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Research on the Content Construction and Teaching Strategy of Equipment Technical Support Comprehensive Training Course

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ABSTRACT
For the purpose of improving the ability of students posts competencies and the creativity, it is very important to build content architectures and select reasonable teaching strategies when organizing the equipment technical support comprehensive training course. So this paper sets up an ability-oriented teaching content system and proposes a new teaching strategy called "CDPEF", to fulfill the personnel training demand of equipment technical support post. Through practice, it proves that the implementation of the content architectures and teaching strategies can have a positive teaching effect in teaching.
Keywords: *Technical support, Practical teaching, Curriculum content system, Teaching strategy*

1. INTRODUCTION

In recent years, stealth aircraft, ballistic missiles, cruise missiles, supersonic aircraft and other new threat targets have brought great challenges to the early warning systems, because any early warning equipment cannot independently search and track the above typical targets. So, it is necessary to fully use different types of early warning equipment to cooperate, which means the equipment technical support personnel need to expand their support capability from "knowning how to repair, being able to maintain and operate" to "knowning how to repair, being able to maintain and operate, being good at cooperatively using multiple early warning equipment". However, the cultivation of cooperative application ability is not contained within the recent equipment technical support comprehensive training course. Therefore, we need to rebuild the teaching contents and innovate the teaching strategies of the course to fulfill a new education demand.

2. ABILITY-ORIENTED CONTENT SYSTEM CONSTRUCTION

In the process of teaching, the selection of course content should be very careful, because the content is the sole of one course [1-2] and is the key part in practical teaching reforms [3-4]. According to the talent training ability goal, the content system of the equipment technical support comprehensive training course is mainly divided into four categories: maintenance course content, repair course content, operation course content and cooperative application course content, as shown in Figure 1.

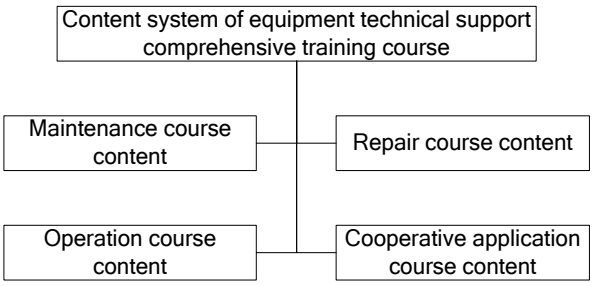

Figure 1 Content system of equipment technical support comprehensive training course

The contents of maintenance course mainly include: typical radar equipment diagnosis, debugging, calibration, disassembly and replacement of damaged or faulty parts. Teaching emphasis includes: regular debugging and calibration of important equipment such as antenna equipment unit, electronic equipment unit and cooling equipment unit, as well as preventive disassembly and replacement operation process of radar key parts.
The contents of repair course mainly include: the operation steps and processes of daily maintenance,

weekly maintenance, monthly maintenance, quarterly maintenance, semi-annual maintenance and annual maintenance.

The contents of operation course mainly include: selection of equipment deployment location (select qualified position according to external conditions such as task command, infrastructure and electromagnetic environment), switching operation of radar equipment, setting operation of radar equipment working mode (searching, tracking and identifying), etc.

The contents of cooperative application course mainly include: multiple radar equipment mission planning (such as automatic search planning, focused search planning and accurate search planning), and typical aerial threat target cooperative detection tactics.

The teaching emphasis and difficulty of the content system mainly consists of two parts: one is the fault location and cause analysis of typical fault of radar equipment, the other is the cooperative detection technical support of multiple early warning equipment.

3. "CDPEF" TEACHING STRATEGY

In order to break through the teaching points of the content system, in practice, we adopt a teaching strategy of "CDPEF" namely "CASE – DISCUSSION – PLATFORM – EVALUATION – FEEDBACK". The design idea is that firstly introduce the heavy crux part in the content of course through carefully selected cases, secondly deeply analyze the cases by the interactive discussion between students and teachers and propose some solutions and methods, thirdly, with the help of practical comprehensive simulation training platform, simulate and verify the above discussed solutions, finally, feedbacks of simulated results are used to strengthen the teaching effects.

In practice, there are two concrete forms of teaching strategies. One is five steps of teaching process of technical support of equipment maintenance and repair, the other is six steps of teaching process of technical support of cooperative detection based on multiple early warning equipment.

3.1. Five steps of teaching process of technical support of equipment maintenance and repair

According to the "CDPEF" teaching strategy, when breaking through the teaching focus of typical radar equipment fault location and cause analysis, five steps are adopted, including case introduction, analysis and diagnosis, scheme formulation, specific implementation and deepening development. The corresponding relationship between these five steps and "CDPEF" teaching strategy is shown in Figure 2.

Step 1. Case introduction. In the process of teaching implementation, the teacher introduces the typical cases of radar equipment maintenance and repair which closely interrelated with teaching emphasis and difficulty. This part corresponds to the case link of "CDPEF" teaching strategy.

Step 2. Analysis and diagnosis. According to the specific cases introduced in the first step, the signal flow, circuit flow and control flow of typical radar equipment are analyzed through the ways of the guidance of teachers and group coordination of students. This part corresponds to the discussion link in "CDPEF" teaching strategy.

Step 3. Scheme formulation. According to the results of the discussion, students begin to prepare the troubleshooting solution by considering the working conditions of typical radar equipment. In this section, the students need to propose various plans following some principles such as the shortest troubleshooting time.

Step 4. Specific implementation. After the formation of various of preliminary plans, students in the form of group confrontation or cooperation, respectively, to carry out practical operations to optimize the best plan.

Step 5. Deepening development. In this step, the results of different schemes are evaluated by means of teachers' comments and students' self-evaluation. The feedback results are used to help students better understand and recognize the knowledge points. In the end, the teachers expand the knowledge of the cases to promote the students' cognition.

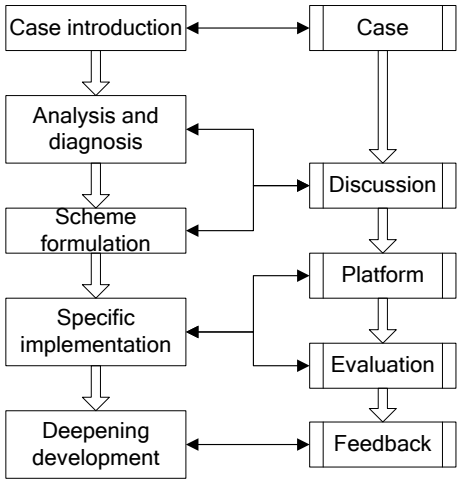

Figure 2 The corresponding relationship between five implementation steps and "CDPEF" teaching strategy

3.2. Six steps to teaching process of technical support of cooperative detection based on multiple early warning equipment

According to the "CDPEF" teaching strategy, in order to break through the teaching difficulties of cooperative early warning based on multiple radar

equipment, six steps are adopted including situation introduction, case analysis, plan formulation, task implementation, process control, inspection and evaluation. The corresponding relationship between these six steps and "CDPEF" teaching strategy is shown in Figure 3.

Step 1. Situation introduction. In teaching, firstly we need suppose a specific combat scene which can make sure the teaching content close to actual combat. In the hypothetical conditions, both the attacker and the defender are described in details. This part mainly corresponds to the "case" link in the "CDPEF" teaching strategy.

Step 2. Case analysis. In view of the combat scenarios introduced in step 1, the instructor needs to carefully choose the positive and negative cases of "fighting alone" and "coordination winning", which can help deepen the students' understanding of the advantage of system cooperating. This part also corresponds to the "case" link in the "CDPEF" teaching strategy.

Step 3. Plan formulation. Driven by "combat scenario" and "selected cases", in the teaching, teachers organize students to jointly break through the teaching difficulties. According to the specific combat scenarios introduced in case link, the attack and defence plan of both sides is formulated, and the penetration methods of the enemy's main threat targets, as well as the specific equipment deployment and collaborative parameter settings of our side are defined. This part mainly corresponds to the "discussion" link in the "CDPEF" teaching strategy.

Step 4. Task implementation. In the class, the teacher instructs the students to deduce and verify the prepared plan by means of map operation, simulation system operation and equipment operation. The relevant simulation results of the plan can support deep analysis. This part mainly corresponds to "platform" and "evaluation" of "CDPEF" teaching strategy.

Step 5. Process control. In practice, the system cooperative detection process is very complex, because there are many models of participating equipment, and the whole detection process involves a large number of signal forms and command and control instructions. Therefore, it is necessary to ensure that teachers can supervise and control the whole process, and realize fast forward, pause and other process control, which can be convenient for teachers to explain each specific link in detail. This part mainly corresponds to "platform" and "evaluation" of "CDPEF" teaching strategy.

Step 6. Inspection and evaluation. The whole teaching implementation process needs to be repeated many times between steps 3 and 5. Teachers' comments and students' self-evaluation are repeated to jointly judge the problems in the practical operation process and the students' methods to solve the problems, and find out the reasons for the difference in results. This part mainly corresponds to the "feedback" link in the "CDPEF" teaching strategy.

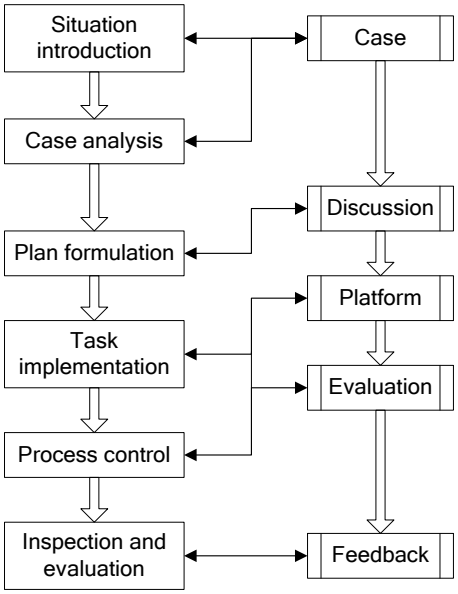

Figure 3 The corresponding relationship between the six implementation steps and the "CDPEF" teaching strategy

4. CONCLUSION

According to the new curriculum teaching content system, our college organized a class teaching practice, and found that there're still remain some bottleneck problems such as "lack of comprehensive training platform, case teaching is not close to the actual combat, students' ability training goal is difficult to achieve" during the implementation process of "CDPEF" teaching strategy. So, there are four suggestions as below need to be considered in the future.

4.1. "Combination of virtual and actual" to build a complete training platform

In the process of teaching practice, although part of the teaching content is very close to the actual combat, but due to the limited conditions of the campus training platform, it is difficult to achieve the teaching objectives. Therefore, it is necessary to adopt the strategy of "combining virtual with actual", to build a comprehensive training platform to solve the bottleneck problem. The specific implementation strategies include: 1) combining the immersion 3D virtual maintenance support system with the actual T/R module test system to form a typical fault comprehensive analysis training platform; 2) establishing a small satellite ground station to receive the orbit data of space targets, and combining with the

virtual radar simulator to build a comprehensive training platform for space target monitoring; 3) using RTI and other virtual simulation loops Environment, connecting satellite, radar and other equipment simulators to build a comprehensive simulation training platform for equipment system application.

4.2. Carefully select training cases

Equipment comprehensive training is a course close to actual combat. In order to improve the pertinence of classroom teaching, it is particularly necessary to select representative cases for typical combat scenarios through consulting public information, discussion and investigation, and foreign exchange, especially emergency repair in field environment and multiple equipment collaborative application in future war scenario. The real reproduction of the above cases by training platform will achieve the purpose of improving the classroom teaching effect, so that "teaching for war, learning for war" can be used as a reference.

4.3. Training "small teachers"

There are many complicated knowledge points in equipment comprehensive training, which cannot be fully digested by students only through classroom teaching. So, it is necessary to cultivate "small teachers" in the process of specific teaching implementation. That is to say, the designated students are assigned to be "small teacher" of one class, so that they can prepare lessons independently and receive the special training of teachers. When they master the teaching contents of the designated parts, they can play a "yeast" role in the class, lead the rest of the students to explore independently.

4.4. Speed up the application of new educational technology

When teaching the course content, it is difficult to improve the classroom teaching effect by only relying on the interaction between students and teachers. This is mainly because there are too many knowledge points involved in system collaborative detection, which makes it difficult for students to digest and absorb in a short period of time. Therefore, it is necessary to introduce new educational technologies such as artificial intelligence and block-chain in the teaching implementation process of the course. The artificial intelligence technology can be used to real-time access to students' learning situation, attitude and knowledge points to facilitate teachers to guide students. The block-chain technology can be used to trace the learning situation of each student. Through the application of the above two new technologies, the teaching effect of the course can be improved effectively.

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