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Research and Practice of Innovative Talent Training Model Based on Industry-University Integration and School-Enterprise Cooperation

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Abstract: *Innovation is the soul of national development, and school-enterprise cooperation (SEC) can enable enterprises and schools to share resources and promote mutual development. In terms of personnel training, the integration of industry and learning has been widely used and deeply promoted. The industry and universities are closely combined to carry out in-depth cooperation, aiming at cultivating talents with innovative spirit and practical ability to meet the society's demand for high-quality talents. This innovative talent training (TT) model has achieved remarkable results in many countries and regions. In this mode, a close cooperation mechanism is established between universities and enterprises. This article mainly uses the methods of case analysis and questionnaire survey to analyze the TT mode, and uses the analytic hierarchy process to calculate the weight of the indicators. The results show that the relative weights of content system, practice environment, training mechanism and quality monitoring are all 51%.*

Keywords: *Industry-University Integration, School-Enterprise Cooperation, Innovative Talents, Training Mode*

1. Introduction

With the rapid development of the economy and society, various TT models between enterprises and universities, scientific research institutions and colleges and universities (CU) have become an irresistible trend. Industry-university integration (IUI) refers to the organic combination of higher education and corporate education to cultivate high-level compound talents with innovative and entrepreneurial capabilities. The innovative TT model based on IUI and SEC is of great significance to improving the quality of TT and employment competitiveness. It can build a bridge between universities, enterprises and students, promote the organic combination of knowledge and practice, and cultivate high-quality talents to meet the needs of social development.

SEC is an effective way to cultivate high-level talents, but in the process of China's economic development, enterprises and schools have not paid enough attention to the integration of industry and learning. In order to adapt to the higher requirements of the economic society in the new era for compound high-end technical talents, and to meet the needs of the structural adjustment of the market's demand for high-quality applied professionals, and to solve the problems of emphasizing teaching content and ignoring practical ability training and skill improvement in innovative education in CU, SEC is an inevitable choice. Regarding the integration of industry and learning, Marina Rostoka believed that the changes in the higher education system, the development of scientific institutions and the requirements of the Industrial Revolution 4.0 have determined the revision of the concept of scientific TT by the Engineering Bureau [1]. Regarding TT, Yafeng Wen mentioned that it was particularly important to cultivate intelligent building talents with appropriate knowledge structure, knowledge system and professional skills. He also researched how to cultivate prefabrication and smart building talents [2]. Eduardo Baldo Moraes identified the use of Industry 4.0 technologies in education and how they facilitate learning, emphasizing their educational level [3]. This paper mainly studies the connotation, characteristics and significance of SEC, and based on the theoretical basis of "IUI", combines relevant professional knowledge and practical needs to explore the innovative TT mode.

This paper first studies the integration of industry and learning, and describes its basic concepts and

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importance. Secondly, this paper analyzes the SEC model and describes the key points of SEC. Then this paper expatiates on the training mode of innovative talents, and conducts hierarchical analysis on the evaluation of the quality of talents training. Finally, through questionnaire survey and case analysis, this paper investigates and scores the ways of personnel training, and obtains the final data and results.

2. Industry-Education Integration and School-Enterprise Cooperation

2.1 Industry-University Integration

IUI refers to the in-depth cooperation between the industry and universities to jointly carry out education and training, scientific research innovation, personnel training and other aspects of cooperation. It advocates the organic combination of schools and enterprises, making education and training closer to actual needs, providing students with more competitive skills and qualities, and promoting technological innovation and social progress. Through cooperation with universities, enterprises provide various platforms and conditions for cultivating high-end talents, and realize the organic combination of schools, industrial bases and scientific research institutions. Both schools and enterprises cooperate and support each other in terms of educational resources. On the one hand, it is necessary to strengthen the guidance for students to learn theoretical knowledge during school, and on the other hand, it is also necessary to pay attention to the cultivation of practical operation ability [4].

The basic points mainly include close connection, interdependence and mutual promotion. First of all, close connection refers to the establishment of close communication channels and cooperation mechanisms between universities and enterprises to achieve resource sharing and information exchange. Secondly, interdependence means that CU can provide education and training programs that meet market demand with the help of practical experience and resource support from enterprises, and enterprises can also obtain talents and technical support through cooperation with CU. Finally, mutual promotion means that through close cooperation with enterprises, CU can better adjust teaching content and methods and improve the quality of personnel training. At the same time, the participation of enterprises can also promote the transformation and market application of scientific research results.

The integration of industry and learning can improve students' practical ability and innovative thinking, so that they can better adapt to social needs and job market. Second, IUI can accelerate the transformation of scientific and technological innovation and R&D results, and promote technological progress and industrial upgrading. At the same time, the enterprises in cooperation can provide financial and resource support for universities and promote the development of educational research. Finally, IUI can also enhance the social influence and service capabilities of CU, and enhance their comprehensive strength and competitiveness.

In practice, there have been many successful cases of IUI. For example, a university cooperates with an aviation manufacturing company to carry out a TT project for aeronautical engineering. This project includes a series of activities such as the establishment of professional courses, practical internships and scientific research cooperation. Through partnerships with businesses, students gain hands-on experience and expertise through exposure to the latest aviation technology and equipment. At the same time, enterprises can also select excellent talents from students to meet the talent needs of enterprises. This cooperation model not only promotes the employment competitiveness of students, but also promotes the innovation and development of aerospace engineering technology.

2.2 School-Enterprise Cooperation

The SEC model is a cooperation model that closely cooperates with universities and enterprises, aiming to promote the integrated development of education, scientific research and industry [5]. This cooperation model has become one of the important development trends in the field of higher education. Under the SEC model, universities and enterprises establish a long-term and stable cooperative relationship to jointly implement a series of cooperation projects such as cultivating talents, carrying out scientific research and innovation, and promoting industrial upgrading [6-7].

This model focuses on the organic combination of education and industry needs. Through cooperation with enterprises, CU can better understand the development trends and demands of the industry, adjust educational content and training programs in a timely manner, and cultivate talents that are more suitable for market demand. At the same time, the participation of enterprises can also provide CU with the latest technology and practical experience, make education closer to reality, and pay

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attention to cultivating students' practical ability and innovative consciousness. Through cooperation with enterprises, students can get in touch with the real working environment and practical problems, carry out practical projects and internships, and improve their practical ability. At the same time, professional mentors and industry experts from companies can also provide guidance and support to students. In addition, this model can also promote the transformation and industrialization of scientific research results. Through close cooperation with enterprises, scientific research results of universities can be transformed into actual products and technologies more quickly, promoting technological innovation and industrial development. The participation of enterprises can not only provide financial and resource support, but also provide universities with market demand and application scenarios, making scientific research closer to actual needs.

3. Evaluation of the Quality of Personnel Training

3.1 Innovative TT Model

This model needs to cultivate talents with innovative ability and spirit to meet the needs of social and economic development, and to promote technological innovation and industrial upgrading [8]. Cultivating innovative talents should pay attention to cultivating students' innovative thinking and ability. Through the development of innovative education and innovative practice activities, students' innovative potential is stimulated, their ability to think independently and solve problems is guided, and they are encouraged to try new ideas and methods. At the same time, in order to cultivate innovative talents, it is necessary to give students enough autonomy, encourage them to try and take risks, and cultivate their innovative consciousness and entrepreneurial spirit. Secondly, it should pay attention to the cultivation of interdisciplinary and comprehensive literacy. Modern society's demand for talents is increasingly emphasizing interdisciplinary ability and comprehensive quality. Therefore, CU should offer interdisciplinary courses and projects, encourage students to conduct interdisciplinary study and research, and cultivate their comprehensive qualities, such as communication skills, teamwork skills, leadership skills, etc. In this way, innovative talents with more comprehensive development and comprehensive quality can be cultivated, and the integration of practical teaching should also be emphasized. Practical teaching is an important way to cultivate innovative talents. By participating in practical projects and solving practical problems, students can apply the knowledge they have learned to practice and gain practical experience. CU should establish close cooperation with practical teaching partners such as enterprises and scientific research institutions to provide students with practical opportunities and practical environment, and cultivate their practical ability and problem-solving ability.

The training facilities jointly established by schools and enterprises provide a good organizational guarantee for the joint training of high-quality and innovative talents by schools and enterprises, and can ensure the smooth progress of various joint training tasks [9-10]. In this way, resources beneficial to schools and enterprises can be wisely allocated and effectively integrated, thereby offsetting the differences in talent development between universities and enterprises [11-12]. Under the joint construction model of schools and enterprises, universities and enterprises form a highly interconnected community of interests, which can fully mobilize the motivation of both parties to participate in talent development. The training facilities jointly established by schools and enterprises provide a platform and carrier for collaborative education between schools and enterprises, which not only helps to improve the innovative and practical skills of teachers and students, but also accelerates the transformation and dissemination of scientific and technological achievements. The introduction of business models in schools fully embodies the leading role in the cultivation of first-class innovative talents, and can continue to promote the orderly promotion of various types of TT connections according to the training objectives and directions. The company supports talent development in research universities and provides financial support, technology, faculty, programs, laboratories, and equipment to fill gaps in the university's unique talent development model [13-14]. Opportunities for companies to participate in the joint training of the best innovative talent in an attractive business model are varied, flexible and relatively unrestricted, and as such, this model is the easiest to apply and implement.

3.2 Building a Hierarchical Model

Establishing the hierarchical structure and determining the elements of each level are the most important steps in the process of hierarchical analysis [15-16]. The hierarchical structure of TT quality

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assessment in schools and enterprises is divided into four levels from top to bottom: general system level, general principle level, standard level and index level. Through layer-by-layer comparisons, the importance of elements is assigned using the 1-9 scale method. 1-9 grade scale and importance level content are shown in Table 1.

Table 1: 1-9 Scale and importance level content

	Scale
Extremely important	9
Strongly important	7
Obviously important	5
Slightly important	3
Equally important	1
Slightly unimportant	1/3
Not important	1/5
Very unimportant	1/7
Extremely unimportant	1/9

Hierarchical single ranking is the process of obtaining eigenvectors by solving and normalizing the attribute roots of the evaluation matrix to obtain sequential weights of the relative importance of related factors at the same level with respect to specific factors at the previous level [17-18]. Taking the general grassroots of "curriculum implementation" as an example, the weights of three main indicators "course content", "classroom teaching" and "curriculum evaluation" to curriculum implementation are calculated. Calculating the product Q_{i} of each row element of the judgment matrix as follows:

$$Q_{\mathrm{i}} = \prod_{i=1}^{m} X(ik), i = 1,2,...,m \tag{1}$$

Then calculating the m-th root of Q_{i}, and normalize the transposition of vector W_{i}, as follows:

$$W_{\mathrm{i}} = W_{\mathrm{i}} / \sum_{i=1}^{m} w_{\mathrm{i}} \tag{2}$$

All judgment matrices must be tested for consistency, and the value of matrix consistency index CI is expressed as:

$$CI = \frac{\eta \max - m}{m-1} \tag{3}$$

Finding the average random consistency metric for the judgment matrix. Hierarchical total sorting is to calculate the sorting weights of all elements of the same level for the target layer [19-20]. The weights of "curriculum content", "classroom teaching" and "curriculum evaluation" at the level of curriculum implementation are different in the single-level sorting and the total leveling sorting.

As shown in Figure 1, at the level of curriculum implementation, the weights of single-ranked "course content", "classroom teaching", and "course evaluation" are 14.3%, 46%, and 39.7%, respectively. In the entire evaluation system, their weights are 2.7%, 8.7%, and 7.5%. According to this method, the weight values of the other seven judgment matrices are calculated, and the comprehensive weight of each indicator is obtained.

As part of the process evaluation, 270 learning effectiveness questionnaires were released using the questionnaire method with a recovery rate of 74%, of which 200 were valid questionnaires with an effective rate of 100%. After mathematical statistical analysis, it is confirmed that the questionnaire is true and effective. According to the analysis of the questionnaire information, the admission score is 60 points, the expenditure score is 70 points, the course content score is 75 points, the classroom course score is 85 points, the course grade score is 70 points, and the quality control score is 60 points. The scores of the first-level indicators are shown in Figure 2:

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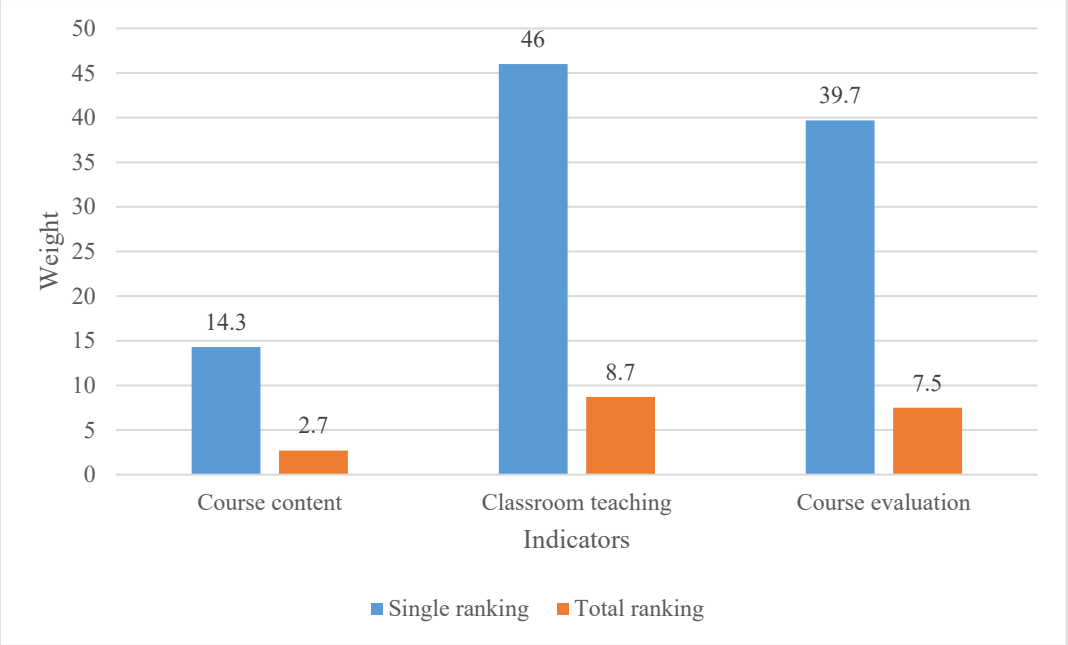

Figure 1: Weight values for the hierarchical single sort and the hierarchical total sort

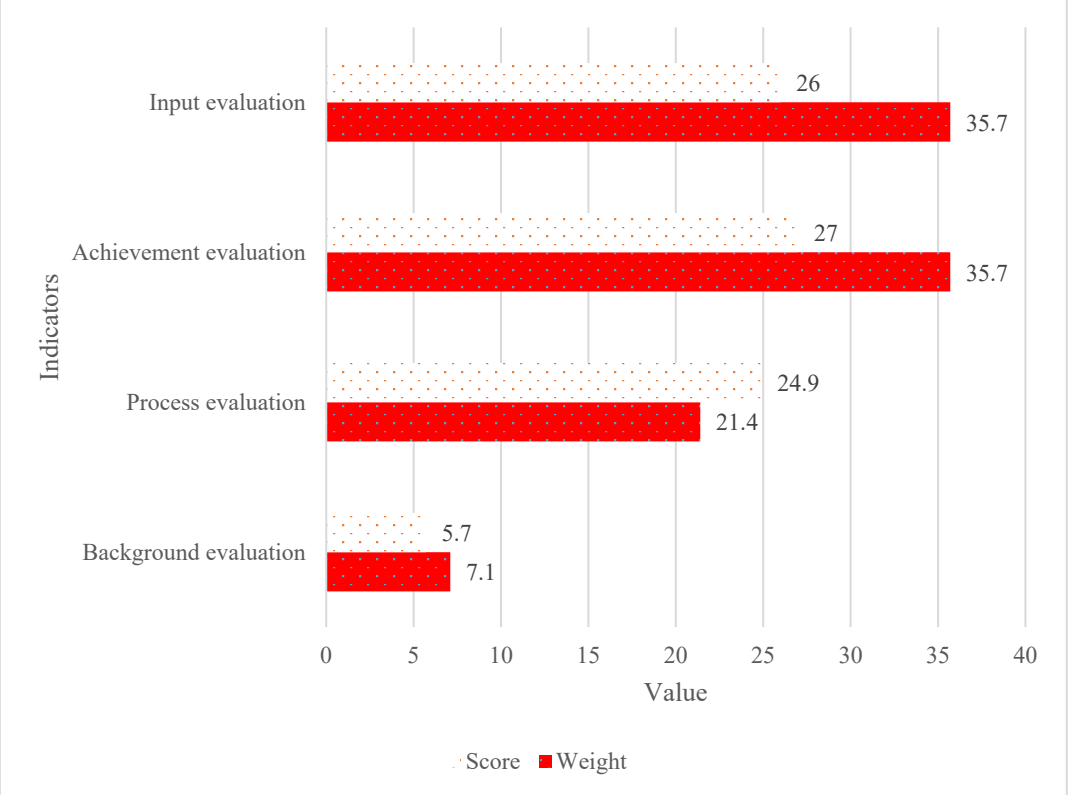

Figure 2: Level 1 index score

As shown in Figure 2, in the first-level indicators, the score of the background evaluation is 5.7, and the weight value is 7.1%. The score of the process evaluation is 24.9, and the weight value is 21.4%. The score in the achievement evaluation is 27, and the weight value is 35.7%, which is the same as the weight value of the input evaluation, but the score of the input evaluation is slightly lower than the achievement evaluation.

3.3 Existing Problems and Scoring Results of the Third-Level Indicators

The development of computerized education platform is not yet perfect, and online distance

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education needs to be improved and promoted. The proportion of practical courses has increased and the time allocated for implementing practical courses has also been allocated. The course content system can track time, but it is not enough to just update the course content, it is necessary to improve the cooperation between schools and enterprises to design innovations in classification and training mechanisms, and to develop sustainable development mechanisms for teachers. Regarding quality control, there is a lack of feedback mechanism between teachers and students. All these problems limit the development of cooperation between schools and enterprises.

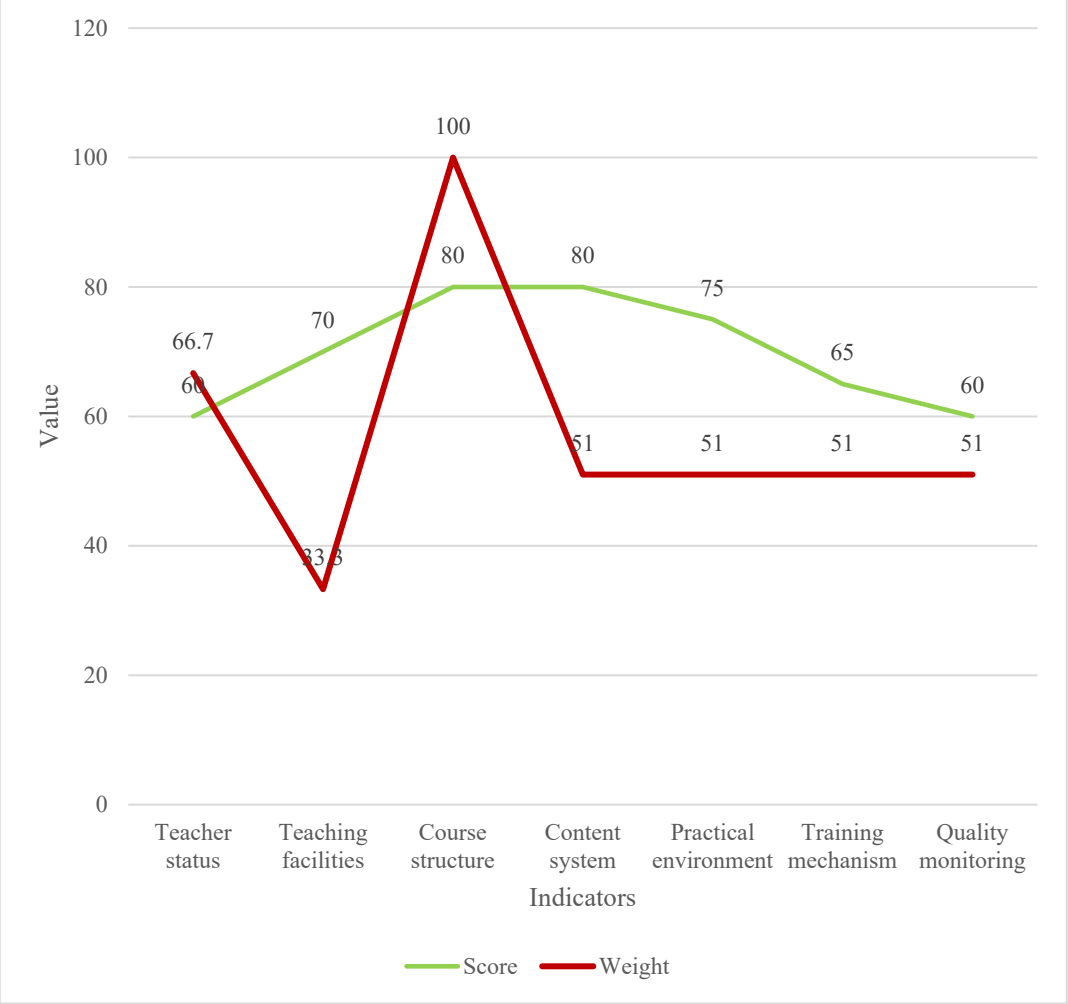

Figure 3: Three-level index results of the process evaluation

As shown in Figure 3, in the process evaluation, the three-level indicators include the status of teachers, teaching facilities, curriculum structure, content system, practice environment, training mechanism and quality monitoring. Among them, the relative weight of the latter four items is consistent, and the relative weight of the course structure reaches 100%. In addition, the scores of the course structure and content system are consistent, both are 80 points, the highest score. This means the importance of these two indicators, indicating that the two indicators are performing well. However, the scores for the remaining indicators are a bit low and there is a lot of room for improvement.

As shown in Figure 4, we can find that in the background evaluation, the relative weight of social background is 42.4%, the overall weight is 3.01%, and the score is 80. The relative weight of environmental conditions is 16.6%, and the overall weight is 1.16%, with a score of 85. The relative weight of professional planning is 10.6%, the overall weight is 0.75%, and the score is 75. The relative weight of each party's demand is 30.4%, the overall weight is 2.15%, and the score is 80.

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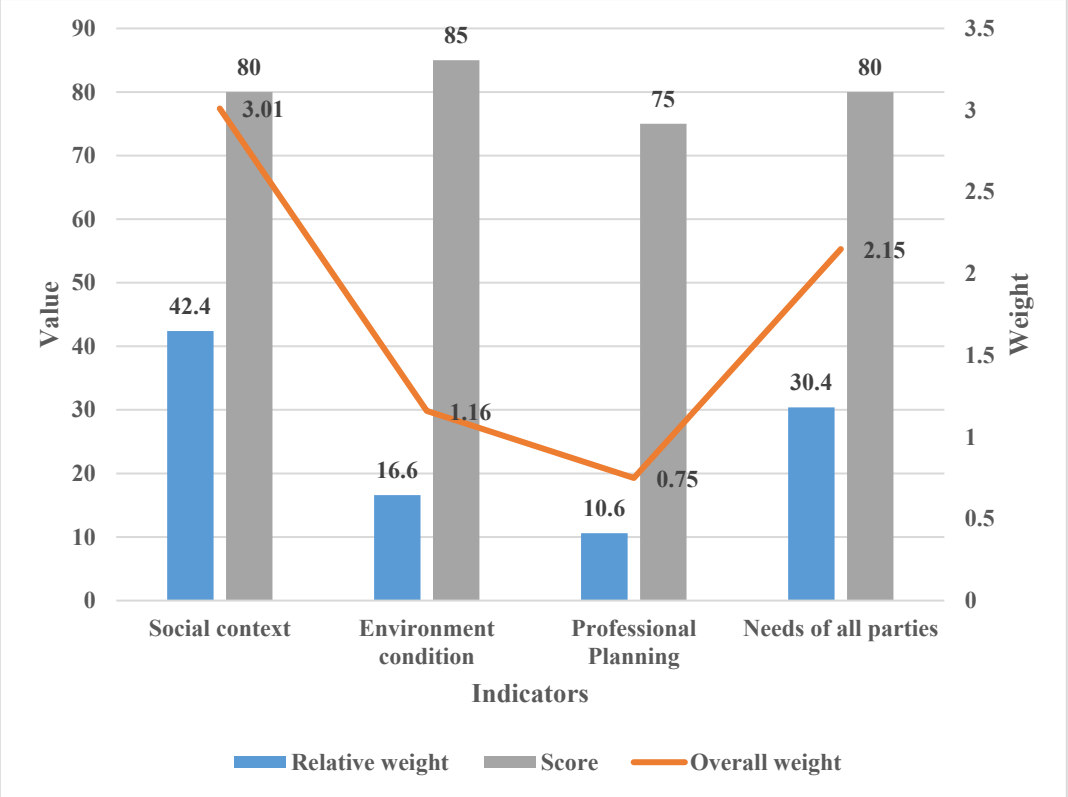

Figure 4: Three-level index results of the background evaluation

4. Discussion

CU can rely on the resources and practical experience of the industry to offer professional courses and practical projects that match the needs of enterprises. Enterprises can provide practice platforms, mentor resources, and solutions to practical problems, providing students with real working environments and practical opportunities. Through close cooperation with enterprises, CU can better understand industry needs and trends, adjust teaching content and methods, make education closer to reality, and improve students' employment competitiveness.

Secondly, this model focuses on cultivating students' innovative thinking and practical ability. In practical projects, students will face real problems and challenges, and need to apply the acquired knowledge to solve practical problems. This kind of practical learning makes students pay more attention to the methods and ideas of solving problems, and cultivates their innovative thinking and problem-solving ability. At the same time, students can also communicate and cooperate with corporate mentors and industry experts during the practice process, which broadens their horizons and enhances their professionalism.

In addition, the innovative TT model based on IUI and SEC can also effectively promote the industrialization of scientific research results. Through cooperation with enterprises, university scientific research teams can better understand market demand, adjust research direction, and transform research results into actual products and technologies. The participation of enterprises can not only accelerate the transformation of scientific research results, but also provide research teams with more financial and resource support, and promote technological innovation and industrial upgrading.

Establishing a strong mechanism for schools and enterprises to jointly develop high-level innovative talents is the basic guarantee for cultivating high-level innovative talents and plays a vital role in improving the synergy between schools and enterprises. Schools and enterprises should continuously optimize the high-level innovative TT system on the basis of full communication and combined with practice, to ensure that different cultural sub-mechanisms interact and complement each other, and promote the healthy development of high-level innovative talent development mechanisms in schools and enterprises. Close and effective communication should be established between universities and enterprises to ensure the smooth progress of joint education between universities and

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enterprises and to deepen cooperation in student training. Relying on the two advantages of universities and enterprises, it is difficult to make full use of the joint training of high-level innovative talents by schools and enterprises. The government must strengthen its design leadership role in talent development, and strongly support schools and enterprises to jointly train the best innovative talents, including policy, funding and consulting.

5. Conclusion

Through the combination of production, education and research, a win-win development relationship between enterprises and schools is formed. SEC, as a new model of TT, has already had initial development in China. In this paper, when researching on the training mode of innovative talents in SEC, it mainly uses the methods of questionnaire survey and data analysis. Establishing a new type of industry-university-research alliance between schools and enterprises, strengthen innovation awareness and capacity building, and increase students' participation in self-employment practice. Finally, we must pay attention to the improvement of the quality of talent education. In order to better integrate into the "innovative" construction, it is necessary to strengthen the development planning of schools and industries by both schools and enterprises. It is also necessary to establish a good investment operation mechanism for industry-university funds and actively explore new models to realize the transformation of the quality of TT to quality improvement and benefit optimization.

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