



Strategies and methods for promoting post capability on the hydraulic course of sergeant

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Abstract. According to the teaching rules of sergeant hydraulic course and through proper analysis of current teaching, the appropriate strategies and methods for promoting post capability are given, which are, developing simulation training system, employing the theory-virtuality- reality teaching mode, integrating the teaching content and improving teachers' teaching capability. The research findings should be beneficial to sergeant-teaching.

Keywords: post capability; simulation training system; theory-virtuality-reality teaching mode; sergeant hydraulic course.

1 Introduction

Modern motive radar could realize many functions such as antenna lift, antenna overturn and antenna levelling, in which hydraulic technique has played an important role. In order to improve post capability, the students should not only study the basic knowledge of hydraulic technology, but also understand the operational principles of representative radar hydraulic systems, especially could be skillful in removal of hydraulic faults.

Through long-term hydraulic course teaching, three main characteristics have been found. Firstly, the course has high theoretical property, since its technical theory has hydromechanics as the base; secondly, the course has high operational property, since its one important training goal is to bring up the students' operational skills of trouble clearing for radar hydraulic systems; thirdly, the course has high requirements for teaching resources[1][2][3][4], and need simulation training systems, animation library, micro lessons to support the teaching. Therefore, to substantially promote students' post capability, the focal problem is to propose a series of strategies and methods for teaching reforms[5][6][7].

2 Current Status of Hydraulic Course Teaching

To allow students to play more important role in their future work, the hydraulic course should focus on promoting students' post capability. Thus, complicated knowledge

which has nothing to do with radar technical support for hydraulic system is not recommended. So the rational goal of the course is to tell the students about how to analyze and solve hydraulic post problems.

2.1 Simulation Training is Absent to Teaching Instruments

As hydraulic oil flows in closed elements and pipes, it is very difficult for teachers to carry out visual teaching. Although animations, videos and pictures have been widely used to show internal structures and operational principles, there is a blank between theory teaching and equipment training. Because of the absence of simulation training systems, the closed relationship between theory teaching and practice teaching has been cut off, and students could hardly understand the hydraulic system of radar, neither do they grasp the procedures of trouble clearing.

2.2 Teaching Methods are not Flexible and Multiple

Theory-virtuality-reality teaching mode has not been widely used. The relationship between theory teaching and operation teaching is not close. The chief method of hydraulic teaching still depends on instructions and sometimes could not obtain the best teaching effects. Some advanced teaching methods, such as case-based teaching, seminar teaching, blended teaching, CBL, BOPPPS, are still at the level of the primary stage. Because of the actual problems existing in teaching methods, creative thinking trainings for students have not been adequately carried out.

2.3 Teaching Content is Lack of Maintenance Work

Most current teaching contents are about operational principles of hydraulic elements and circuits. Some more important maintenance works, such as elements installation, oil replacement, system monitoring and trouble clearing, are rarely presented in the hydraulic course. So to some extent, there has existed the problem of emphasizing theory over practice. Another problem is that existing theoretical contents and operational contents, are not well integrated. When students graduate from school, facing practical hydraulic systems, they even do not know how to carry out maintenance work.

2.4 Teachers' Abilities have Defects

Most hydraulic teachers' educational experiences are not abundant, which only include school education. Although these teachers could easily handle some basic hydraulic experiments, such as elements and circuits assembly, they are not skillful in trouble clearing and have fewer experiences of hydraulic maintenance. Specifically, most hydraulic teachers do not have comprehensive understanding on modern servo system of radar and could not solve problems by utilizing the technique of mechanics-electronics-hydraulics.

3 Strategies and Methods for Promoting Post Capability

To promote post capability rapidly on the hydraulic course, it is necessary to make breakthroughs on the teaching system, including teaching instruments, teaching methods, teaching contents and teachers' abilities.

3.1 Introduce Software Simulation Training to Improve and Perfect the Teaching Instruments

On the hydraulic course, teachers may utilize various kinds of teaching instruments, such as software simulation training, hardware simulation training and real equipment training, to merge virtual and real training into each other and to explore complementary advantages. If introduce software simulation training, intuitional and vivid effects could be achieved, by revealing three-dimensional structures, operational principles and three-dimensional processes of elements assembly, circuits lapping, trouble clearing. Thus, not only students' theoretical base could be strengthened, but also their practical trouble clearing skills could be raised.

To make up the defect of lacking software simulation training, a hydraulic simulation training system of radar maintenance has been designed and developed, as shown in Figure 1.

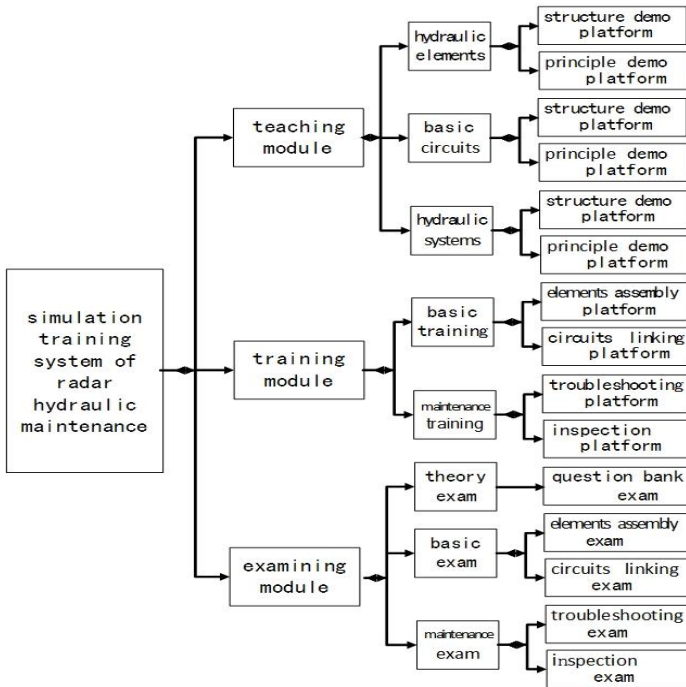


Fig. 1. structure block of hydraulic simulation training system

3.1.1 Teaching Module

1.hydraulic elements submodule

More than twenty kinds of three-dimensional models of hydraulic elements have been created. Because these models could easily demonstrate the three-dimensional structures and three-dimensional animations, students' disadvantage of weak in the space-imagination-ability has been overcome.

2.basic circuits submodule

Three-dimensional models of basic circuits, such as pressure-control circuit, load-release circuit, speed- control circuit, have been created. Through these models, students could not only understand the operational principles of basic circuits easily, but also recognize the different functions developed by hydraulic elements.

3.hydraulic systems submodule

Three-dimensional hydraulic animations of antenna lift, antenna overturn and antenna levelling have been developed. From these animations, students could easily understand the types, quantities, locations of the elements and the operational principles of radar hydraulic systems.

3.1.2 Training Module

1.basic training submodule

To elements training, students could firstly disassemble the elements, and then install them, through introducing the same technics, procedures, tools as the real assembly; to circuits training, students could choose the appropriate elements, place them at the correct positions, connect them through pipelines, and finally run the circuits.

2.maintenance training submodule

To the four kinds of typical working procedures, which are antenna lift, antenna withdrawal, antenna overturn and landing legs spread, more than ten kinds of typical hydraulic faults have been developed. In the process of trouble clearing training, firstly, according to the schematic diagrams of subsystems, students should locate all the hydraulic elements in the three-dimensional models; secondly, according to the faults appearances, the functions of hydraulic elements and the possible consequences caused by the faults, students should locate the broken-down elements exactly; thirdly, students should investigate all the possible failure causes and complete the works of replacing or adjusting fault elements, imitating the real procedures and operations of trouble clearing.

3.1.3 Examining Module

Firstly, more than two hundred choice questions and true or false questions, according to the important knowledge points, have been designed to launch the theory exams; secondly, scores for every step of elements assembly, circuits lapping, trouble clearing and maintenance, have been given and allow the reasonable evaluations on students' virtual operations.

3.2 Select Teaching Methods According to the Requirements of Psychological Cognition and Technical Ability Training

On the basis of the teaching characteristics of hydraulic course and the learning base of sergeants, firstly, theory-virtuality-reality teaching mode and heuristic, analogous teaching methods have been employed to improve students' ability of autonomic learning and independent thinking; secondly, strengthening the connections between theory, real equipments and experiments to relate theory with practice; thirdly, employing various kinds of teaching instruments, such as real equipments, real objects, simulation training softwares, animations, models and micro lessons, to improve teaching effects.

3.2.1 Theory-virtuality-reality teaching Mode

With regard to theory-teaching, the teaching mode of theory-simulation-equipment is utilized to intensify the relationship between theory-teaching, real equipment and could encourage students to relate professional knowledges to the structure characteristics of radar hydraulic systems and elements. With regard to experiment-teaching, the teaching mode of theory-simulation-practice is employed to merge theoretical knowledge into experiments and could ensure that theory drag practice and practice verify theory. At the same time, information means such as simulation training system, model library, animation library would play important roles in the theoretical and experimental teaching. Through revealing the structures and principles of radar hydraulic systems, circuits, elements, also through imitating the operational procedures of trouble clearing, complex structure would be intuitional and abstract principles would be visualized. Thus students' studying interest would be aroused and better teaching effects would be received.

3.2.2 Heuristic Teaching Method

On the hydraulic course, according to the teaching goals, teaching contents and students' scienstial levels, cognitive regulations, teachers could provide a series of question circumstances to edify students' thinking. Through various kinds of heuristics, such as query heuristic, analogy heuristic and graph heuristic, students' curiosity and thirst for knowledge could be aroused and could guide students' active thinking to join teaching directly. Heuristic teaching method could not only bring up students' the ability of analyzing and solving hydraulic problems, but also could arouse students' the enthusiasm for independent learning. Thus the students' interest in learning would be improved.

3.2.3 Analogy Teaching Method

There are many analogous hydraulic systems, circuits, elements existing on the course. If the close relationship among them could be grasped by teachers, not only the teaching loads could be reduced, but also the students' understanding could be deepened. Thus, the teaching effects of twice as much should be obtained with half the effort. For example, a radar hydraulic system generally consists of several subsystems, such as antenna lift, antenna overturn and antenna levelling, which are similar to each

other on structures. So, when teachers introduce the operational principles of subsystems, they could only elaborate one typical subsystem and to others, just explain the local differences. As the analogy teaching method has been widely used, students could easily grasp the key points and obtain a comprehensive study.

3.3 Merge Teaching Contents Aiming at Acknowledging Principles and Developing Skills

The design concept for teaching contents is “one goal, two principal lines, three modules”. One goal is to maintain the normal working conditions of radar hydraulic systems and clear troubles; thus the actual combat direction would be strengthened. Two principal lines are radar hydraulic technical principles and hydraulic maintenance works. Radar hydraulic technical principles, which are mainly about the components, principles and characteristics of the constituent parts of radar hydraulic systems, could be the theoretical basis for hydraulic service. Radar hydraulic maintenance works, which are mainly about elements assembly, circuits lapping, trouble clearing, could be the practical basis for hydraulic service. Thus, the two principal lines have emphasized the basis of knowledge, ability and quality required for hydraulic service. Around the two principal lines, three modules have been designed, which are hydraulic elements, circuits and systems.

3.3.1 Hydraulic Elements Module

The typical and frequently-used elements from radar hydraulic systems are chosen for the module. According to the four kinds of hydraulic elements, which are power elements, execution elements, control elements and aid elements, the theoretical teaching would introduce their structures, principles, characteristics and faults successively. The analyses of application in basic circuits and radar hydraulic systems are highlighted and the students' capabilities of analyzing principles according to structures have been improved. The experimental teaching, otherwise, has emphasized on the training of elements assembly.

3.3.2 Basic Circuits Module

The typical and frequently-used circuits from radar hydraulic systems are chosen for the module. According to the four kinds of basic circuits, which are pressure-control circuits, speed-control circuits, direction-control circuits and other circuits, theoretical teaching would introduce their operational principles, functions, characteristics successively. Theoretical base of hydraulic elements is consolidated opportunely and the applications of basic circuits would be elaborated in close connections with the functional requirements from radar hydraulic systems simultaneously. Thus, students' ability of analyzing the principles of circuits according to the functions of elements would be improved. The experimental teaching, otherwise, has emphasized on the training of circuits lapping.

3.3.3 Hydraulic Systems Module

The typical hydraulic systems of chief radars are chosen for the module. The theoretical teaching would introduce the operational principles, functions, characteristics and maintaining cases of various hydraulic systems and consolidate the theoretical base of basic circuits in time. Thus, students' ability of analyzing operational principles and faults for complex hydraulic systems would be improved. On the other hand, the experimental teaching would emphasize the skills training of trouble clearing and could realize the organic integration of knowledge, ability, quality. Thus the character of high level for teaching content would be exhibited.

3.4 Intensify Applications of Technology and Accumulations of Experience to Improve Teaching Abilities

Although hydraulic teachers have better theoretical base, there would be obvious disparities to the real demands of sergeants' education. So, it is necessary to improve teaching capabilities by three means, which are intensifying applications of technology, highlight accumulations of experience and cultivate qualities of information.

3.4.1 Intensify Applications of Technology

Hydraulic teachers should not only grasp the structural compositions and operational principles of various kinds of hydraulic elements and basic circuits, but also integrate hydraulic technology into maintenance works of radar hydraulic systems forwardly. So, it is necessary for hydraulic teachers to understand the functions, effects, installing structures, operational principles of new kinds of radar hydraulic systems in depth, and expertly grasp various technologies applied in it, which are hydraulic technology, mechanical technology, sensor technology, electric technology and information processing technology.

3.4.2 Highlight Accumulations Of Experiences

Hydraulic teachers should not only grasp the methods of elements assembly and circuits lapping, but also improve the skills of trouble clearing for radar hydraulic systems. So, it is necessary for hydraulic teachers to go deep into radar troops and repairing factories, studying the knowledges, experiences, methods, strategies of trouble clearing, and experiencing the maintenance works of radar hydraulic systems by themselves. Thus hydraulic teachers could transform their systems of theoretical knowledges to systems of practical engineering, bring up operational skills and accumulate practical experiences.

3.4.3 Cultivate Qualities of Information

Under the background of carrying out information teaching, hydraulic teachers should emancipate their minds and renew their ideas of information teaching forwardly. Hydraulic teachers should study, explore various kinds of information teaching modes, such as flipped classroom, network course, MOOC, micro-course, improve the ability

of understanding and utilizing information technology voluntarily, develop and make multimedia teaching resource library, network course platform, discipline and speciality network station, hydraulic simulation training system, fault-case-library. Thus, teachers' ability and standard of information teaching could be promoted through the development of information resources.

4 Conclusions

To promote sergeants' capability of maintenance effectively, it is necessary to carry out teaching reforms on conventional hydraulic course, specifically make breakthroughs on teaching instruments, teaching methods, teaching contents and teachers' teaching ability. Through teaching reforms, students not only increase their learning interests, but also strengthen their theoretical base of hydraulic transmission and promote their maintaining skills of elements assembly, circuits lapping, trouble clearing. Thus, after their graduations, the students would play more important roles on the maintenance works of radar hydraulic systems.

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