Study of Evaluation of Electronic Information Student's Engineering Practice Ability Based on AHP

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Abstract

In this paper, the engineering practice ability evaluation index system which aims at the problem of electronic information students' engineering practice ability cultivation was designed. First the engineering practice ability indicators were collected using the method of the literature search and questionnaire survey, and then these primary indicators was repeated siftings using Delphi method. Second, using improved AHP to determine levels of indicators weights, while using questionnaire survey random sampling survey to related professional college students obtain the relevant data that needed for the evaluation though, and to implement applications of the evaluation index system. Finally, according to the evaluation model put forward corresponding countermeasures to improve the students' engineering practice ability.

Keywords: Engineering practice ability; Improved AHP; Delphi; Evaluation index system

1. Introduction

In the era of knowledge economy globalization, the electronic information engineering plays an important role in solving the complex problems associated with human life because of the rapid development of information technology, so the world pay especially attention to the engineering education reform. Train and bring up high-quality electronic information talents with engineering practice ability to participate in the construction and development of the enterprise is directly related to the success of building an innovative country. Practicality is the essential attribute of engineering properties, and also is the core issues of engineering education transformation from the traditional "scientific paradigm" to modern "engineering paradigm" .Research the Evaluation and application of electronic information specialty students practice ability has an important significance to promote the teaching reform of electronic information specialty, improve the quality of training engineering talents, create new electronic information Engineer, service innovation-oriented country.

2. The establishment of evaluation index system

Electronic information specialty engineering talents training is based on strengthening practical ability cultivation of applied talents, and emphasizes the engineering quality training to satisfy the variety of enterprise requirements. The engineering and technical personnel should have the basic qualities.in the whole process of decision-making and the implementation of engineering practice .Establish a scientific evaluation index system engineering practice is the core of the engineering practical ability

and it also is the key to realize the evaluation target.

Electronic information engineering students' engineering practice ability training throughout the higher education stage, it is a long and complicated process, it must follow the principle of comprehensive and systematic, it can't care for this and lose that. Considering the characteristics of the formation of the engineering practice ability, it is not only related to students themselves, also with the college teachers' teaching level, the school's management level, social environment and the social education are closely related. To evaluate students' engineering practical ability, must be analysis and grasp the above various factors comprehensive, find the mutual contact and mutual influence between them, improve the effects of these factors on students' engineering practical ability comprehensive and systematic. The way to training students' engineering practical ability can be finding only in this way.

The evaluation indexes were collected through the literature search and evaluation questionnaires by the author. These evaluation indexes have certain pertinence, authority and effectiveness, but it is more scattered and did not constitute a system. Therefore, the author also through expert interviews and access to relevant information, first identified four basic dimensions, and the above indexes were sorted to ensure the interrelated and logical relation between indexes. Thus the four basic dimensions of University dimension, Industrial dimension, Personal dimension, Social training institutions dimension were determined as the first-level indicators, while 25 indicators which frequency of appearing in the index statistics over 5 times as level2 indicators of three level evaluation system, as shown in TABLE 1, the electronic information engineering practice ability evaluation index system was constructed initially, and finally Delphi method was used to screening indexes.

TABLE 1　　The primary indicators of engineering practice ability evaluation

Level1 indicators	Level2 indicators
University dimension	The Professional curriculum setting
	Practice course credit requirements
	Understanding of University to the needs of the industry
	The engineering practice experience of Faculty
	The evaluation standard of practice teaching quality
	The abundant degree of practice teaching resources
	School arranged the practice or internship tutor
	Practice teaching system
Personal dimension	The individual practice consciousness
	The motivation to improve Personal Practical Capabilities
	Personal ability of knowledge transformation
	Intellectual curiosity and ability of lifelong learning
	Communication and cooperation ability
Industrial dimension	Enterprises set up a specialized tutor for students
	Enterprises are willing to receive school students to internships
	Enterprises are willing to recruit students without work experience
	Pre-service training of Enterprises for students
	Enterprises' continuing education of professional fields to students
	Mutually beneficial relationships between enterprises and schools
	The exchange with Enterprise personnel in an informal setting
Social training institutions dimension	Training institutions staffs' ability of engineering practice
	Involved in the professional and technical appraisal of the industry
	The pertinence of training content
	Embodiment of training
	Project resources of training institutions

Delphi method is widely used in all kinds of the establishment of evaluation index system and the process of determine specific indicators as a kind of subjective, qualitative method. The biggest characteristic of Delphi method is to make forecasts objectively and possibly. Eventually the electronic information specialty students engineering practice ability evaluation index system was built as shown in Fig. 1. In the evaluation index system, the indexes of 4 first-level

indicators showing an interactive situation, which connected to each other, and restraining each other, interaction, there are institutions become standard engineering practice ability evaluation system, more fully reveals the electronic information engineering students' engineering practical ability of the connotation of the elements.
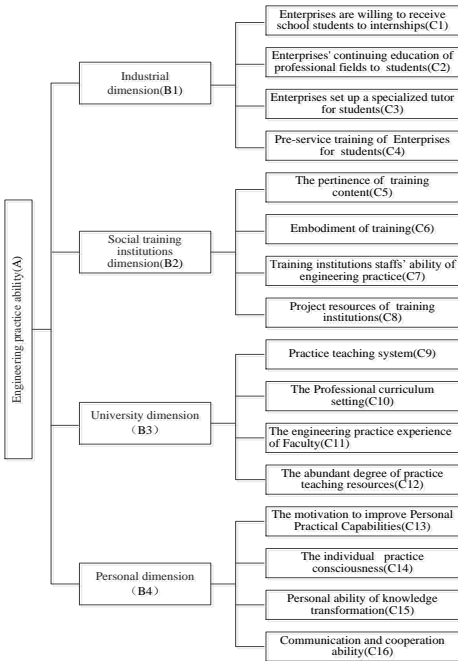

Fig. 1: Evaluation index system

3. Analysis of the evaluation indexes based on AHP

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The affiliations between each indicator were determined after the establishment of evaluation index system. The index system can really play the role of only when indicators at all levels were to given a certain weight. AHP was use in this paper. AHP was formally proposed by the U.S. Operations Research Experts T. L. Saaty in the mid-1970s. Its core idea is to put the evaluation of complex hierarchical. The evaluation questions was Constructed to multi-level structure including evaluation objectives, evaluation areas, evaluation index. The level single ranking (weights) and the total ranking calculated through qualitative indicators Quantization is as the systems approach which is applied in multi-index and Multi-plans optimization decision. AHP can decrease the difficulty of work and meanwhile it can improve the accuracy and science of the index weight; But it must be taken measures of verify the consistency to judgment matrix to determine the weighing values to improve the reliability and validity of the weights determine. So in this paper, the concept of optimal transfer matrix was Put forward to improve AHP , and let it meet the conformance requirements naturally , and thus the weight value can be calculated directly, and the tedious process of conformance testing can be revoked. The specific method is:

3.1. To construct judgment matrix

By the method of questionnaire investigation and expert scoring, the level1 index, level 2 index of evaluation index system was pairwise comparison, judgment matrix table was obtained after the results was pooled analysis. As shown in Fig. 2:

A	B1	B2	B3	B4
B1	1	2	1/4	1/3
B2	1/2	1	1/7	1/5
B3	4	7	1	3
B4	3	7	1/3	1

B1	C1	C2	C3	C4
C1	1	5	9	3
C2	1/5	1	4	1/5
C3	1/9	1/4	1	1/7
C4	1/3	5	7	1

B2	C5	C6	C7	C8
C5	1	1/4	1/3	1/6
C6	4	1	1/2	1/4
C7	3	2	1	1/3
C8	6	4	3	1

B3	C9	C10	C11	C12
C9	1	5	1/4	3
C10	1/5	1	1/8	1/4
C11	4	8	1	6
C12	1/3	4	1/6	1

B4	C13	C14	C15	C16
C13	1	1/4	1/3	2
C14	4	1	3	6
C15	3	3	1	5
C16	1/2	1/6	1/5	1

Fig. 2: Judgment matrix table

3.2. Seeking transfer matrix B

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Matrix B can be obtained according to the transfer matrix A:

$$B = \log A = \begin{bmatrix} 0 & 0.30103 & -0.60202 & -0.47712 \\ -0.30103 & 0 & -0.84510 & -0.69897 \\ 0.60202 & 0.84510 & 0 & 0.47712 \\ 0.47712 & 0.69897 & -0.47712 & 0 \end{bmatrix}$$

3.3. Seeking optimal transfer matrix C

$$C_{ij} = \frac{1}{n} \sum_{k=1}^{n} \left(b_{ik} - b_{jk} \right)$$

$$C = \begin{bmatrix} 0 & 0.266737 & -0.675607 & -0.369280 \\ -0.266737 & 0 & -0.942344 & -0.636017 \\ 0.675607 & 0.942344 & 0 & 0.306327 \\ 0.369280 & 0.636017 & -0.306327 & 0 \end{bmatrix}$$

3.4. Seeking quasi-optimal consistent matrix A'

$$A' = 10^C \begin{bmatrix} 1 & 1.848148 & 0.211053 & 0.427287 \\ 0.541082 & 1 & 0.114197 & 0.231197 \\ 4.738173 & 8.756778 & 1 & 2.024544 \\ 2.340347 & 40325308 & 0.493938 & 1 \end{bmatrix}$$

3.5. Seeking feature vectors λ

$$\lambda_1 = \sqrt[4]{1*1.848148*0.211053*0.427287} = 0.638943$$
$$\lambda_2 = \sqrt[4]{0.541082*1*0.114197*0.231197} = 0.345271$$
$$\lambda_3 = \sqrt[4]{4.738173*8.756778*1*2.024544} = 3.027400$$
$$\lambda_4 = \sqrt[4]{2.340347*4.325308*0.493938*1} = 1.495349$$

3.6. Normalized the vector λ to seek power coefficient X

$$X = \left(\lambda_1 \bigg/ \sum \lambda, \lambda_2 \bigg/ \sum \lambda, \lambda_3 \bigg/ \sum \lambda, \lambda_4 \bigg/ \sum \lambda \right)$$
$$= (0.1159, 0.0630, 0.5510, 0.2721)$$

X_1, X_2, X_3, X_4 can be calculated Using the same method , finally the weights of engineering practical ability evaluation index system can be obtained, as shown in TABLE 2.

TABLE 2   The weights of n index system

Level1 indicators	Weights	Level2 indicators	Weights
B1	0.5501	C1	0.5551
		C2	0.1030
		C3	0.0409
		C4	0.3010
B2	0.1159	C5	0.5510
		C6	0.0649
		C7	0.2250
		C8	0.1591
B3	0.2721	C9	0.3489
		C10	0.5095
		C11	0.0199
		C12	0.1217
B4	0.0630	C13	0.0644
		C14	0.5388
		C15	0.2766
		C16	0.1182

By the quantitative analysis, engineering practice education can be understand fully though to scan the four key(universities, industry, students themselves, and social status of training institutions) of engineering practice ability to forming. So that the development of electronic information engineering students engineering practice education can be planed scientific and rational, and make it's gradually took to the benign development path, the ability of engineering practice can be improved effectively.

4. Application of the engineering practical ability evaluation index system

The index weight shows that the university has significant positive effect for the formation of students' practical ability. Construction of University practice teach-

ing system, setting of professional courses, practice teaching resources and engineering practical experience of teaching staff are the important factors influencing the engineering practical ability. In the research we found that in recent years, the awareness of students' project practice ability training is improving, but the ascension of electronic and information profession graduates practical ability of most of the universities is not obvious. The capacity and quality of graduates with the requirements of the industry has a long distance. So we must reform the existing practice teaching system, and make the practice teaching link has gradation, continuity and penetration, a class of set According to subject logic must be broken, the course system of "based-competency" must be to establish，the relevant courses and practice teaching must be designed according to" "student outcomes".

Industry is also important to the cultivation of students' engineering practical ability. With the development of information technology, the market environment faced by industry is undergoing rapid change. In electronic information engineering under the present situation of the graduates practice ability is generally low; the problem through a series of policies and measures to safeguard and motivate the enterprise to participate in engineering practice education is an urgent need to consider. While enterprises should also have a sense of social responsibility, and gradually participate consciously the training of talent practice ability, and Assist universities bear some of the roles of higher engineering education, And through the co-operative education, receiving graduate internship, carry out to the student to develop continuing education training and other forms of practice and training.

Individual as the main subject and internalization of ability, and it's also played the role should not be overlooked in the process of ability to be formed and improved. Knowledge is a kind of learning ability which is produced in a certain environment and working background. Engineering practice ability as part of the individual ability, it also follows the basic theory of ability forming process. Therefore consciousness, power and the inherent ability of the individual are the important factors that affect its engineering practice ability strong or weak. But through survey statistics found that the electronic information engineering students' motivation to improve engineering practical ability is insufficient, so requiring all levels of the education sector through the reform of the current structure and course credit assessment mechanism, and through the proper guidance to enhance the motivation of students' initiative getting practical ability.

In the influence of the social training institutions, Studies have shown that, Due to the strengthening of specialization, social training will play an increasingly important role, many training function of universities and industrial will be gradually replaced by the social training institutions. The influence of the social training will be more and more important to enhance the practical ability. Social training will be an important channel for practice ability of engineering talents training.

5. Conclusion

Under the macroscopic background of the construction of an innovative country, we should clearly recognize that the development of the enterprise and product innovation in addition to rely on the fair market environment and a good system of intellectual property rights protection, it should also mainly rely on talent, especially the engineering technology talents with engineering practice ability. But the cultivation of engineering practice ability,

is not entirely responsibility of universities, it will be affected by the social environment, so it requires sustained effort of government departments, universities, enterprises, teachers and students. Especially in the aspect of practice teaching reform, in addition to changing concepts and really realize the importance of the leading factors which has a decisive role in practice teaching , that must have the systematic implementation measures: we must to allow sufficient time For engineering practice of students ,and to provide sufficient space, proper teaching requirements, practical content, teaching methods and evaluation methods, and we also must give full play to the student's personality and initiative to stimulate student enthusiasm for engineering practice. In this paper, the key factors influencing the engineering practical ability has carried on the qualitative and quantitative analysis, and the operational countermeasures to the development of the engineering practice education and the improving of engineering practice ability cultivating was proposed. But the complexity of the relative to the object of study, this research still exist certain limitations, only to the region specialized electronic information carried on the analysis, that need to expand and improve in the future study.

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