labviewer can be used to conduct the field experiment demonstration and even encourage students to participate in the experiment process. In this way, students can feel the intuitive effect brought by the experiment in class, so as to stimulate students' interest in learning, learning enthusiasm and creativity.

The implementation of the flipped classroom teaching model enables students to participate in the whole teaching process, instead of passively accepting it as in the traditional teaching model. Therefore, students' initiative in learning can be brought into full play to a large extent. However, if the flipped classroom model is adopted in classroom teaching, the teaching plan needs to be modified according to its characteristics. The course content is organized into several modules according to the knowledge structure, and each module is divided into several small knowledge points. There is coupling between modules and modules, and each module is connected in series, so as to develop a complete course teaching content. In addition, in order to enable students to better integrate theory with practice, the course teaching can be extended to the first line of production practice. Make full use of students' internship opportunities on the ship, lead students to visit Marine electrical and electronic equipment, and explain the relevant knowledge of Marine electrical and electronic on site. To enable students to learn in order to apply, clear learning objectives, stimulate interest in learning.

### (3) The Establishment of Virtual Simulation Network Experiment Platform

At present, there are many problems in the course experiment, which affect students' mastery of course knowledge. These problems do not only exist in this course, but also exist more or less in various engineering experimental courses [7-8]. And the use of various virtual simulation software Multisim, VB, Labview combined with the Internet to build a course of virtual simulation experimental platform is undoubtedly a good solution. After the content of the theoretical course is finished, the teacher can immediately publish the corresponding virtual simulation experiment on the Internet. Students can finish the virtual simulation experiment of the course independently on any mobile network terminal equipped with platform software and submit the experiment report directly on the Internet without the limitation of experimental site and time. The simulation results of the simulation experiment platform reach or are close to the results of operating real instrument experiments. In the background, teachers can know the completion degree of students'

experiments through the completion time, submitted experimental data and analysis of experimental results, so as to solve students' problems pertinently. The establishment of the virtual simulation experiment platform can reduce the cost of loss and experimental design, especially for electrical part of the high voltage experiment involved still can guarantee the safety of the experiment, students can be taught in accordance with the requirements of the experiment used his pioneering experiment design and operation, will not cause damage for personal and equipment safety, therefore very conducive to the cultivation of students' innovative and hands-on ability. In addition, the use of virtual simulation experiment can really make the content of theoretical teaching and practical teaching closely linked in the class schedule, but not limited by the laboratory capacity, experimental hours teachers can also be arranged according to the needs of theoretical teaching, without considering the limit of experimental hours.

### **Conclusion**

Aiming at the problems existing in the teaching of Marine electrical and electronic technology, the improved hybrid teaching method is adopted to make teaching reform plans from the aspects of the establishment of network teaching platform, the application of flipped classroom teaching model, and the construction of virtual simulation experiment platform. The results of teaching evaluation and course evaluation show that these measures can effectively improve the teaching effect of the course.

### **Acknowledgement**

This work is partially supported by teaching reform projects of Guangdong Ocean University [No.524210274, 570219044], scientific research start-up funds of Guangdong Ocean University [No.E15031, R17012], Characteristic Innovation Projects of Guangdong province [No.2017KTSCX088, 2017KTSCX092].

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