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Study on the Evaluation Index System of Engineers

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Abstract. There are many evaluation criteria in the specific assessment process of the engineer's suitability assessment. The evaluation criterias have the characteristics of uncertainty and ambiguity. At the same time, the evaluation subjects are prone to participate in too many artificial factors. Therefore, the credibility of the evaluation results is questioned. This paper attempts to use the fuzzy assessment method to study the assessment of the suitability of engineers. A new evaluation method is proposed for the assessment of the suitability of engineers.

Introduction

The assessment system for the suitability of marine engineer members is mainly composed of four parts: the outline of the certificate of suitability of marine engineer members and the outline of engineer evaluation norms and evaluation outline(engineer part), the specification of marine engineer members suitability evaluation equipment, the standard of assessors, and the standards of crew medical examination. The evaluation criteria are based on the requirements of the STCW evaluation standards and the actual evaluation criteria according to actual operational needs; It includes evaluation principles, evaluation standards, evaluation methods. There are many evaluation criteria in the specific assessment process of the engineer's suitability assessment. The evaluation criterias have the characteristics of uncertainty and ambiguity. At the same time, the evaluation subjects are prone to participate in too many artificial factors. Therefore, the credibility of the evaluation results is questioned. This paper attempts to use the fuzzy assessment method to study the assessment of the suitability of engineers. A new evaluation method is proposed for the assessment of the suitability of engineers.

Introduction of the concept of ambiguity

At present, the assessment method for the suitability of turbine members is relatively single, there are inconsistent standards, the arbitrariness is large, and there is a lack of clear quantitative indicators. It is difficult to accurately evaluate, so it is necessary to introduce the concept of ambiguity. The so-called fuzzy concept refers to the concept that the boundary is not clear and the extension is not clear. In the fuzzy set, whether some elements belong to this fuzzy set is in the mold.

System of Competency Assessment Indicators for Engineer

According to the eligibility criteria of the engineer, the evaluation indicators are classified. In the first indicator, including Physiological Aspects, Vocational Skills, Psychological Characteristics, Theoretical Knowledge and Practice Skill. In the second indicators, Physiological Aspects includes Visual, auditory, health; Vocational Skills includs communication skills, basic work, emergency handling, communication; Psychological Characteristics includs stability, attention, emergency response , work attitude, coordination ability .Theoretical Knowledge includes convention, main engine, auxiliary engine, English, PSC.Practice skill includs oral English, equipment maintenance, equipment operation, welding operation.

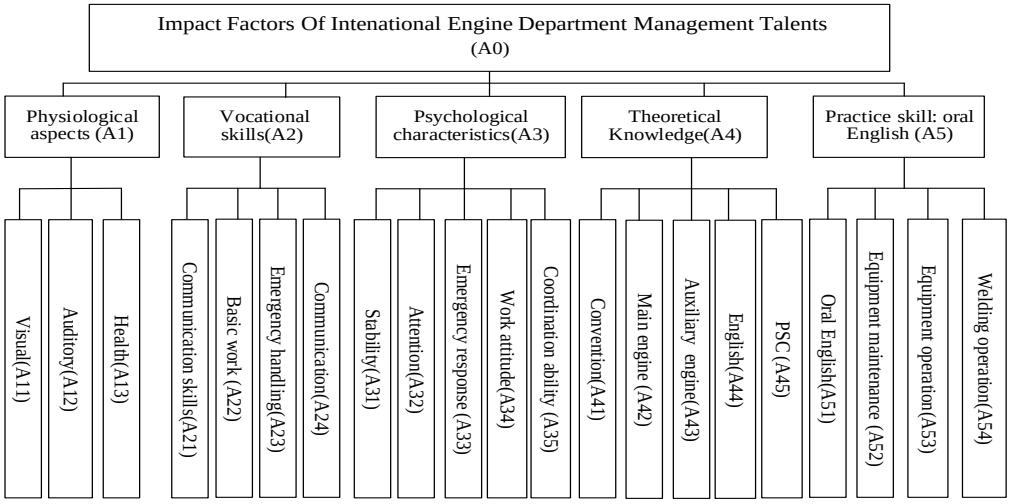

Figure 1. Impact Factors Of International Engine Department Management Talents

Setup Judgment Matrices

The hierarchical structure of this paper is based on the evaluation index system of Engineers established above, and test the consistency, and weigh the value of each index layer as follow：

Table0 Judgment Matrice

A0	A1	A2	A3	A4	A5
A1	1.0000	5.0000	3.0000	2.0000	2.0000
A2	0.2000	1.0000	1.0000	2.0000	0.5000
A3	0.3333	1.0000	1.0000	0.5000	0.5000
A4	0.5000	0.5000	2.0000	1.0000	1.0000
A5	0.5000	2.0000	2.0000	1.0000	1.0000

The contrast matrix A0 passes the consistency test, and each vector weight vector W is:
A0: W0 = (0.4008 0.1395 0.1049 0.1577 0.1972) ;

A0: CI= 0.0737 CR= 0.0658<0.1; $\lambda_{\max} = 5.2948$;

Table1 Judgment Matrice

A1	A11	A12	A13
A11	1.0000	2.0000	5.0000
A12	0.5000	1.0000	1.0000
A13	0.2000	1.0000	1.0000

The contrast matrix A1 passes the consistency test, and each vector weight vector W is:
A1:W1 = (0.6098 0.2247 0.1655)
A1: CI=0.0470; CR=0.0810; $\lambda_{\max} = 3.0940$

Table2 Judgment Matrice

A2	A21	A22	A23	A24
A21	1.0000	3.0000	2.0000	3.0000
A22	0.3333	1.0000	0.5000	2.0000
A23	0.5000	0.2000	1.0000	1.0000
A24	0.3333	0.5000	1.0000	1.0000

The contrast matrix A2passes the consistency test, and each vector weight vector W is:
A2:W2 = (0.4492 0.1758 0.2281 0.1469)
A2: CI=0.0569; CR=0.0632, $\lambda_{\max} = 4.1707$

Table3 Judgment Matrice

A3	A31	A32	A33	A34	A35
A31	1.0000	2.0000	3.0000	2.0000	2.0000
A32	0.5000	1.0000	2.0000	3.0000	3.0000
A33	0.3333	0.5000	1.0000	1.0000	3.0000
A34	0.5000	0.3333	1.0000	1.0000	1.0000
A35	0.5000	0.3333	0.3333	1.0000	1.0000

The contrast matrix A3 passes the consistency test, and each vector weight vector W is:
A3:W = (0.3439 0.2722 0.1590 0.1225 0.1024)
A3: CI=0.0697; CR=0.0622; $\lambda_{\max} = 5.2786$

Table4 Judgment Matrice

A4	A41	A42	A43	A44	A45
A41	1.0000	1.0000	4.0000	2.0000	2.0000
A42	1.0000	1.0000	2.0000	1.0000	3.0000
A43	0.2500	0.5000	1.0000	1.0000	3.0000
A44	0.5000	1.0000	1.0000	1.0000	1.0000
A45	0.5000	0.3333	0.3333	1.0000	1.0000

The contrast matrix A4 passes the consistency test, and each vector weight vector W is:
A4: CI=0.0850; CR= 0.0759; $\lambda_{\max} = 5.3401$
A4:W 4= (0.3246 0.2561 0.1571 0.1569 0.1053)

Table5 Judgment Matrice

A5	A51	A52	A53	A54
A51	1.0000	0.3333	0.2500	0.2500
A52	3.0000	1.0000	0.5000	1.0000
A53	4.0000	2.0000	1.0000	2.0000
A54	4.0000	1.0000	0.5000	1.0000

The contrast matrix A4 passes the consistency test, and each vector weight vector W is:
A5: CI=0.0153; CR=0.0170; $\lambda_{\max} = 4.0458$

A5:W5 = (0.0818 0.2346 0.4288 0.2548)

In the first index, including Physiological Aspects, Vocational Skills, Psychological Characteristics, Theoretical Knowledge and Practice Skill, Practice skill is a little important. In the second index, among physiological aspects, health is important; among vocational skills, emergency handling is important; Among Psychological characteristics ,emergency response is important; Among theoretical knowledge, PSC is more important. Among practice skill, equipment maintenance is important.

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Conclusion

The core of the fuzzy suitability assessment model established in this paper is that linear weighted fuzzy analysis operator is used in the paste transformation. It takes into account the balance of all evaluation factors according to the weight, and solves the difficulty of evaluating qualitative indicators. The theory of fuzzy mathematics can objectively reflect the real situation of the comprehensive quality of the engineers through the theory of qualitative and quantitative analysis. The assessment process is rigorous, the results are more persuasive, and the evaluation methods are clear and clear. It provides a new evaluation method for the assessment of the suitability of engineers and has certain application value.

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