

# Probe on the Teaching innovation of advanced manufacturing technology oriented to oceanic engineering

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## Abstract

Teaching innovation of advanced manufacturing technology is necessary for oceanic universities. The application of AMT in oceanic engineering equipment is emphasized to make the students master the oceanic professional knowledge and improve their practical abilities. The educational thought oriented to oceanic engineering is proposed, the existing problems of AMT teaching are solved efficiently.

**Keywords:** Advanced manufacturing technology, Teaching innovation, Oceanic engineering, Practical teaching,

## 1. The necessary of offering an Advanced Manufacturing Technology course with oceanic characteristics

With the rapid development of China's manufacturing industry, more and more AMT and modern management methods are applied to production<sup>[1-3]</sup>. At the same time, a new demand for engineering education is proposed, which requires that the development of manufacturing technology adapt to the training of personnel<sup>[4]</sup>. It's necessary to open AMT course in universities for giving a systematic introduction of new technology and new ideas about the AMT to students, and making them adapt to the jobs of the future and win the international competition.

Shanghai Ocean University is a univer-

sity which has a hundred years' history, strong strength, bright features, and important influence at home and abroad. This university has high level of teaching and scientific research especially in the subject of oceanic science and engineering, oceanic fisheries, oceanic food, oceanic information, oceanic economy has strong teaching and research level. Recently, the breakthrough progress in oceanic engineering material, equipment, submersible buoys and renewable energy has been obtained in college of engineering with AMT. The key problem for us is how to blend research in teaching, guide students with the theory of scientific research, explore and summarize the inherent laws of teaching on the basis of experiment, investigation, comparison as well as analysis to improve teaching quality. To open an AMT course with oceanic characteristics and introduce the application of AMT in oceanic engineering equipment can solve this problem fundamentally.

## 2. Existing problems of AMT teaching course

Owing to the AMT course of wide coverage, multifarious content, class based-on teaching, as well as a lack of actual case teaching, integrated teaching, and practice teaching, students are beset with difficulties in the learning process, and the teaching effect is not ideal. The existing problems of the course teaching are

summarized as follows:

First, AMT is a dynamic, constantly absorbing the high-tech developing technology. Most of teachers are limited by the existing textbooks and can't introduce the latest development situation of AMT in the teaching process<sup>[5]</sup>.

Second, there is a high demand for teachers because of limit hours and large amounts of information of AMT course<sup>[6]</sup>.

Third, it's difficult for teachers to make courseware<sup>[7]</sup>. Teaching process by combining pictures with text is not enough.

Fourth, a lack of experimental equipments and practice link make students difficult to deepen the understanding of the theory of teaching content.

Fifth, many teachers still adopt cramming method of teaching, only give a general introduction to kinds of AMT without further expansion or explaining the primary and secondary clearly. Hence, students have no deep thought and just learn the basic concepts, principles and applications, which can't cultivate creative thinking and innovation capability of students.

Sixth, current textbooks have many disadvantages, such as old and multifarious content, a lack of practical examples and strong theory, so it is difficult for students to understand.

### **3. Teaching Reform and Practice**

#### **3.1. The integration of course content**

Aiming at the current situation, such as lacking of AMT course hours, much content, disperse course system and limit teachers' professional level. Combining the school-running model of Shanghai Ocean University with the demand for employment and advanced study of students, the course content needs to be reorganized and integrated.

In terms of the phenomenon of AMT course crossing with other courses, the

syllabus is drafted again. Modern design technology and numerical control technology are leaved out from the advanced manufacturing technology course teaching. Three coordinate measuring machine is applied to the teaching practice to enhance the students' understanding and mastering of this technology.

Advanced oceanic equipment manufacturing technology is introduced in AMT course. which includes the research technology of seawater desalination equipment, the building of oceanic ecological pasture, the physical simulation of wave and the key technology of wave energy power supply. Fluent and ANSYS are used in molding and simulation. By utilizing a large number of pictures and videos, the advanced oceanic equipment manufacturing technology are lectured combining teachers' professional background knowledge with research accumulation. This lecture method helps students to enrich the professional knowledge, broaden the horizons of vision, and enhance the professional skills. The innovative consciousness of students is cultivated, the strict research idea is inculcated, the glorious sense of mission that puts forward science progress and social development is set up.

#### **3.2. Improvement of teaching method for arousing the enthusiasm of students**

The main measures improving teaching method for arousing the enthusiasm of students are as follows:

- Heuristic teaching.

Heuristic teaching is employed to AMT course. The questions are raised at the beginning of class so as to make students attend a lecture with questions. Questioning and other interactive mode are adopted to encourage students to express their ideas and views for one of the advanced manufacturing technologies, and activate classroom atmosphere. The

students' mastery degree of course content can be inspected by asking questions at the end of class.

- Making a distinction between the important and the lesser one and case teaching.

After summarizing one kind of technologies, the most promising advanced manufacturing technology is introduced in detail. And then case teaching is performed. Taking surface engineering technology for example, here is introduction process. Firstly the definition and classification of surface engineering technology are overviewed. Secondly the definition, principle and application of each surface engineering technology are introduced. Thirdly the plasma nitriding technology is introduced in detail. In the courseware, the productive process of plasma nitriding technology is described by a lot of pictures. Luminescence and vocal phenomena of nitriding process are displayed in the video. The principle of sputtering and deposition is explained by using cartoon. Finally the case of active screen plasma nitriding is employed to deepen the students' understanding and mastering for this technology. Author is awarded the first prize of young teachers' lecture competition of Shanghai Ocean University by using this case teaching, and gives a lecture of the teaching criticism lesson of college during 2012. The powerful influence has been reflected among students after class. Increasing teaching practice link

In order to develop the experimental abilities of students, the experimental equipments are fully utilized in the process of advanced manufacturing technology course or practical teaching link. Aiming at junior students, comprehensive practical module is set up, which is composed of electromechanical integration, testing, hydraulic, fixture design, micro-controller and mechanical design. The practical and experimental abilities of

students are improved by making full use of experimental equipments and choosing three modules to practice. In the final four weeks of semester, students are trained in training center and some companies with advanced mechanical manufacturing technology and equipments. By increasing practical opportunities and operating advanced manufacturing equipments ( such as NC Machine Tool, Machining Center, EDM Machine Tool, Carbon Dioxide Laser etc.), the practical abilities of AMT is improved and the intuitive impression and students' understanding for AMT are deepened.

### **3.3. Reforming the assessment mode**

Much recite contents and the difficulties of review are the main reasons of unsatisfactory exam results.

Aiming at the present situation, the value of the regular grade is increased by adding lecture part for students. Students' lecture link obtains the obvious effect. From the response of two sessions of graduates, the thinking ability, expression ability and competition ability of employment are improved obviously. The final score of the course is determined by a comprehensive consideration through reviewing literature, writing reports, making speech, participating in scientific research project (teacher's project or technological competition project) and doing the final examination.

### **3.4. Pay attention to the development of oceanic characteristic applied talents**

AMT course teaching should trace the frontier of oceanic technology, enhance the connection between theory and practice and achieve the purpose of application at the same time. Depending on the stock of equipment and strong research strength of oceanic engineering research institution, a lot of experimental teachings are established to enrich the profes-

sional oceanic technology knowledge of students. Signal acquisition experiment is opened by using self-designed buoy of our college. The power-supply experiment of buoy is performed by using efficient wave power devices. By using Sugon high-performance server, the properties of oceanic nano materials are calculated. Using Fluent and ANSYS to perform the dynamics simulation of oceanic mechanical equipment and the calculation of oceanic fluid. From the above practice teaching, the oceanic feature of our college is highlighted, the professional knowledge is mastered by students, and practical abilities of students are improved. They will be sent to all parts of country as the applied talents of oceanic feature, and promote the development of national oceanic affairs.

#### 4. Peroration

Above are the author's thoughts of oceanic characteristic AMT course. Through the reform of curriculum content, teaching methods, teaching practice link, examination mode, training of applied personnel with oceanic characteristics, the quality of classroom teaching is improved effectively, the comprehensive ability of learning, practicing, and oral expression is raised, and compound talents with stronger innovation ability, comprehensive ability, and adaption to environmental changes are cultivated.

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