

# The Reform and Practice of the Radar Principle Course's Experiment Teaching

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**ABSTRACT:** Aimed at the future information war zone, the high-quality and comprehensive military commanding talents are strategy support. As an important means of military academy to carry out teaching, the model of experiment teaching plays an important role in cultivating the cadetships' practical ability and innovative thinking. For better to perform function of the experiment teaching and improve the quality of the military academy's teaching, this article combined with many years of front-line experiment teaching experience constructs a new model of experiment teaching and has achieved a good results.

**KEYWORD:** the model of course; the reform of teaching; the practice of teaching;

## 1 INTRODUCTION

The radar principle course for the navy surface ships primary command growth cadre education information and communication engineering, and command information system engineering is a compulsory course in the education of the major modules and main courses. This course is mainly used for learning the basic parts of a single pulse radar base principle, measuring principle and related, main technical parameters of physical meaning; Cultivating students' professional skills and professional. This course has strong systematic, involving wide knowledge, theory, such as deep. Therefore, the curriculum experiment as a curriculum theory knowledge and practical application of the link, is an important link in the whole teaching process, but also can cultivate students' practice ability and innovative thinking. Early, because of the influence of college department is set up, "radar principle" course experiment conduct can only depend on information and the information against laboratory experimental apparatus of "radar/radar against", mainly the verification experiment. During the experimental process, students through the actual operation and observation of the experimental phenomena,

analysis, understand the basic concept and theory of the principle of radar. This experimental teaching mode obviously unfavorable to the perceptual knowledge of the radar live-fire of the students', more is not conducive to cultivate students' autonomous learning ability and innovative thinking ability, unable to realize The teaching goal. Nowadays, as the school establishment system adjustment, to further integration of teaching resources, "radar principle" course is obtained through experimental conditions improved. Updating the experimental teaching content and build a new experimental teaching mode become the main direction of experimental teaching reform of this course.

## 2 THE CONSTRUCTION OF A NEW EXPERIMENT TEACHING MODE

The author based on the principle of "radar" experimental teaching practice for many years, relying on existing on resources, the existing the layout, optimization of experiment contents, selectively added some new experiment content, to build the new experimental teaching pattern, help to cultivate students' operation ability. How to construct new experimental teaching pattern is divided into two directions. Longitudinally and formed a "radar principle, principle of radar detection, measuring principle of the" three part of the experiment teaching content, from easy to difficult, step by step. On the lateral shape became

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"radar live-fire - radar, radar simulator, a virtual experimental apparatus of demo - computer simulation" five one of the experimental teaching system. The model really centered on students, for students to construct a from perceptual knowledge to radar, to grasp the principle of the detection and measurement of target, again to the integrated use of theoretical knowledge to solve practical problems follow the sequence of gradual learning route, especially pay attention to the development of students' innovative thinking and practice ability training. On the basis of the above, the new experimental teaching mode can be further subdivided into: ginseng experiments, the verification experiment, virtual demonstration experiments, practical, comprehensive and design experiment and so on five big classes, a total of 6 hours (radar principle course for 40 hours), by existing experimental equipment and site security.

### 2.1 Visit experiment

Through the study of the theory of the curriculum part of radar principle, students have a basic understanding of the ray of the definition, composition, working principle, working frequency, etc, but did not step into a view each composition unit of radar object and its physical connection, radar is a lack of understanding of the whole body. As a result, we arrange 1 hour to visit LABS, organizing students to visit "radar comprehensive laboratory". Radar comprehensive laboratory room, three points is new: navigation radar equipment room, room 366 microwave over horizon radar, microwave components a showroom. Through visiting, participants of the radar transmitter, a receiver, the sending and receiving a body machine, antenna, display terminals, such as physical, as well as the waveguide, microwave components, traveling wave tube, the forward wave tube, fan beam, needle beam and other physical and anatomical model will have an intuitive understanding, and deepen understanding of radar equipment as a whole, the composition and working process of the radar at the same time also will have a more profound understanding. Arrangement and experimental, help students to strengthen the shipboard radar in the understanding of the importance of early warning detection, enhance their interest in the principle of radar, as sequence learning technologies of radar war after the index such as content to lay a good foundation.

### 2.2 The verification experiment

The verification experiment is mainly require the students pick up circuit, changing the experimental parameters according to the experiment steps, via the oscilloscope to observe the result of the experiment,

and reasonably explain the experimental phenomena[1]. Experiment was carried out in "radar and radar countermeasures laboratory", relying on the "experimental apparatus of radar/radar confrontation". The experiment is divided into two times, a total of 2 hours. Focus on the first lesson is experimental operation and observe the experiment phenomenon, understand the radar of the extension of the important technical indicators affect the performance of radar detection. Focus on the second class is to observe the experiment phenomenon, understand the principle of radar measurement and tracking. Through the experiment, strengthen student to learn key theoretical knowledge in the course, to cultivate the scientific style, theory with practice to improve the understanding of the importance of student to practice.

### 2.3 Virtual experiment

Virtual experiment refers to the use of multimedia, virtual experiment simulation and virtual reality (VR) technology in computer build can assist and partly replace or all of the alternatives to traditional experiments of each operation link related hardware and software operating environment. The experimenter can be done like in the environment of the true real all sorts of experiment item, the experimental results obtained is equivalent to or even better than the effect it has in the real environment.

Through theoretical study, we know the radar detection range is one of the important performance indicators of the radar, the size of its own performance with radar, target and probe the nature of the environment and other factors. The experiment which to describe the impact of various factors on detection range, can be achieved by actual radar equipment and virtual demonstration. The former has the advantage of good effect, the real experiment process, the experimental results are accurate, but there exists large radiation, the process is not easy to control, large scale and high cost problems. And radar equipment structure and the internal parameters in the design has been solidified, can't change, lack of systemic experiments. The latter based on a virtual experimental environment, pay attention to is the interactivity and real test result of the experiment operation of the simulation , effectively alleviate the experiment conducted in funds, sites, difficult management, etc. At the same time, also broke through the traditional experiment of the limitation of time and space ", students can according to your own work schedule, free Internet access into the virtual demonstration laboratory learning, is a safe, economic, and can meet the demand of experimental teaching mode of experimental teaching learning[2].

Virtual demonstration experiment, this course is conducted in the "battle command integration professional classroom", based on the principle of radar network curriculum resources "radar detection range of interactive simulation system" and "the principle of radar" finished "virtual simulation system" into multimedia resources, a total of 1 hour. The system consists of the flash animation and three D technology, showed the dynamic radar detection intuitive demonstrates the influence of various factors on the radar detection range, numerical display affected after the detection range, Compared with the default detection range. Through the experiment, can make the students understand the radar work each extension on the influence of parameters on detection range and special environment of radar resources reasonable use.

#### 2.4 Operational experiment

Operational experiment is conducted when curriculum theory knowledge teaching finished, the purpose is to make students experience the operation process of radar observations of the radar target echo shape, feel found, admission and tracking process. Operational penetration experiment the teaching idea of combining theory and practice of, helps to cultivate the students speaking skills and meticulous and serious attitude towards study, research.

Type of the course of the experiment, in the "XXX ships warning radar simulation training teaching room", relying on the "type" XXX ships warning radar simulator is complete, a total of 1 learning. Students on the simulator, according to the selected radar operation instruction, familiar with the process of ray to open and shut down, the knob and table page display each menu functions. In faculty by the director to set goals and target environment, by adjusting the rotary knob and rational selection page table menu, the display screen, and then found, admission and tracking target to complete the whole process of radar to detect targets. Due to the analog device interface live-fire completely consistent with radar, the experiment also helps to the cultivation of students' consciousness of the position.

#### 2.5 Comprehensive design experiment

Comprehensive design experiment pay attention to cultivate students use of multidisciplinary knowledge to solve actual problem ability, make its have the broad academic view and the activity of dynamic dimension, high theory accomplishment, is to train students comprehensive quality, the effective ways to improve students practical skills and innovative ability.

The course of comprehensive design experiment, conducted in the "battle command Professional classroom", relying on the integration of

"computer", a total of 1 hour. Students according to the radar principle knowledge and related professional knowledge learned early and using Mat lab software, the simulation of radar signal waveform, pulse pressure reduction process and phased array antenna scanning process, analysis of radar signal in the time-frequency domain features, design of the parameters of the matched filter, phase shifter phase array, etc. making it aware of the importance of radar waveform selection, parameter design, the deep understanding of the technology to solve practical problems, and then in the subsequent jobs in reasonable boldly With radar equipment, maximize its effectiveness.

The experiment carried out in 30 hours after the course, the last 1 hour to evaluation. Carried out as follows: teachers on the basis of the teaching goal, set up the experiment selected topic; Students root According to personal interests independent subject, consists of 2 ~ 3 students a small experimental group; For a limited time date, each team needs to complete literature consulting, program design, software, program debugging, spectrum data analysis, report writing and speech reporting and a series of links. The whole experiment process seeks to provide students with a bold thinking, uninhibited, give full play to the individual character space and conditions, cultivate students from the main study, the integrated use of knowledge ability and strict truth-seeking style and mutual coordination and team spirit.

### 3 THE EXAMINATION EVALUATION SYSTEM

The course experiment implemented diversified examination way[3], and adopted the evaluation way which is "experimental process (30%) + experimental results (20%) + experimental report (10%) + comprehensive design and report (40%)". Through the four aspects of evaluation, faculty more accurately grasp the students' ability of experiment operation, observation analysis ability and innovative thinking ability, to each student comprehensive assessment is given. Comprehensive evaluation results into excellent, good, qualified and unqualified four class, the corresponding scores respectively for 20, 15, 10, 5 points, combined with actual written test results out of 80 recorded in the course grade. If the test result or written examination result has a unqualified, which the course grade is not qualified.

Examination is not the ultimate goal of learning, but this method of experimental results should be brought into the examination link, changes the past single written examination, changed the students attaches great importance to the written test, the doctrine of rote learning mode, improve the teaching

level and quality of students, cultivate the students' comprehensive practical ability.

#### 4 THE EFFECT OF EXPERIMENT

In the principle of "radar" to carry out teaching activities under the new mode of experiment teaching, effectively improve the students' self-study ability and practical ability, cultivate their innovative thinking ability and the comprehensive design application ability, to the undergraduate teaching work has continued. At present, information and communication engineering specialty and command information system of radar principle knowledge is full of interest in learning, students on subsequent ray (feeling) electrical professional positions filled with hot feeling, but also laid the foundation they positions required professional knowledge and can force. Opened a period to results mainly manifested in two aspects:

(1) The students we cultivated performed very well in the floor all kinds of games, won several academic reward; Choice for training professional mostly choose ray (feeling) electricity industry, and radar basic knowledge in learning, to promote the related course of study, by the classroom teacher's high praise.

(2) The group teachers to actively participate in teaching reform, teaching model to explore research,

one teacher for one year was rated as "national excellent teacher", one teacher were rated as "military colleges and universities teaching award silver medal winner", one teacher was named "learning school outstanding teachers"; Development of "a shipboard radar and operational use network curriculum" the 17th session of the national education teaching information competition open courses of higher education group first prize contest "; Development "a principle of radar multimedia teaching materials of" the 12th army military training excellent digital media resources competition award activity second prize "; "XXX ships warning radar simulator developed" through the acceptance and promotion; Related to a number of scientific research achievements obtained military progress prize in science and technology or patents.

#### REFERENCES

- [1] Jianxin Hu Mousen Cheng Liya huang. Rocket propulsion principle\_course experimental teaching mode reform. J. 2013.32 (12): 166-167
- [2] Wang Ke, Yanyan Zhou. xiaoyan wu, "automatic control principle" course experimental teaching reform and exploration. China power education. 2013, (34): 140-142.
- [3] Wenqing Cai, Xiao Jing, Yao-hui Chang etc. the reform and effect of the experiment teaching pattern of "fundamentals of computer". Education teaching BBS. 2014.2 (8): 41 and 42