Combined application of employment education and big data internet technology based on the context of vocational education reform

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Abstract

In the context of vocational education reform, with the rapid development of big data and internet technology in recent years, coupled with the increase of employment pressure in China, universities have paid more attention to students’ employability competitiveness and paid attention to the reform and innovation of employment education and management work around the goal of higher vocational education personnel training. Based on the theory of the GRU employment education model and supported by big data internet technology, this paper uses a questionnaire survey and semi-structured interview to conduct exploratory factor analysis and validation factor analysis on the constructed employability evaluation index system by using empirical analysis method and finally constructs an employment education model for higher vocational students. At present, compared with the nearly 100 years of exploration history of employment education in colleges and universities in developed countries such as the United States, the employment education of college students in China has a relatively short history and is still in the exploration and development stage. The combination of vocational education reform and big data and internet technology will create a good environment for the future development and growth of students. Therefore, it is necessary to improve the relevance of employment education and management from the perspective of students and teachers in the “Internet+” environment and provide some new ideas to solve the outstanding problems in the employment education of college students so as to ensure that students can enter and adapt to the workplace smoothly after graduation.

Keywords: Education reform; Career education; Big data; Internet; Teacher-student relationship

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1 Introduction

In January 2019, the State Council issued the document “National Vocational Education Reform Implementation Plan,” which clearly states: Vocational education must adhere to the guidance of promoting employment and adapting to the needs of industrial development, focusing on cultivating high-quality technical and skilled talents and provide high-quality human resources support to improve national competitiveness [1-2]. With the in-depth promotion of the implementation of national vocational education reform, vocational education has stepped into the fast track of high-quality development [3-5]. Currently, vocational education reform has achieved certain results around the national industrial development needs, but it still faces many difficulties in promoting the employment of higher vocational students [6-7]. From the current employment market survey, the employment of higher vocational students generally still has problems such as low employee satisfaction, mismatch of job abilities, high employment mobility, and low evaluation of employers [8]. To improve students’ employability, the key is to determine the composition structure of employability, evaluation indexes, and the size of the impact of evaluation indexes on employability, and then to strengthen the learning and training of evaluation index content in a targeted manner [9-11].

At present, there are many studies on the current situation of employment education in domestic and international academic circles, and in-depth studies have been carried out at different levels, focusing on “employment difficulties” and “fuller and higher quality employment” [12-13]. Some scholars believe that employment education is mainly about career planning and employment skills guidance, while some scholars have studied students’ employment outlook through questionnaire surveys [14-16]. In the environment of “Internet+,” the role of teachers, curriculum, student management, classroom teaching content, and students’ psychological counseling and employment work all need to be changed. From the current employment situation of university students, the employment rate of students is not satisfactory, the employment satisfaction of students is low, and the number of students who are not successfully employed is becoming more and more [17-19]. On the other hand, there is a large job gap in enterprises, and it is becoming more and more difficult to recruit employees, and the quality and ability of employees are difficult to meet the employment standards of enterprises, thus causing an imbalance between social demand and talent training, which not only causes a waste of educational resources but also has a negative impact on the social and economic development of China [20-22]. At present, the reform of vocational education has achieved certain results around the national industrial development needs, but it still faces many difficulties in promoting the employment of higher vocational students. From the current employment market survey, the employment of higher vocational students generally still has the problems of low employment satisfaction, mismatch of job ability, high employment mobility, and low evaluation of employers [23-26]. In addition to the fierce competition in the job market caused by the high number of graduates due to the expansion of colleges and universities, the lack of employability of higher vocational graduates is the fundamental reason affecting their employment. It has been found that employability, as an employment-oriented comprehensive ability, has a direct impact on the realization of full employment and high-quality employment of college students [27-31].

The whole paper is mainly based on the background of vocational education reform and supported by big data Internet technology. Firstly, it is the study of the model of employment education based on education reform and big data internet technology. Secondly, it is the study of the influence of employment education based on the combination of vocational education reform background and big data internet technology, and finally, it is the detailed study of the realization countermeasures of employment education and the construction of practice paths. Thus, it helps college students to understand themselves correctly, establish a correct concept of career selection and practice, plan
their careers reasonably, and continuously improve their comprehensive quality and employment competitiveness.

2  Career education model under education reform and big data internet technology

2.1  Introduction to the model of employment education based on educational reform and big data internet technology

The model based on the teacher-student relationship in the Internet era is a method of training personalized models by taking historical sequences of user-item interaction behaviors and capturing the user’s interest preferences from the dynamic changes in the sequence data to make recommendations. The challenge of sequence recommendation is that the features of sequence models are high-order, dynamic, and complex, and it is important to capture this information concisely. Several common and efficient methods for sequence recommendation are described next.

2.1.1  Recommended method of employment education based on education reform and big data internet technology

The method uses a teacher-student relationship model based on GRU, which is a model of teacher-student relationship based on the Internet era, as is more typical in the recommendation of teacher-student relationship models based on the Internet era.

The core of a teacher-student relationship model recommendation system based on the Internet era is the GRU layer, and an additional forward propagation layer can be added between the final layer and the output. The input is the actual state of the sequence data, and the output is the predicted preference for the next event in the sequence, i.e., the probability that each item will be the next item in the sequence data. The neuronal activation part of the GRU network part can be a linear interpolation, calculated as follows.

\[ h_t = (1 - z_t) h_{t-1} + z_t \hat{h}_t \]  

where the update gate in GRU is calculated as

\[ z_t = \sigma(W_z x_t + U_z h_{t-1}) \]  

The candidate activation function \( \hat{h}_t \) is calculated as

\[ \hat{h}_t = \tanh(Wx_t + U(r_t \odot h_{t-1})) \]  

The reset gate in GRU is calculated as follows.

\[ r_t = \sigma(W_r x_t + U_r h_{t-1}) \]  

When multiple GRU layers are used, the hidden state of the previous layer is the input to the next layer. The input can also be optionally connected to a deeper GRU layer in the network, which will improve the performance to some extent. The entire architecture of the recurrent neural network-based sequence recommendation system is shown in Figure 1, which depicts the neural network structure and prediction method for a single sequence in a time series.
The loss function used in this method is the Bayesian personalized ranking loss function, which is a matrix decomposition method using two-by-two ranking losses. By randomly sampling out the negative example items, the scores of the positive example items are compared with the scores of the negative example items, and their average is used as the loss function. The calculation formula is:

\[ L_s = -\frac{1}{N_s} \sum_{j=1}^{N} \log \left( \sigma \left( r_{s,j} - \hat{r}_{n,j} \right) \right) \]  

(5)

where \( N \) is the sample size, \( r_{s,j} \) is the positive case score in the sequence, and \( \hat{r}_{n,j} \) is the negative case score.

### 2.1.2 Recommendation system for employment education based on education reform and big data internet technology

With the rapid development of the Internet, some people began to try to represent sequential information as a graph structure and use Internet technology to make recommendations on teacher-student relationships, as shown in Figure 2.

The workflow of the Internet-based teacher-student relationship is as follows: first, all sequences are modeled as sequence graph structures, where each sequence can be considered as a subgraph. Then each sequence subgraph is processed in turn, and the vectors of nodes in each graph are obtained by neural graph networks, representing each sequence as a combination of the user’s global preferences and current interests in the sequence. Finally, the item with the highest probability of the next click is predicted for each interaction sequence. Formally, the GNN graph convolutional neural network is used for the node updates of the graph and is computed as follows.
\[ a_{s,d}^t = A_{s,d} \left[ v_{t-1}^s, \ldots, v_n^s \right]^T H + b \]  \hspace{1cm} (6)

\[ z_{s,d}^t = \sigma \left( W_z a_{s,d}^t + U_z v_{t-1}^s \right) \]  \hspace{1cm} (7)

\[ r_{s,d}^t = \sigma \left( W_r a_{s,d}^t + U_r v_{t-1}^s \right) \]  \hspace{1cm} (8)

\[ \tilde{v}_t^i = \tanh \left( W_o a_{s,d}^t + U_o \left( r_{s,d}^t \odot v_{t-1}^s \right) \right) \]  \hspace{1cm} (9)

\[ v_t^i = \left( 1 - z_{s,d}^t \right) \odot v_{t-1}^s + z_{s,d}^t \odot \tilde{v}_t^i \]  \hspace{1cm} (10)

Where \( H \in R^{d \times 2d} \) controls the weights, \( z_{s,d}^t \) and \( r_{s,d}^t \) are reset weights and update weights, respectively. \( \left[ v_{t-1}^s, \ldots, v_n^s \right] \) is a list of node vectors in the sequence and \( \sigma \) is a sigmoid function. \( a \) is the joint matrix of the outgoing and incoming degrees of the adjacency matrix, which determines how the nodes in the graph are connected to each other. For each subgraph of the sequence, the cross entropy is used as the loss function, and the formula is

\[ L_G = - \sum_{i=1}^{m} y_i \log (\hat{y}_i) + (1 - y_i) \log (1 - \hat{y}_i) \]  \hspace{1cm} (11)

where \( y \) is the true result and \( \hat{y} \) is the predicted result.

### 2.2 Introduction to Knowledge Graph-based Recommendation Methods

The knowledge graph is a kind of directed information heterogeneous graph, and the data is in the form of a triple \( (h, r, t) \) containing “head nodes,” “tail nodes,” and “relations.” The knowledge graph contains a large amount of external information and the relationships between items and items and between items and entities. Existing knowledge graph-based recommendation methods can be divided into two categories, including embedding-based methods and path-based methods, but more people will mix the two methods to further improve the representation capability of knowledge graphs.

The embedding-based approach maps the “entities” and “relationships” in the knowledge graph to a continuous vector space to obtain a low-dimensional dense representation vector. The model is often divided into two parts, the embedding module, and the recommendation module. The recommendation module is the commonly used recommendation method, and the main embedding module method is explained here. Figure 3 shows the schematic diagram of four common traditional mapping embedding methods.
Figure 3. Schematic diagram of four common traditional graph embedding methods

The most common method for embedding modules is the Trans family, which mainly includes Trans E, Trans H, Trans R, and Trans D. By comparison, we can find that although Trans E can perform large-scale knowledge graph embedding, it still has difficulties in dealing with complex relationships, and Trans H allows each relationship \( r \) to have its own specific relationship hyperplane. Therefore, an entity will have different embedding vectors on different relational hyperplanes, which have a certain enhancement to the representation of relationships. Trans R extends the concept of a specific relational hyperplane proposed by Trans H to a specific relational space, which further enhances the representation of relationships. The Trans D method uses two vectors to represent each entity and relationship. The first vector represents the meaning of the entity or relationship, and the other vector (called the projection vector) will be used to construct the mapping matrix, which increases the training difficulty, although it allows a more accurate embedding representation of the items.

The core idea of Trans series embedding is that each triple \((h, r, t)\) in the knowledge graph such that \( h + r \approx t \). So that its credit score can be expressed as

\[
f(h, t) = \| h + r - t \|^2_2
\]  

(12)

In the training process, the embedding vector is trained with positive and negative samples, and the embedding vector is updated by generating a certain percentage of negative samples with the following loss function.

\[
L_{\text{TransR}} = \sum_{(h, r, t', t)} \max(0, f(h, t') - f(h, t))
\]  

(13)

Where the purpose of \( \max(x, y) \) is to calculate the maximum value between \( x \) and \( y \). \( t \) is the correct counterpart of \( h \) and \( r \) in the knowledge graph and \( t' \) is a negative sample generated by
random sampling. The method is used to train the knowledge graph by maximizing the difference between positive and negative examples.

3 3. Results and Analysis

3.1 The impact of employment education with big data Internet technology

In traditional teaching, teaching resources are basically in the hands of teachers, and teachers are the most authoritative experts. When students encounter problems, the first thing they think of is to seek help from the teacher, and learning activities can only be carried out with the teacher’s participation. In this case, students are very dependent on the teacher. Therefore, the main task of the teacher is to transmit knowledge and experience through the accumulation of previous students. In this way, the student is the recipient of knowledge. Due to his superior knowledge, the teacher gets the leadership of the class. It is not easy to accept the doubts and new ideas of the students. Students have a weak sense of subjectivity and are used to obeying and depending on the teacher. They are afraid to challenge the teacher’s authority with their skeptical eyes and critical thinking. Based on the current teacher-student relationship, university education is seen by the public as a one-sided communication from teachers to students. However, the integration of the Internet and education has brought a new way of thinking and approach. With a diversified view of knowledge, the educational space for teachers and students is no longer closed, which will form a cultural symbiosis between teachers and students with the characteristics of Internet thinking such as pluralism, equality, participation, cross-border, interconnection, cooperation, openness, and mutual benefit. The learning mode of the university classrooms has quietly shifted from textbook style to symbiosis mode, where diversified knowledge coexists.

3.1.1 Shaping an open and shared educational relationship

The teacher-student relationship is the relationship between the educator and the educated formed in the process of teaching. The impact of the Internet on teaching and learning is comprehensive, so the “Internet + Education” model is defined as a new form of education. In the traditional teacher-student relationship, the limited content and dissemination of knowledge make the relationship unbreakable. The application of Internet technology has broken the previously closed knowledge field and introduced society directly into classroom teaching, expanding the knowledge horizon of teachers and students. Teachers and students can make full use of the Internet to collect and study literature, videos, and other materials related to the topic to satisfy their learning interests. The Internet also enriches the form of educational activities, which both enlivens the learning atmosphere in the classroom and improves the intuitiveness and effectiveness of teaching. The gradual and deep integration of the Internet and education has had a significant impact on optimizing the allocation of educational resources and promoting educational equity.

3.1.2 Forming harmonious and mutually reinforcing ethical relationships

Education is not only the teaching of objective knowledge; Socrates said that “virtue is knowledge” and that knowledge includes all goodness, and people need to acquire good virtue through education. The ethical relationship between teachers and students is not only manifested through individual virtue but also through the teacher’s duty to educate people so that in the process of learning, the educated person can conform his or her values to the requirements of the times. “The basic function of teaching is to promote the dual construction of man and culture, that is, to accelerate the cultural production of man.” Teachers and students consciously or unconsciously understand the social roles
they play in the process of teaching and interacting with each other and behave themselves according to the corresponding role requirements. People’s words and actions are exposed to the sunlight in the Internet era, which easily allows teachers and students to form a stronger sense of self-restraint and abide by the corresponding moral codes.

### 3.1.3 Formation of democratic and equal interpersonal relationships

In his book *Free to Learn*, Rogers proposed the theory of interpersonal relationships in teaching, and he believed that sincere, respectful, and understanding teacher-student relationships could contribute to the achievement of learning goals. In the traditional education model, teachers are socially recognized for their role as knowledge transmitters, and members of society strive to maintain the dignity of the teacher, forming a dependent relationship of respect and inferiority between teachers and students. In the Internet era, on the other hand, everyone can share and communicate, giving new meaning and value to information and breaking the confines of the knowledge network. Teachers and students can freely discuss and cooperate with each other in teaching activities, forming an exchange of information in a brainstorming way. In the off-class, informal interaction can further ease the confrontation between teachers and students, remove the label of “face,” and realize equal and sincere interaction.

### 3.2 Countermeasures for building employment education with big data Internet technology

#### 3.2.1 Building a learning community of cooperation and mutual trust

Teachers and students are the main subjects of teaching activities, and the construction of a healthy teacher-student relationship not only ensures the successful completion of teaching tasks but also has a greater role in promoting teaching and learning and mutual trust between teachers and students. The learning community between teachers and students is not simply a collaborative relationship but emphasizes “common spiritual awareness, a strong sense of belonging and identity, and the interactive development of the individual and the collective,” which is continuous and deep cooperation and interaction between teachers and students. It is a continuous and deep cooperation and interaction between teachers and students, in which teachers and students can interact and exchange ideas in the process of discussion and collision of ideas around problems, improve their own knowledge spectrum, enhance their ability to identify and solve problems, improve their sense of learning, and form a “facilitating” learning atmosphere.

#### 3.2.2 Improving the utilization of the Internet and enhancing deep learning

The Internet brings the sharing of knowledge but also challenges the ability to acquire knowledge, such as identifying “fake knowledge” and solving “fragmented” learning problems. Students’ browsing of web pages is mainly focused on entertainment and short and fast news, and their knowledge intake is fragmented. Deep learning is comprehension learning, which is different from superficial learning. It focuses on critical thinking, emphasizes the application of knowledge transfer and problem-solving, and cultivates students’ “higher-order critical thinking, information integration ability and the ability to actively construct new knowledge.” Teachers should pay attention to guiding students to think deeply about a certain problem or relevant event in their major, make full use of the information provided by the Internet, combined it with the theories learned in the classroom, and improve the ability to link theory with practice. From the professional structure of employment education teachers, as shown in Figure 4, the personnel of management, education, computer, and finance majors account for 88.25% and also include foreign languages, literature, and mechanical
architecture. It can be seen that the professional sources of the existing college employment education teachers are complicated, and among the complicated professional sources, most of them are part-time, and the employment guidance courses are mostly temporary “side jobs,” which makes it difficult to guarantee their educational effectiveness. The practice of deep learning requires teachers to strengthen their own learning ability and teaching skills and to realize the positive teacher-student interaction of mutual promotion.

![Figure 4. Percentage of professional sources of teachers employed in higher education](image)

### 3.2.3 Improving role identity

Role identity is the internalization and adaptation to social role expectations, and both teachers and students should define their roles in a reasonable manner. Teachers’ identification with their own roles is a need for professional development and a process of self-worth realization. A competent college teacher should fulfill his or her duty of teaching and educating people, constantly update his or her knowledge and ability structure, and improve his or her ability to adapt to social development, as well as respect the individual differences of students, understand their needs and improve the awareness of serving them. The role of students is not synonymous with passive receivers, but students are members of learning communities and practitioners of deep learning. Students should improve their awareness and ability to active learning and should also respect teachers, eliminate communication barriers, and establish cordial interpersonal relationships with teachers.

### 3.3 The construction of the practical path of the teacher-student relationship of “Internet + education.”

#### 3.3.1 Building an artificial intelligence-driven system of virtual and real integration of intelligent learning partner relationships

First, developing artificial intelligence-driven virtual intelligent learning companions. Artificial intelligence technology provides the possibility of creating personalized virtual intelligent companions for large-scale online learners, which can realize the functions of personalization,
collaboration, companionship, real-time, and guidance of virtual intelligent companions. The personalization of virtual intelligent learning companions is based on each learner’s learning characteristics, learning style, learning behavior, and learning process, and can realize teaching or guiding each learner according to his or her ability. The collaborative nature of the Virtual Intelligent Learning Companion emphasizes the ability to collaborate with learners in problem-solving. It communicates with students based on their learning process, problem-solving status, and learning behavior data and facilitates problem-solving through message prompts voice communication, and example presentation. The companionship of the virtual intelligent learning companion focuses on learners’ emotions and emotional states and realizes the “emotional companion” function of the virtual intelligent learning companion based on the big data analysis of learners’ learning behaviors, learning process, and learning performance, highlighting the humanistic care for learners. In order to reflect the real-time and guidance function of the virtual intelligent learning companion, teachers build a database based on students’ common problems, learning behavior status, and emotional performance to realize real-time guidance and help for learners.

Second, establish a learning companion learning mechanism that integrates online and offline. Regular learning and discussion activities are the keys to building companionship, which is an important manifestation and demand of learners’ socialization. Teachers can be integrated into learners’ offline learning activities as companions, such as learning experience discussion, problem-solving negotiation, individual or team emotional communication, etc. Third, the seamless integration of virtual and real learning partners is constructed based on the Internet of Things, big data, and learning analytics technologies. Construct a virtual-real learning companion support system based on “Internet +,” collect data related to learners in the real learning field through technologies such as IoT, big data, and learning analytics, and use data dashboards to provide timely feedback for the session mechanism, learning guidance and learning management between teachers and students. With “Internet +” as a link, we realize the deep integration between virtual smart learning partners and teachers and build an artificial intelligence-driven system of virtual-real integration of smart learning partner relationships.

3.3.2 Creating a Smart Adaptive Learning Ecosystem for Personalized Learning

First, a multimodal digital learning resource library for personalized learning is formed. Multimodal learning resources are “nutritional packages” that nourish learners’ personalized development, taking learners’ multiple intelligences, learning styles, knowledge bases and learning abilities as the basic pointers. Based on the theory of multiple intelligences, teachers need to create collections of learning resources that support students’ multiple intelligences. The collections of learning resources are created, organized, and generated according to learning goals, students’ overall development, and the needs of different intelligence nurturing. In terms of students’ learning styles, teachers need to create types of learning resources that point to different learning styles and meet the needs of learners with different learning styles by using multiple representations of the same learning content, such as text, pictures, audio, video, animation, and virtual reality. In terms of students’ knowledge base, teachers need to granularly process learning content to push it to students of different levels, and teachers or learning systems need to decompose knowledge to meet the needs of students with different knowledge bases. In addition, the learning ability of students determines the hierarchical design of resources in the “agro-ecological cultivation” learning system, which requires that learning resources be arranged in a hierarchical order from easy to difficult so that teachers or learning systems can push learning resources according to the learning ability of students.

Second, build an adaptive learning service system for the learning process. The adaptive learning system can provide precise positioning and service support for learners’ learning process and provide
powerful support for the cultivation of learners’ personalized ecology. The personalized characteristics of learners usually contain eight dimensions, namely personal information, preference information, academic information, relationship information, safety information, management information, work information, and performance information. The learner’s personalized characteristics data includes the various information of the learner’s initial registration. Based on the learner’s personality characteristics and learning behavior big data, teachers can use learning analytics to provide early warning of online learners’ learning performance, track, accumulate and filter online learning behavior data, and predict the factors affecting learners’ learning performance through multiple regression analysis. The adaptive learning system can automatically take intervention measures based on the early warning factors of learners’ learning performance, such as learning schedule adjustment, learning content replacement, learning style change, and learning resource filling. Based on the knowledge space theory, information flow theory, Bayes’ theorem, and big data analysis technology, the adaptive learning system can accurately locate the acquisition status of knowledge points, develop learning progress and review methods, and recommend the best learning path. Teachers can observe learners’ learning dynamics in real-time based on students’ learning behavior data dashboards and adopt targeted and personalized learning cultivation methods.

Finally, we build a personalized learning ecological cultivation model of “test, learning, practice, test, and assistance.” Teachers use artificial intelligence technology in the whole learning process to obtain the learning starting point of learners through pre-testing and then use artificial intelligence technology to obtain students’ learning performance status in real-time in the subsequent learning process. Students use a combination of online and offline learning modes, online interactive learning in the form of video, text, or remote live, offline in the specific field of teacher-student, and student-student interactive learning in small groups. The integration of online and offline teaching not only achieves precise learning support for learners’ personalization but, more importantly, dissolves the loneliness generated by learners’ online learning and the deficiencies of offline learning resulting in patterned training. The “practice” refers to the learner’s testing of the learned content based on the wisdom-adapted learning system, and the system precisely locates the weak knowledge points according to the learner’s testing behavior and results and provides corresponding teaching videos, cases, and real-time adjustment of the best learning path. The “assist” emphasizes regular offline tutoring by teachers, who provide targeted explanations, communication, and humanistic care based on learners’ learning performance data in the Smart Learning System.

4 Conclusion

With the gradual development of network technology, “Internet+” has become the main development trend of modern society, which has brought great changes to people’s work and life. This paper is based on education reform and the strategy of employment education and management of college students under the environment of “Internet+.” It is hoped that this paper can provide some reference and help for the smooth development of college students’ employment education and management under the background of big data and internet technology. In solving employment problems, teachers can use the GRU employment education model theory for macro guidance of problem-solving activities, use a self-organization strategy based on educational reform to realize the continuous management of problem-solving process and combine critical thinking and deep conversation strategy to realize cultural symbiosis.

References


