Research on the Design of Training Evaluation Assistant Analysis System Based on Digital Capability Label Hierarchy

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Abstract. In order to meet the personalized learning needs and clear learning objectives of online learners. Meanwhile, push appropriate online resources for them, this paper established a digital capability labeling hierarchy based on job positions and actual work tasks by researching on digital capability labels which are integrated into learner modeling, test assessments and online learning resources. Using big data mining analysis technology, the training evaluation auxiliary analysis system automatically generates learning ability analysis reports, achieves accurate push learning resources. In this way, it will revitalize online learning resources and further improve enterprise human resources, while promoting industrial upgrading and technological innovation of training.

Keywords: online learning · digitization · labeling · competency assessment

1 Introduction

With the continuous development of new information and communication technologies, great changes have taken place in human production and life. Many scholars explore the influencing factors of online teaching service quality, which has important practical significance and research value for proposing targeted improvement of online teaching services and improving learners' online learning experience. [1–3]. The way of learning has also changed from traditional offline learning to large-scale online learning and mobile learning. At the same time, blended learning supported by various smart sensor wearable devices under multi-space fusion has become popular gradually. Promoting personalized education is one of the 14 major technological challenges that human beings will face in the 21st century selected by the National Academy of Engineering [4, 5]. Using new communication technology and big data technology to mine the value behind data and transform it into productivity will become a strong competitive advantage for education and training enterprises [6–8].

With the continuous emphasis on talent development, personal ability analysis has been studied by more and more experts and scholars. Scholar Yang Juan studied the factors related to the depth of learning cognitive participation in the online learning process [9]. Qiu Zhaomin and others found that the objectivity and fairness of teachers' evaluation will significantly affect students' willingness to continue using online learning

websites [10]. Wu Hongyi and others found in the empirical research that curriculum construction, evaluation, guidance and tracking, teaching design, and online curriculum resources have a significant impact on online learning service quality [11];.Vahid Baradaran and others pointed out that providing online learners in developing countries with the necessary information infrastructure and financial support can significantly improve learners' perception of online learning service quality [12].By constructing an automatic evaluation model of cognitive participation depth, he proposed an integrated prediction framework based on latent feature variational autocoding to weaken the effect of imbalanced educational data set on prediction of learning outcomes. The high-skilled talent strategy China Insight Report [13] released by the IBM Institute for Business Value pointed out that data is called a new natural resource, the core of an enterprise is human resources which is crucial to extracting value from data and then using it in innovative ways.

Considering the post competence requirements, this paper takes the power communication operation and maintenance as the research object, labels the technical skills that needed by in-service staff in this position and then forms a digital capability labeling hierarchy of communication major which is applied to training evaluation auxiliary analysis system. By adding digital ability labels to online learning resources, examination question bank and employees' training courses, etc. Moreover, conducting big data analysis on exam results, we can refine the generic skills and professional skills that employees need to master. Accordingly, this paper can create a quantitative analysis system that integrates with communication business, which can make a close analysis on correlation between company and employee participation in training and ability improvement, then generate analysis reports and customized learning plans intelligently so that promotes employees professional skill accurately.

2 The Overall Design of the Training Evaluation Auxiliary Analysis System Based on the digital Capability Labeling Hierarchy

The training and evaluation auxiliary analysis system based on the digital capability labeling hierarchy divides into two parts. The first part mainly sorts out the relevant chain of communication business and the basic information of learners (training data & examination data), etc. which realizes the construction of the professional digital capability labeling hierarchy. Combining with the needs of education, training and evaluation work, the second part focus on building a learning evaluation analysis model and analysis system via formed digital capability labeling hierarchy, which includes a four-layer structure of data source layer, data layer, application layer and display layer. The specific functional architecture is shown in Fig. 1.

2.1 Data Source

The data source of the evaluation analysis system based on the digital capability label system needs to ensure the integrity and quality of the data, such as basic information of the learner, work experience and job requirements, at the same time, the basic information data in training management is also included in the data source. Moreover, the whole system needs to ensure the integrity and quality of the data.
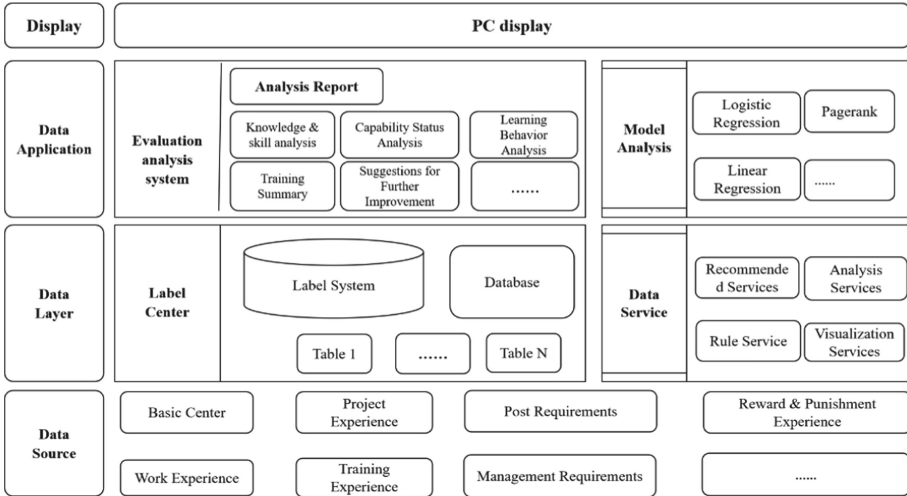
Fig. 1. The basic functional requirements framework of the evaluation system of the digital capability label system [Owner-draw]

2.2 Digital Capability Labeling Hierarchy

Establish a digital capability labeling hierarchy for communication operation and maintenance professionals through six steps, including business analysis and research, data collection and processing, business refinement, labeling hierarchy design, evaluation and analysis business model construction and business model verification, which consists of five-level labels, as shown in Table 1, the first level is technology and skill labels, technology labels are mainly theoretical knowledge that needs to be mastered, and skill labels are skill items that need to be mastered; The second level is the professional direction label, which can be used to quickly position to professional direction, such as distribution network automation major, communication operation and maintenance major; the third level is the post label, which is the subdivision of the second level label; The fourth level is the business direction label, the fifth level is the knowledge point skill item label, and then the sixth level and the seventh level label are added to refine the knowledge point skill item according to the actual needs. Through the label definition and hierarchical design, a label library is formed. This paper utilizes the fifth-level label to label the existing examination question bank and massive online learning resources and associates trainees' competencies and learning resources together.

2.3 Evaluation Analysis Model

Based on the data in the label hierarchy, an evaluation analysis data model is established. By adding capability label to test questions, according to the test results, artificial intelligence and big data technology are used to automatically analyze the correlation results of individual, team and major's ability improvement, etc. By the way, evaluation analysis data model can output the evaluation analysis report which has some main indicators,

Table 1. Example of Digital Capability Labeling hierarchy for in the field of communication [Owner-draw]

first level		second level		third level		fourth level		fifth level	
Code	Name	Code	Name	Code	Name	Code	Name	Code	Name
A	Technical management	A07	communications technology	A0704	Communication Technology sharing capability	A070401	Communication technology expertise	A07040101	Communication principle
								A07040102	Transmission network technology
								......	......
						......	......	......	......
B	Production skills	B07	Communication operation & maintenance	B0701N	Communication operation & maintenance	B0701N01	Operation and maintenance of transmission system	B0701N0101	SDH equipment operation and maintenance
								......	......
						B0701N02	Operation and maintenance of switching system	B0701N0201	Operation and maintenance of voice switching Core equipment
								......	......
						B0701N03	Network system Operation and maintenance	B0701N0301	Network equipment configuration and commissioning
								......	......
						B0701N04	Communication infrastructure maintenance	B0701N0401	Operation and maintenance of rectification and distribution equipment
								......	......

such as knowledge and skill analysis, ability status analysis, etc. It provides a reliable data basis for cultivation of professional talents and other work.

2.4   Evaluation Analysis System

On the basis of the label system and analysis model, this paper develops the evaluation analysis system. This system maintains not only traditional system management but also user management, authority management, system management, interface management, etc.

3   Design of Digital Capability Labeling Hierarchy

This paper comprehensively sorts out the current situation of the communication professional business, investigates the business standardization operations and job requirements of each chain in communication major's working process. Combining with various skill and knowledge points of communication profession in Skill Level Assessment, a valid digital capability hierarchy in this field should be taken shape after data collection that focus on practical behavior and management requirements in whole working process.

3.1   Business Research Analysis

According to the construction goal of the digital capability hierarchy framework of the communication major, this paper determines the research needs and designs labels particularly.

3.2   Data Collection and Processing

For data provenance, investigation on business supports tracing the data source and acquisition method for each data item. This paper definite the coverage of required data items in relevant business systems and clarifies what kind of data items can be obtained online and others need to be collected offline. For data obtained online, if there is a system authority problem with the data obtained online, it will be coordinated by various departments of college. For data obtained offline, it needs to further clarify collection method. For data acquisition, the first draft of data collection is formed based on the standard of ability requirements in Skill Level Assessment and combined with post ability requirements.

3.3   Business Refinement Design

Focus on the practical behavior business item, this paper determines the detailed requirements through label design. On the basis of this step, analysis methods and model selection of making label are clarified. By this way, data field requirements are clarified and we can expect the results in the future.
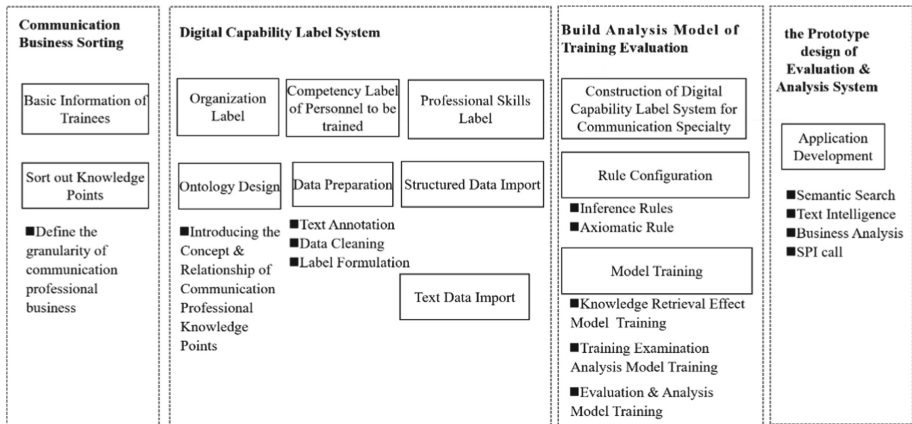
Fig. 2. Evaluation and Analysis Data Model Construction Route [Owner-draw]

3.4 Label Hierarchy Design

In term of the processed business data and business detailed design, this paper performs a label hierarchy, which is preliminary label summary and classification of business data in light of label of basic data, job data and skill data.

4 Evaluation and Analysis Data Model Construction

In this paper, a data model for evaluation and analysis is established by utilizing artificial intelligence and big data technology to automatically analyze the correlation results between training attendance and their ability improvement and output evaluation analysis reports to provide reliable data for the digital capability training and construction in the field of communication. As shown in Fig. 2.

4.1 Business Sorting and Label Construction

On the ground of sorting out the relevant business chains of communication major and the basic information of trainees, it forms the digital capability labels of the trainees, such as organization labels, trainees' ability labels, and professional skill labels, which is the basic step for constructing the training evaluation analysis model. The main process is to fix the list of communication professional knowledge points, finish ontology design, import data to label library, carry out rule configuration and model training and finally develop application, so as to realize the construction of the digital capability label hierarchy in communication field and prototype design of evaluation and analysis system.

4.2 Business Model Building

On account of the initially established label hierarchy, according to statistical modeling and machine learning theory, a variety of data modeling methods and multi items are

selected to test the accuracy and validity of label. Simultaneously, multiple groups of sample sizes are introduced for repeated testing. On the one hand, the advantages and disadvantages of various analysis methods are compared. On the other hand, the maturity of the labeling hierarchy could be verified.

4.3 Business Model Verification

For valid models, combined with historical year data, this paper coordinates communication experts to make professional judgments, interprets and discoveries comparative analysis results and conducts in-depth research on the final application effect of the labeling hierarchy. If verification effect is poor, label hierarchy can be adjusted and optimized by changing the label value, adjusting the model parameters or re-acquiring data.

5   Application Results of Training Evaluation Auxiliary Analysis System

5.1 Precise Guidance for Communication Major's Trainees Aimed at Their Skill and Technology Promotion

Through the collection of information system and communication professional ability information data, the big data analysis is carried out, and the communication professional digital ability label system is established. Through scientific management and maintenance of course recommendation, and mastering the maturity of trainees' knowledge, accurate guidance for the improvement of communication practitioners' skills can be achieved.

5.2 Enabling the Digital Transformation of Training

Training auxiliary analysis system based on the digital capability label hierarchy is applied on existing learning platform. The association analysis combining training data and test data of employees that generates ability analysis report which could be viewed from different dimensions and levels. It provides data support for making plan of training projects and accurate training position of headquarter and provincial companies which could empower training decisions making.

5.3 Optimize and Improve Training Effect

The training auxiliary analysis system based on the digital capability labeling system can grasp and analyze the utilization of communication professional training resources by trainees in real time. Absolutely, it has a direct promoting effect on efficiency and satisfaction of training, to some extend, and earning ability of trainees as well as training ability of trainers.

6 Conclusion

Based on the data collected by the digital ability of the communication specialty, the evaluation analysis data model is established through the data of the tag system, and the correlation results between the examination situation and the ability improvement are automatically analyzed using artificial intelligence and big data technology, and the evaluation analysis report is output. The main indicators include knowledge and skill analysis, ability improvement suggestions, etc., providing a reliable data basis for the digital ability training and construction of the communication specialty. In the next step, we will continue to study the efficient use of existing training resources, and use analytical data to provide decision support for talent cultivation.

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