Use a good "TOP-DOWN" design to train students' abilities

J. Wu, K. Zhou, J. Jin, X. Zhao & L. Yao
School of Transportation, Tianjin University of Technology, P.R. China

Abstract

In this paper, the authors introduce the "TOP-DOWN" approach to the design of courses in higher maritime education. In an effort to improve the students' abilities to meet the requirements of the global maritime transport development, we propose to change the education plan from teaching the students the knowledge requirements to an approach which trains their abilities. In that way students will be better able to comply with the human resource requirements for officers and engineers in the area of global maritime transport.
Keywords: TOP-DOWN design, training, abilities.

1 Introduction

Over the last two or three decades, global maritime transportation has rapidly developed and up-dated the technology used on board ships. With ships becoming more and more advanced, it is now an issue for the nautical and engineering academies to consider, in particular the issue of how to educate senior seafarers who will have to master modern navigation technology available on board ships.

2 Making a good "TOP-DOWN" design

Most maritime universities are institutions where students are not only taught knowledge, but where they are also trained, e.g. in the use of technology to navigate a ship. In the traditional course design, the emphasis lay on teaching the necessary knowledge, but with today's rapid development of technology, it was found that when more and more knowledge is taught, the teaching program has to be adjusted continuously, leaving the educators no other choice but to increase the teaching hours. Year by year, we found ourselves busy in adjusting the

education plan. Finally we found that we had entered a monstrous circle. But, how could we stop this monstrous circle?

2.1 A possible solution

After studying all related factors affecting course design, we reached a joint key point, which is that the academy should adjust its teaching direction from mainly focusing on training students using the technology to focusing on improving their abilities to continuously up-date their knowledge after having completed their college period. In this adjustment period, the Tianjin University of Technology carried out a teaching reform, which focused on the so-called "TOP-DOWN" design [1]. By adopting this new international concept of an education method, many complex problems will be simplified. Instead of relying on the sub-systems having developed their own advanced teaching techniques, the "TOP-DOWN" design emphasizes the whole system's capability of training. The "TOP-DOWN" is a design method, which aims to satisfy the top requirement what should be done at the lower sections, from the top layer to the foundational layer, step by step.

As a starting point and in order to improve the basic knowledge of the students', we have to carry out a "technical orientation" for the students. Then we re-arranged the contents of the courses and adjusted the teaching hours. Furthermore, we selected sub-systems related to the courses, such as competent teachers, suitable teaching materials, experiments, practical training sessions and other miscellaneous related training courses of professional skills.

Every sub-system is based on the following key points:

- firstly, it should be designed to meet the respective requirements;
- secondly, it should be optimized as far as possible;
- thirdly, enough space should be left to the students for self-study and self-development.

To set up courses and train the students only according to the skills or competence of the teacher will only lead to an "accumulation" of skills in how to use high technology. The proportion of their knowledge systems will not be satisfied even though great efforts have been made and long teaching hours have been used. In the concept of "TOP-DOWN", teaching is considered as an integrated system, and great importance is placed on the design of this system. In order to achieve a good result it is only necessary to develop an excellent "TOP-DOWN" design for the respective courses. If this is not kept in mind, some difficulties will be encountered, such as a lack of teaching quality, talent knowledge system, ability structure, and most importantly the management of the university's teaching resources. One way to achieve this is to prepare the training scheme and the guidance of a teaching plan separately in order to guarantee a good "TOP-DOWN" design.

2.2 Targets set

The students, or should we rather say the officers and engineers in the not too far away future, should acquire three different kinds of abilities within their college period:

- strong ability to work independently;
- excellent language and communication skills;
- general management skills, based on law consciousness.

In order to increase the ability to work independently, we should mainly teach the students how to analyze and solve real-life problems by themselves, using the knowledge they have been taught in class as well as new knowledge which they may have acquired by self-study. We recognise that the speed of development of modern ship-handling technology as well as other ship devices is much faster than that of our teaching materials. In addition, due to the limitation of teaching hours, the level of knowledge of individual teachers and also the technical limitations of university experiments, it is impossible for the students to learn and master all the necessary knowledge about ships during their university period. Therefore, it is very important that students should be capable to carry out self-study and solve problems by using the knowledge they have learned [2].

In order to increase the language and communication skills, the main task is to train the students' ability of collecting all kinds of information and also to exchange ideas with other persons. As a characteristic of the maritime industry, officers and engineers should master a foreign language fluently. The language skills are not only essential for them to collect information more effectively in order to ensure the safe navigation of the ship, but also to exchange and communicate conveniently with other officers and engineers who are on board the same ship to form a team to accomplish shipping tasks together, or with personnel ashore or onboard other vessels to ensure the safety of navigation. General management skills are based on law consciousness that refers to do things legally, to operate the ship according to operational rules and regulations and to increase the ability of cooperating with others. As different countries have different cultures, ideas and consciousness, the laws of different countries often are also different from each other. It is therefore necessary for the students to learn and master local laws and regulations. At the same time, they should also learn how to protect their legal rights and interests by using the weapon of law. The university has to frame its own scientific and logical programme development and to set up a scientifically based and sensible "TOP-DOWN" design, which can express modern advanced educational concepts. These are just some of the basic steps when setting up a "TOP-DOWN" design for courses teaching the specialty of maritime transportation.

3 Paying attention to training students' abilities

In order to train students' abilities as mentioned before, we have mainly adjusted our course design and added some education contents as follows:

3.1 STCW related courses for officers and engineers

In order to comply with the requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW78/95) and the regulations promulgated out by the Ministry of

Communication and Maritime Safety Administration of the PRC, we have selected officers and engineers eligible for training courses. The key point is to ensure that the students complete the compulsory theoretical training in maritime functions, such as: cargo handling, cargo stowage, marine operation management and human resources management. The main emphasis of the training regime lies on students to acquire the theory, using the knowledge they have learned at the university and through their self-studies as well as relevant practical sessions. They also need to practice other teaching items which include cargo plan, route planning, and ships in-port and out-port operations, all-weather navigation, fault diagnoses, and prevention of accident, either on board a real ship or in the ship handling simulator [3].

3.2 Improving students' language and communication skills

Adding to the training of students the improvement of their language and communication skills will greatly enhance their ability to collect and exchange information [4]. The method is: students should finish two essays in English in order demonstrate their language skills in exchanging information. The students themselves can select the subject of the first essay. The topic could be their daily study and life or popular science knowledge. The second report should cover a professional topic in the maritime field, which would introduce new technology and new developments in some detail. The duration of each task is 30 minutes. In addition to these two tasks, the students should answer some related questions. In order to complete the two essays, students need to collect, select, review and summarize all the materials available e.g. in the library or through some own research. The students can then finish the preparation of their essays and also the oral defence.

Such tasks will improve the research skills of finding and reviewing available material. Furthermore the student's abilities of proper expression can be trained, and at last the aim of language ability can be reached.

3.3 Training students' ability to work independently

In order to improve the students' ability to work independently, we have added after class science and technology activities, which we believe should also cover closely the subject of navigation. For example, recently our after class science and technology activities included: researching and manufacturing solar powered lifeboat, or the network of maritime safety education which students are studying. Through these after class activities, students have learned some new knowledge. In particular, through the development of solar powered life boat, the students have not only had a better understanding of the potential use of solar energy, but have also learned a great deal of professional knowledge relating to shipboard lifesaving devices.

Another example is the maritime safety educational network, where students have to analyze the underlying reasons of a maritime accident, repeat the accident scenario on the computer screen and analyze the wrong operation that led to the accident by using a ship-handling simulator. Students can put their

discussion and research results on the network. We found that the students showed a more safety conscious attitude, and, after long discussions they prepared a safety warning to navigators. It would seem that the after class science and technology activities have aroused the learning interests of the students, fostered better studying habits, and most importantly, changed the attitude of students from passive ("made me study") to active ("I want to learn").

4 Teaching results

We are quite confident that the ability of self-study and practical problem solving of students have been improved. The ability to collect relevant material, to gather and summarize information, and the ability to communicate in English has been enhanced remarkably. The students are much more aware of laws and regulations governing the safe operation of ships. As a consequence, our university's examination pass rate of national officers and engineers has reached the top level in recent years.

When summarizing our experience, we would say that the fundamental goal for us is to improve our maritime transportation education, recognise and adapt to recent development in science and technology, so that qualified students are entering the shipping industry. To achieve this, the most successful method has been found to the "TOP-DOWN" course design concept, which improved the whole course design. Theoretical and practical examples have been used and demonstrate the success in this approach.

References

[1] Jin Jianguo, Wu Jianhua, et al. Application of Modern Teaching Methods to study of Navigation and Marine Engineering Technology. The 5th Annual General Assembly of IAMU, 2004.

[2] Wu Jianhua, Cao Zuoliang, et al. Imitation Platform for Robot Based on Virtual Reality Technology. 4th International Conference on Virtual Reality and Its Applications in Industry, Proceedings of SPIE, 2003.

[3] Wu Jianhua, Wang Ting et al. Combination Case Study with Theory Teaching, Proceedings of the 7th CMIT 2004.

[4] Wu Jianhua, et al. Bilingual Teaching Practice, Journal of Tianjin University of Technology Vol.18, 2002.