2017 2nd International Conference on Education and Development (ICED 2017)
ISBN: 978-1-60595-487-5

Study on the Evaluation System of Practical Teaching Guarantee Condition for the Command Specialty of Radar, Intelligence and Electric Countermeasure in Naval Ships

Hao ZHANG[1,2,a,*], Zheng-Yi WANG[2,b] and Zhong-Chen XING[1]

[1]Dalian Naval Academy of the PLA, Dalian 1160018, China

[2]Naval Command College, Nanjing 210016, China

[a]zhanghao_zhh_81@126.com, [b]wangzy7134@163.com

*Corresponding author

Keywords: Radar, Intelligence and Electric countermeasure command, Practical teaching, Evaluation system.

Abstract. The paper analyzes the evaluation indicator system of practical teaching guarantee condition for the command specialty of radar intelligence and electric countermeasure in naval ships. On this basis, the calculation model of indicator and weight based on AHP is proposed. Finally, the paper discusses the method of comprehensive assessment of practical teaching guarantee condition, and provide reference for the evaluation and construction of the practical teaching guarantee condition for the command specialty of radar, intelligence and electric countermeasure in naval ships.

Introduction

In the process of personnel training for the command specialty of radar, intelligence and electric countermeasure in naval ships, the construction of practical teaching guarantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships is directly related to the realistic problems that is aimed at “strengthen tenure, close to the army, face the future and train qualified department head”. the construction of practical teaching grantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships is promoted by building the assessment system of practical teaching guarantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships, adopting a scientific method of assessment and establishing and improving the evaluation system gradually. It is of great practical significance to improve the quality of the training of practical teaching guarantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships.

The Evaluation Indicator System of Practical Teaching Guarantee Condition

The evaluation model of practical teaching guarantee condition is shown in Fig. 1.

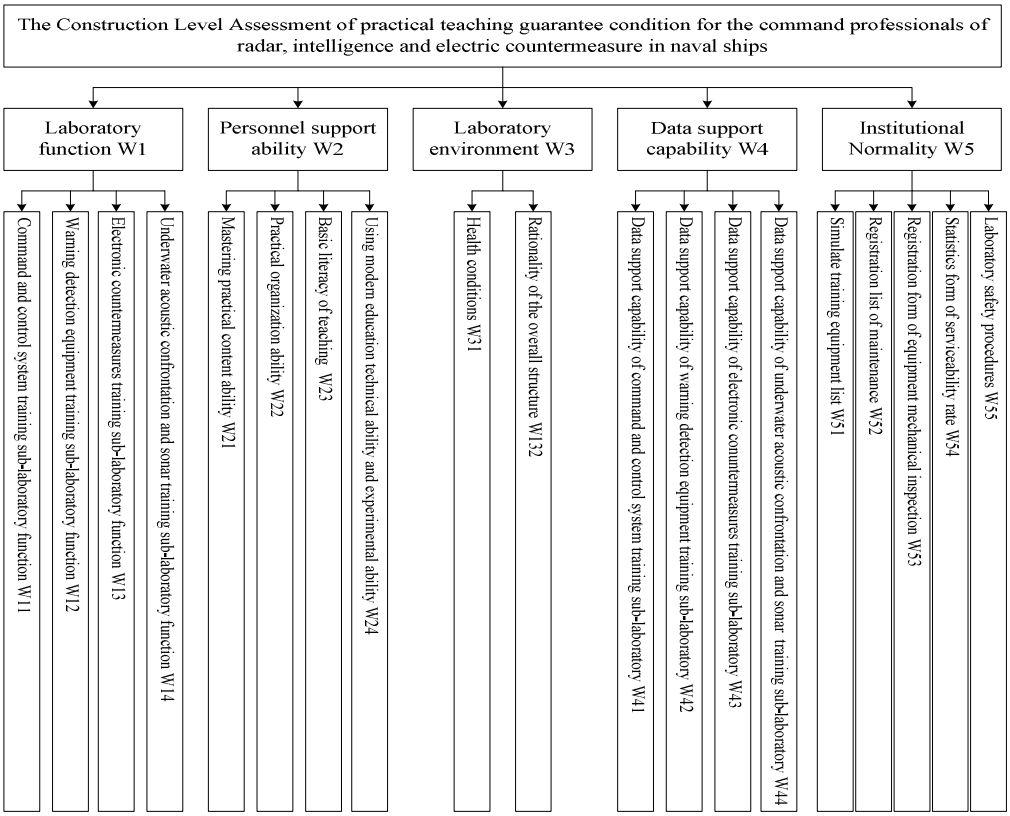

Figure 1. The Evaluation Model of Practical Teaching Guarantee Condition.

The construction level assessment of practical teaching guarantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships mainly establishes five indexes of first grade, including laboratory function W1, personnel support ability W2, laboratory environment W3, data support capability W4 and institutional normality W5.[1,2]

Among them, the laboratory function index is divided into four indexes of second grade, including command and control system training sub-laboratory function W11, warning detection equipment training sub-laboratory function W12, electronic countermeasures training sub-laboratory function W13, underwater acoustic confrontation and sonar training sub-laboratory function W14.

Personnel support ability index is divided into four indexes of second grade, including mastering practical content ability W21, practical organization ability W22, basic literacy of teaching W23 and using education technical ability and experimental ability W24.

Laboratory environment index is divided into two indexes of second grade, including health conditions W31 and rationality of the overall structure W32.

Data support capability index is divided into four indexes of second grade, including data support capability of command and control system training sub-laboratory W41, data support capability of warning detection equipment training sub-laboratory W42, data support capability of electronic countermeasures training sub-laboratory W43 and data support capability of underwater acoustic confrontation and sonar training sub-laboratory W44.

Institutional normality index is divided into five indexes of second grade, including simulate training equipment list W51, registration list of maintenance W52, registration form of equipment mechanical inspection W53, statistics form of serviceability rate W54 and laboratory safety procedures W55.

The evaluation indicator system of practical teaching guarantee condition for the command specialty of radar, intelligence and electric countermeasure in naval ships is shown in Table 1.

Table 1. The Evaluation Indicator System of Practical Teaching Guarantee Condition for the Command Specialty of Radar, Intelligence and Electric Countermeasure in Naval Ships.

First grade index		Second grade index	
Polymerization method	Index name	Polymerization method	Index name
And ⊕	Laboratory function	Multiplication ⊗	Command and control system training sub-laboratory function
			Warning detection equipment training sub-laboratory function
			Electronic countermeasures training sub-laboratory function
			Underwater acoustic confrontation and sonar training sub-laboratory function
	Personnel support ability	Multiplication ⊗	Mastering practical content ability
			Practical organization ability
			Basic literacy of teaching
			Using education technical ability and experimental ability
	laboratory environment	Multiplication ⊗	Health conditions
			Rationality of the overall structure
	Data support capability	Multiplication ⊗	Data support capability of command and control system training sub-laboratory
			Data support capability of warning detection equipment training sub-laboratory
			Data support capability of electronic countermeasures training sub-laboratory
			Data support capability of underwater acoustic confrontation and sonar training sub-laboratory
	Institutional normality	Multiplication ⊗	Simulate training equipment list
			Registration list of maintenance
			Registration form of equipment mechanical inspection
			Statistics form of serviceability rate
			Laboratory safety procedures

The Calculation Method of Indicator and Weight

The calculation of indicator and weight of the evaluation indicator system of practical teaching guarantee condition for the command specialty of radar, intelligence and electric countermeasure in naval ships adopts the method AHP. In order to determine the weights of various technical indexes of practical teaching guarantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships, the practical teaching guarantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships is divided into several first grade indexes, and each first grade indexes is calculated definitely by several second grade indexes which related to the first grade indexes. The scale is indicated by the number of 1-9, and the specific meaning is shown in Table 2.

Table 2. The Tabulation of Scale Description.

Scale	Definition	Description
1	Equal importance of two elements	Same contribution of two elements to certain property
3	Slight important of one element than the other	Slight focus on one element in two elements from the judgement of experience
5	Moderate important of one element than the other	Moderate focus on one element in two elements from the judgement of experience
7	Strong important of one element than the other	Strong focus on one element, and its active status is shown in practice
9	Absolute important of one element than the other	The evidence that focus on one elements in two elements is the highest level of judgment
2,4,6,8	Mid-value of two adjacent judgments	Compromise of two judgments
Reciprocal	Element i and element j are judged to be Q_{ij}, Element j and element i are judged to be Q_{ji}	

If there are four elements which need to be determined the relative importance weights, such as Q_1, Q_2, Q_3 and Q_m, we can compare theme row by row. Meanwhile, the value is assigned according to the definition of the above scale, and we can obtain the following matrix which is shown in table 3.

Table 3. The Tabulation of Importance Weight Relation Matrix.

Q_i / Q_j	Q_1	Q_2	…	Q_{m_4}
Q_1	q_{11}	q_{12}	…	q_{1m}
Q_2	q_{21}	q_{22}	…	q_{2m}
…	…	…	…	…
Q_m	q_{m1}	q_{m2}	…	q_{mm}

The above matrix is the relational matrix. Among them:

$$\begin{cases} q_{ij} = Q_i / Q_j \\ q_{ij} = 1 \\ q_{ji} = 1/q_{ij} \end{cases} \qquad i, j = 1,2,3,\cdots,m \tag{1}$$

The main eigenvector of the matrix is calculated and normalized, and the optimal vector is obtained. Vector element is the weight of the corresponding target element. The calculation steps are as follows:

Firstly, the product P_i of each row of the judgment matrix is calculated.

$$P_i = \prod_{j=1}^{m} a_{ij}, \qquad i = 1,2,3,\cdots,m \tag{2}$$

And then, the m times square root of P_i is calculated.

$$U_i = \sqrt[m]{P_i}, \qquad i = 1,2,3,\cdots,m \tag{3}$$

Finally, the vector $U = (U_1, U_2, U_3, \cdots, U_m)^T$ is normalized.

$$U_i' = U_i / (U_1, U_2, U_3, \cdots, U_m) \tag{4}$$

So U_i' is the required eigenvector.

In order to determine whether the weight is acceptable, the compatibility index is calculated.

$$C \cdot I = \frac{\lambda_{\max} - m}{m-1} \tag{5}$$

Among them, $\lambda_{\max}$ is the largest characteristic root of the judgment matrix Q. The weight vector is considered acceptable when $C \cdot I \le 0.1$.

Comprehensive Assessment of Practical Teaching Guarantee Condition

When evaluating the practical teaching guarantee condition, the evaluation expert should consider five aspects, including laboratory function (W1), personnel support ability (W2), laboratory environment (W3), data support capability (W4) and institutional normality (W5).

$$W = Q_1 \times W_1 + Q_2 \times W_2 + Q_3 \times W_3 + Q_4 \times W_4 + Q_5 \times W_5 \tag{6}$$

Among them, Q_1, Q_2, Q_3, Q_4 and Q_5 is a weighted coefficient of evaluation index.

Evaluation and Calculation of Laboratory Function Indicators

When estimators evaluating the command and control system training sub-laboratory function (W11), warning detection equipment training sub-laboratory function (W12), electronic countermeasures training sub-laboratory function (W13), underwater acoustic confrontation and sonar training sub-laboratory function (W14), the tactical parameter index of several sub-laboratory function is the main reference.

The calculation formula of the specific evaluation results (W1) of laboratory function is shown in formula 7.

$$W_1 = Q_{11} \times W_{11} + Q_{12} \times W_{12} + Q_{13} \times W_{13} + Q_{14} \times W_{14} \tag{7}$$

Among them, Q_{11}, Q_{12}, Q_{13} and Q_{14} is a weighted coefficient of evaluation for several sub-laboratory function.

Evaluation and Calculation of Personnel Support Capability Indicators

When evaluating the personnel support capability, the evaluation expert should consider mastering practical content ability (W21), practical organization ability (W22), basic literacy of teaching (W23) and using education technical ability and experimental ability (W24). Among them, mastering practical content ability refers to the requirements of the master the teaching content, the management the difficult task of the teaching, the organization the teaching content and so on; practical organization ability refers to the requirements of the selection and application of teaching methods, the organization of classroom teaching, the arrangement and regulation of teaching process, the interaction between teachers and students and teaching democracy and so on; basic literacy of teaching refers to the requirements of oral expression, posture expression, blackboard writing and presentation skills and so on; using education technical ability and experimental ability refers to the requirements of the modern education technical assistant teaching, experimental operation steps, skills and effects and so on.

The calculation formula of the specific evaluation results (W2) of personnel support capability is shown in formula 8.

$$W_2 = Q_{21} \times W_{21} + Q_{22} \times W_{22} + Q_{23} \times W_{23} + Q_{24} \times W_{24} \tag{8}$$

Among them, Q_{21}, Q_{22}, Q_{23} and Q_{24} is a weighted coefficient of evaluation index.

In a specific assessment, there are two main ways. The fist is the trial lecture of the practical support personnel to the course, the evaluators scored several aspects of the master ability of practical content, practical organization ability, teaching basic literacy, modern education technical ability and practical ability and so on on the site. The second is to score the above aspects of practical support personnel by the training students after the lecture. The ultimate guarantee ability of practical support personnel is to be weighted in two ways, and the weighting method is and $\oplus$.

Evaluation and Calculation of Laboratory Environmental Indicators

When evaluating the laboratory environmental, the evaluation experts should consider health conditions (W31) and rationality of the overall structure (W32). Among them, the evaluation of the health conditions mainly includes items placement and environmental health and so on; the evaluation of the rationality of the overall structure includes network design, system platform setting and space utilization and so on. The evaluation ways is also to score on the site by evaluation expert.

The calculation formula of the specific evaluation results (W3) of laboratory environmental is shown in formula 9.

$$W_3 = Q_{31} \times W_{31} + Q_{32} \times W_{32} \tag{9}$$

Among them, Q_{31} and Q_{32} is a weighted coefficient of evaluation index.

Evaluation and Calculation of Data Support Capability Indicators

When evaluating the data support capability of command and control system training sub-laboratory (W41), the data support capability of warning detection equipment training sub-laboratory (W42), the data support capability of electronic countermeasures training sub-laboratory (W43) and the data support capability of underwater acoustic confrontation and sonar training sub-laboratory (W44), the assessment experts check the completeness, the integrity and the functional compliance of practical instruction, system maintenance method, technical manual and instruction of the data support in several sub-laboratory.

The calculation formula of the specific evaluation results (W4) of data support capability is shown in formula 10.

$$W_4 = Q_{41} \times W_{41} + Q_{42} \times W_{42} + Q_{43} \times W_{43} + Q_{44} \times W_{44} \tag{10}$$

Among them, Q_{41}, Q_{42}, Q_{43} and Q_{44} is a weighted coefficient of evaluation for data support capability of several sub-laboratory.

Evaluation and Calculation of Institutional Normality Indicators

When evaluating the institutional normality, the evaluation expert should consider simulate training equipment list (W51), maintenance list (W52), registration form of equipment mechanical inspection (W53), statistics form of serviceability rate (W54) and laboratory safety procedures (W55) and so on. Among them, when evaluating simulate training equipment list, evaluation experts check the list of simulated training equipment, and check the list with the actual equipment in several sub-laboratory, then give the evaluation results; when evaluating maintenance list, evaluation experts check whether the maintenance list registration is normative, whether it is consistent with the actual, whether there is a fraud phenomenon, and then give the evaluation results; when evaluating registration form of equipment mechanical inspection, evaluation experts check whether the maintenance list registration is normative, whether it is consistent with the actual, whether there is a fraud phenomenon, and then give the evaluation results; when evaluating statistics form of serviceability rate, evaluation experts check the integrity rate of the equipment, whether the registration of the statistical table is normative, and make the actual inspection and accounting, then give the evaluation results (Note: equipment

integrity rate = the number of good equipment/total number of equipment); when evaluating laboratory safety procedures, evaluation experts check whether the laboratory safety procedures are reasonable and are placed in a reasonable position and so on, and then give the evaluation results.

The calculation formula of the specific evaluation results (W5) of institutional normality is shown in formula 11.

$$W_5 = Q_{51} \times W_{51} + Q_{52} \times W_{52} + Q_{53} \times W_{53} + Q_{54} \times W_{54} + Q_{55} \times W_{55} \tag{11}$$

Among them, Q_{51}, Q_{52}, Q_{53}, Q_{54} and Q_{55} is a weighted coefficient of evaluation index.

Summary

The construction of practical teaching guarantee condition for the command professionals of radar, intelligence and electric countermeasure in naval ships is directly related to the training quality of the command professionals of radar, intelligence and electric countermeasure in naval ships. The construction of the evaluation system of practical teaching guarantee condition for the command specialty of radar, intelligence and electric countermeasure in naval ships is an important measure for improving the training quality of the command professionals of radar, intelligence and electric countermeasure in naval ships and highlighting the characteristics of professionals training. The construction of the evaluation indicator system and the evaluation method in this paper will provide reference for the implement of the specific evaluation and the whole construction of the practical teaching guarantee condition for the command specialty of radar, intelligence and electric countermeasure in naval ships.

References

[1] C. L. Zheng, Research on professional laboratory evaluation indicator system, Higher Science Education. 1(2008)73-76.

[2] K. Zhou, et al, The construction idea of information system for the evaluation of the laboratory, Laboratory Construction and Management. 3(2003)17-18.

[3] J. J. Zhang, Fuzzy analytical hierarchy process (FAHP), Fuzzy Systems and Mathematics. 14(2000)80-88.

[4] Y. J. Lv, The taxis of fuzzy analytic hierarchy process based on fuzzy uniform matrix, Fuzzy Systems and Mathematics. 16(2002)79-85.