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Design of a Data Mining-based Evaluation System for Innovation and Entrepreneurship Skills in Private College Students

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ABSTRACT

This paper proposes data mining base devaluation system for assessing innovation and entrepreneur ship skills among students in private colleges. By leveraging advanced digital technologies, we can reshape traditional evaluation systems to reflect a company's innovation and development better. We will collect substantial literature and organize it in to a comprehensive set of indicators. After meticulous expert reviews, we will establish a refined, scientific, objective, and accurate system for evaluating skill levels. Through this experiment, we have found that this system significantly enhances the precision and reliability of the indicators and better showcases a company's innovation and development potential compared to previous methods.

Keywords: Entrepreneurship Skill Assessment, Data Mining, Software Design, Data Collection, Evaluation Indicators, Weight calculation

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1. Introduction

With the acceleration of global economic and social globalization, the trend of young people engaging in autonomous technological innovation is rising. It is an essential aspect of our country's development and a key driver of economic and social progress. Therefore, conducting a comprehensive assessment of young people's innovative and entrepreneurial development levels can better guide and promote our innovative training [1]. Overseas, measuring entrepreneurial development levels has received wide spread attention [2]. Many overseas scholars have proposed personal entrepreneurial suitability models to measure an individual's potential. This model considers critical factors for entrepreneurial success, such as creativity, market insight, team collaboration, and personal traits. Ultimately, the model assesses an entrepreneur's entrepreneurial potential [3]. In recent years, we have made significant progress in exploring and evaluating Chinese university graduates' innovation and entrepreneurial potential. We have delved into their entrepreneurial capabilities and identified several key factors better to understand their strengths and development status [4]. We devised an evaluation standard to better measure an employee's innovation and development potential. We determine the employee's strengths and weaknesses based on actual conditions while using a multidimensional extension model to ensure the accuracy of our test data. Leveraging digital technology, we have built a digital platform for testing college students' innovation and entrepreneurship capabilities. This platform utilizes statistical and intelligence analysis techniques to explore the underlying mechanisms behind massive data. It offers a macroscopic view to comprehensively analyze different innovation and entrepreneurship requirements, providing users with precise indicators [5].

2. Related Work

In different regions and cultural backgrounds, innovation and entrepreneurship activities of private enterprises have been widely emphasized. Many experts and institutions have started proposing establishing and improving corresponding management systems to support and promote these activities' development. Some developing countries strive to enhance students' innovation and employment competitiveness, benefiting from government support and encouragement. For various reasons, many individuals have begun using e-commerce to enhance their work and income. Over time, more and more people are using e-commerce to achieve greater success. E-commerce holds enormous potential for enhancing individual and team competitiveness, leading to increasing attention to its application. By imparting valuable entrepreneurial information to the younger generation, they can more smoothly accomplish tasks and serve as essential guidance for higher education innovation and entrepreneurship training. Despite the advancement of China's innovative enterprises and fierce competition, universities play a critical role in many fields. To meet current demands, many educational institutions have organized lectures and courses on innovative enterprises and conducted a series of competitions through collaborations to promote the growth of businesses and individuals. However, due to limited emphasis on certain universities, the competitive nature of these innovation outcome conversion competitions aims to motivate and enhance students' innovation and entrepreneurial skills [6].

Although some universities have begun implementing their research management systems to ensure effective project implementation, many regions still lack this effective control, impacting the overall innovation and entrepreneurship process. Apart from procuring external innovative enterprise management systems, the lack of independently developed technology poses greater challenges in the later stages of operation and maintenance and higher costs [7]. Many experts are striving for the success of innovative and entrepreneurial projects by achieving significant achievements in this field. Through various forms such as questionnaires, interviews, and

analysis, they integrate different viewpoints and apply them to specific project management, thus building a comprehensive project management system with remarkable results [8]. Some scholars have conducted in-depth research and constructed a comprehensive innovation project platform for college students. This platform integrates papers, practices, and other relevant resources and builds an efficient project management system, facilitating more efficient management of college student entrepreneurship parks and providing corresponding technical support [9]. In 2020, the government actively promoted innovation and entrepreneurship activities among college students, and scholars also tried to advance this area. The project management system they implemented effectively controls the activities and enhances their quality. Other researchers have deeply explored the concept of a college student innovation and entrepreneurship project management system using B/S architecture and provided beneficial guidance. As a result, the system significantly supports various applications with high reliability and scalability. Scholars have utilized JAVA technology to construct a comprehensive college student innovation and entrepreneurship project management system, which includes SSH framework and HTML5, making the system more sophisticated [10]. Additionally, many overseas scholars have conducted in-depth research, providing a comprehensive innovation and entrepreneurship project capability assessment system for foreign college students, enabling them to better grasp their innovation and entrepreneurship skills.

In summary, the college student innovation and entrepreneurship capability assessment system aim to provide effective supervision and guidance for universities, fundamentally addressing the issues in the graduate employment market. This management system meets the practical needs of current social development and exhibits good foresight and implementation effects, gaining widespread recognition from the government and various sectors of society. The Ministry of Education has consistently promoted mass innovation and public entrepreneurship in China and strives to develop it further. Undoubtedly, with technological advancements, future large-scale innovation and entrepreneurship activities will require more advanced technologies and tools to support them, making college students' innovation and entrepreneurial capability testing an essential component of current and future development.

3. Data Mining-Based Design Method for Assessing Innovation and Entrepreneurship Skills in Private College Students

3.1 Assessment of Innovation and Entrepreneurship Skills

To better assess college students' innovation and entrepreneurship skills, we employed a method involving CKNI and other social media tools to collect relevant information in this area. Then, data mining techniques were applied to extract useful information from this data and organize it into categories. Subsequently, we analyzed and ranked this information to determine which aspects contribute to measuring these skills. After eliminating concept duplicates or repetitions, we used this refined information to construct a comprehensive and reliable set of indicators for assessing innovation and entrepreneurship skills. As shown in Figure 1, we extracted a series of effective measurement indicators from other valid factors for effective analysis.

Through frequency statistics, we initially filtered out a cluster of indicators with innovation and entrepreneurship capabilities. We set the mining frequency threshold for the selected indicators to 4 and considered those surpassing this threshold as candidate indicators [7]. Finally, we used an expert scoring method to conduct a secondary selection of these candidate indicators.

3.2 Calculation of Weight for Evaluation Indicators in the System

By analyzing the 1-9 levels of evaluation indicators, we determined the importance of each indicator and

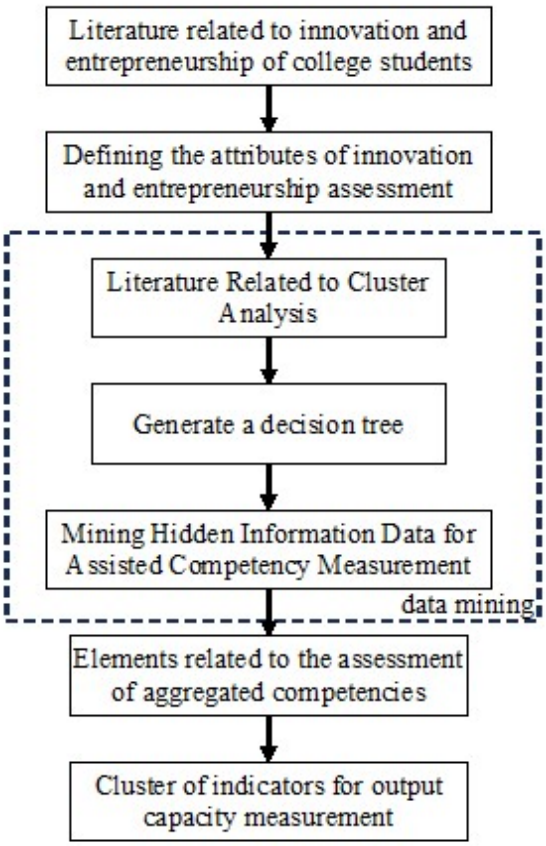

Figure 1. Process for acquiring evaluation indicator cluster

categorized them as target layer, criterion layer, and decision layer. This approach enables us to assess the indicators is relatively low, we can use 2, 4, 6, and 8 as standard indicators for *i*. If we define the standard deviation of *i* relative to *j* as a_{ij}, then the standard deviation of *j* relative to *i* is defined as *aj*.

$$a_{ij} = \frac{1}{a_{ij}} \quad (1)$$

By constructing a weight judgment matrix and using the geometric mean method, we conducted a weight analysis of various subsets of the matrix to determine their respective weights. The average value of the weights, denoted as *wi*, was used as the weight of the matrix to measure the importance of each subset.

$$w_i = n\sqrt{\prod_{i=1}^{n} a_{ij}} \quad (2)$$

Through normalization of the judgment matrix, we can extract its maximum value and use it to measure different analysis methods. We can use these values to determine the importance of each analysis method and normalize them to obtain their values. This way, we can determine their consistency by calculating the negative

values of these normalized values. By evaluating the average random consistency index *S* and considering the order of the matrix, we can determine the optimal selection for *S*. By calculating the relative error of the consistency index *S*, we obtained a percentage for the random consistency index. If this percentage is less than 0.1, we determine that the judgment matrix complies with the consistency index, and we accept the features of *w*. If this percentage is higher than 0.1, we must modify the judgment matrix and recalculate its corresponding percentage. Through precise analysis, we have determined the percentages of various measurement indicators in the system.

3.3 Evaluation of College Students' Innovation and Entrepreneurship Abilities

By arranging the three different weights in order of importance, we can obtain a complete set of weights to measure a person's innovation and development. We can define the weights of this set as *D = (M, N, P)*, which includes a series of measurement factors, such as a person's character, skills, learning, and work experience. Through this set, we can measure a person's potential for innovation and development, as well as their potential for innovation and development. By considering *HN* and *Hr* comprehensively, we can calculate the secondary indicators of the primary indicators to form a complete evaluation matrix *K*, where (3) represents the importance of the secondary indicators.

$$K = \begin{bmatrix} L_M \cdot R_M \\ L_N \cdot R_N \\ L_P \cdot R_P \end{bmatrix} \tag{3}$$

In this formula, *V* is the evaluation set we defined, with values of 96, 86, 76, 66, and 56, representing the completely satisfying conditions. *T* is used to adjust the magnitude of these numbers to a range of 3. Finally, we obtain the overall assessment value D through measurements of the three indicators. By conducting a comprehensive assessment of college students' innovation and entrepreneurship skills, we classify them into five different levels: A, B, C, D, and E. By considering these levels comprehensively, we can accurately identify each person's strengths and use this information to construct a digital, reliable, and measurable system for evaluating college students' innovation and entrepreneurship capabilities.

3.4 Requirement Modeling

Through modeling, we can better understand the functionality of the software. This modeling represents different objects in the form of an Entity-Relationship (ER) diagram, including one-to-many, many-to-many, etc., to show the interactions among various objects more clearly. The system administrator holds a core position in the university and is responsible for ensuring the platform's security. When anyone encounters any platform-related issues or incidents, they seek assistance from this administrator. Additionally, this person is responsible for recording and handling any information on the platform and remains vigilant about potential threats. Thus, the platform's security depends on the exclusivity of this position. By setting up a dedicated account in the classroom, teachers, students, project managers, evaluation experts, auditors, etc., can all participate, following a hierarchical authorization model.

4. Experimental Design and Outcome Analysis

4.1 Experimental Procedure

A comparative experiment was conducted, with the designed system as Experiment Group A, and two

conventional systems as Experiment Groups B and C, respectively, to compare the reliability of the evaluation indicators among the three groups. The experimental environment was set up on a cloud server, with a main server running on Windows. The main server was hosted on Alibaba Cloud, using PHP as the backend server language, Apache as the server, MySQL as the database architecture, GIT for code and copyright control, and the interface was a We Chat mini-program, developed using We Chat public account web development means. College students from one university were selected as the experimental population, with 1000 students representing different genders, occupations, and personality traits. The three systems evaluated the comprehensive innovation and business abilities of these 1000 college students.

4.2 Results and Analysis

Using statistical software SPSS 23.0, the reliability coefficients of each experimental indicator in the three groups were analyzed, and the overall reliability coefficient of the indicator set was examined. A higher reliability coefficient indicates stronger data reliability for each indicator, and the a value represents the value difference of the indicator data. a values ranging from 0.80 to 0.90 are considered optimal, 0.70 to 0.80 as good, 0.65 to 0.70 as acceptable, and 0.60 to 0.65 as the minimum acceptable. The recorded and organized data from the three groups of experiments were compared to assess the data reliability factor, as shown in Figure 2.

According to Figure 2, the reliability of Indicator System A is significantly better than that of Groups B and C. The reliability of Group A reaches 0.857, far surpassing the other two control groups, while Group B has a reliability of only 0.786, and the other two control groups have a reliability of 0.754. However, compared to Groups B and C, Group A shows significant improvement, with reliability increases of 0.071 and 0.103. As the indicator data increases, the efficiency levels of the three groups also change. Group A performs the best with an average efficiency of 0.853, while Groups B and C lag behind with average efficiencies of 0.784 and 0.749, respectively. Group A further improves its performance with average efficiencies rising to 0.069 and 0.104. Comprehensive systematic testing can provide more accurate information and is an important step in system development. This testing method can more clearly reflect the product's performance and assess its cost-effectiveness through factor loading coefficients from the three experimental groups, thus better understanding the product's quality. Through principal component analysis, we can extract relevant common reference values from the three groups' systematic measurement indicators and rotate them to obtain the corresponding loading matrix, thus calculating the loading coefficients. With the increase in loading coefficients, these reference values significantly influence the innovation and development of enterprises.

According to Figure 3, Group A's factor loading level is significantly better than that of Groups B and C. The average loading level of Group A reaches 0.275, while Groups B and C have average loading levels of 0.218 and 0.169, respectively. This indicates that Group A's load capacity is significantly better than that of Groups B and C. Through this transformation, our evaluation system not only greatly enhances the accuracy and reliability of the indicators but also significantly improves the feedback on college students' innovation and entrepreneurship abilities, thus greatly enhancing their capabilities. To validate the effectiveness of this system, we used the Load Runner testing tool and tested it with 30, 80, and 150 different users, obtaining more accurate results and recording them for future development preparation. According to the measurement results, we evaluated the system's feedback rate and confirmed that its performance met our expectations. Additionally, we found that the system's performance was relatively stable.

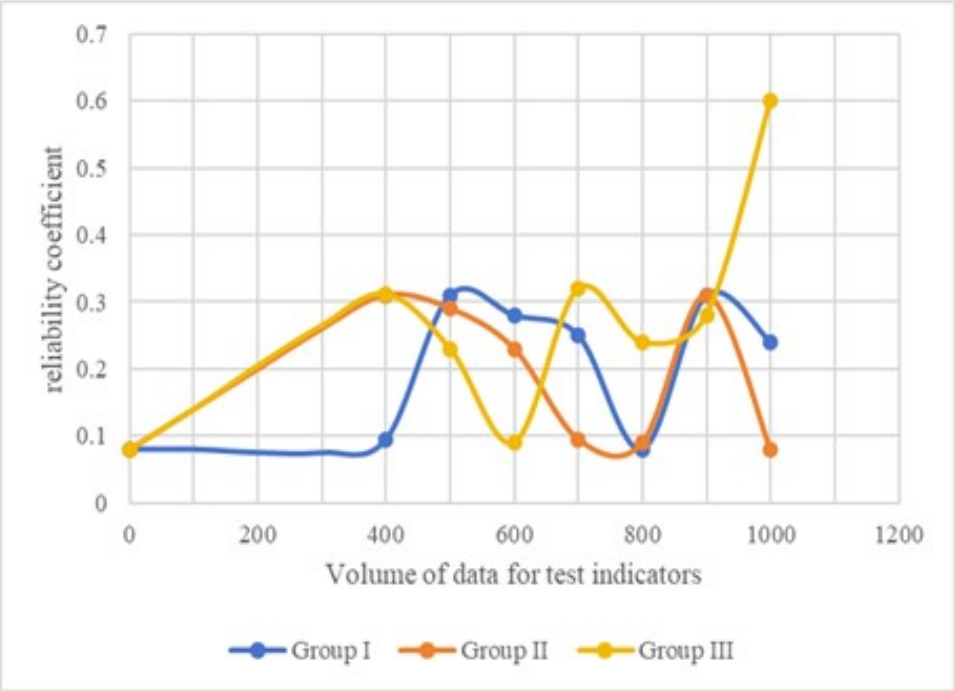

Figure 2. Comparison of Reliability Coefficients

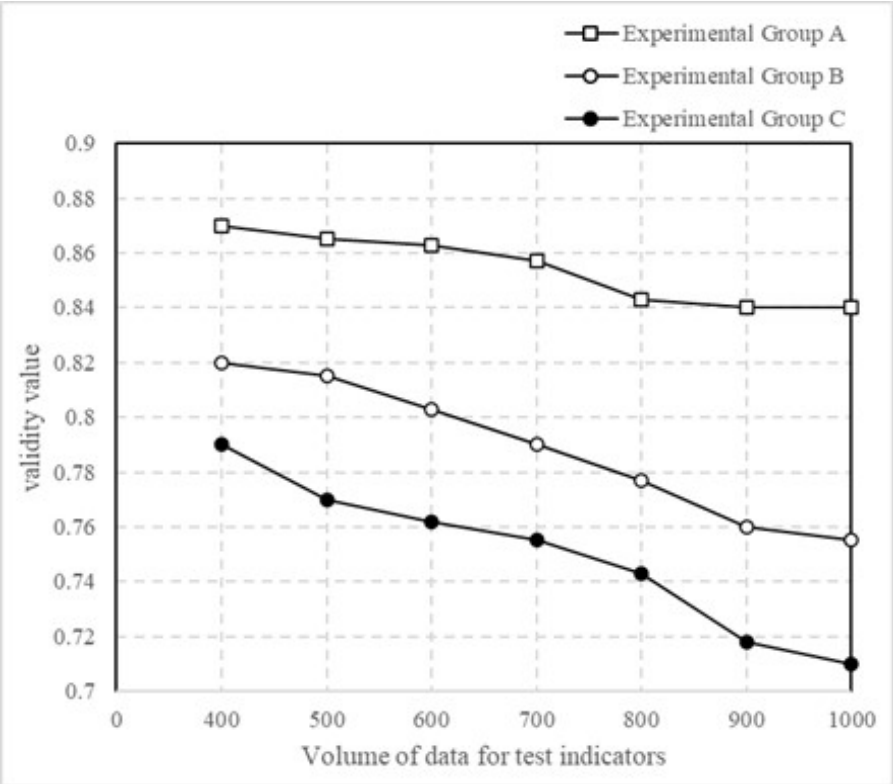

Figure 3. Comparison of Factor Loading Coefficients

5. Conclusions

Through in-depth data mining and analysis, we have established a comprehensive college students' innovation and entrepreneurship capability testing system to help them understand and master their innovation potential and find the best path for innovation and entrepreneurship. This system not only utilizes advanced digital technology but also greatly enhances the precision and efficiency of testing. However, this research still needs improvement as it did not clearly identify individual differences among the tested subjects. Therefore, future research should categorize the subjects into science and engineering and humanities and conduct independent assessments of their innovation and entrepreneurial potential.

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