Curriculum Design Based on Knowledge Graph

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Abstract

Curriculum design systems aim to help trainees find the most suitable training programs from a large amount of training courses in the educational training industry. Currently, there are many training programmes and various content levels of training are available in the educational market, and education management departments often do not provide enough guidance on educational training, making it difficult for trainees to choose to meet their requirements. The existing curriculum design methods fail to provide relevant customized content to users consistently [1]. The content is difficult to be updated and cannot meet users' professional learning needs. In this paper, we propose to design a knowledge graph-based hybrid curriculum training system, which will determine training patterns and training programs according to trainees' requirements. Through evaluating the training motivation based on the learning objectives needs, we aim to build a trainee model based on current cognitive level and knowledge state, conduct the knowledge field description using natural language processing and generate the customized program's curriculum [2]. The training programme mainly consists of training content and training implementation model, which corresponds to the original knowledge graph-based curriculum design. This paper builds a hybrid curriculum design system based on the knowledge graph, which helps trainers to develop learning objectives and learning content, reduce the cost of information search, improve learning efficiency and accelerate the

realization of training objectives.

I. Introduction

A. Motivation

With the rapid advancement of information technology, our society progressed into a new era with an increasing demand for talents of from various industries. According to a study by The United Nations Educational, Scientific and Cultural Organization (UNESCO), information technology accelerates the renewal of human knowledge. In the 18th century, knowledge was renewed every 80 or 90 years; from the 19th century to the beginning of the 20th century, the renewal process was shortened to 30 years; from the 1960s to 1970s, the update of knowledge of general disciplines was available every 5 to 10 years, and it was shortened to 5 years by the 1980s-1990s. While in the new century, the update of various disciplines has been shortened to a drastically 2 to 3 years [3]. In order to optimize the management and professional skills, more and more governments, education administrative departments, enterprises and individuals take part in continuing education and training to follow up and obtain the most up-to-date professional knowledge. With the help of internet technology, information of various kinds can be easily accessed and shared conveniently and almost instntly. These changes bring great challenges to training institutions, which are required to identify the priority of certain knowledge for selection in massive resources, thus "training loss" or "cognitive overload" are to be prevented [4]. As a result, the training curriculum design will be optimized with the availability of training programs satisfying the needs of the trainees in time.

A new hybrid curriculum design system based on knowledge graph assists the trainers to analyze the content, needs etc. of the training project, determine the problems to be solved by the trainees, analyze the behavior mode and efficiency when solving such problems combined with the thinking abilities, skills and cognitive abilities of the trainees, and work out the main content of the training with the goal as the orientation combined with the main factors of the training. Such systems cover the whole training field, including how to illustrate the curriculum design system based on knowledge graph, training content integration, training data collection, sorting, storage and analysis, training project design and training knowledge completion. With the support of the system, learning achievements are displayed, learning scenarios are constructed and learning transformation and skills are consolidated. Under the trainee- oriented concept, it is significant to recommend trainees suitable learning resources and help them master knowledge comprehensively and study efficiently. The trainees arrange their study reasonably according to the curriculum design scheme recommended

through the system, which can save learning time, reduce training costs, improve learning efficiency, and trainees' management and cognitive level as quickly as possible.

B. Challenges

With the rapid development of information technology, the knowledge update cycle is getting shorter and shorter, and the talent demand grows rapidly, and the demand for talent will maintain multiple growth in the future [5]. In order to cultivate more excellent talents in the field and meet the effective supply of talents, it is a huge challenge jointly faced by trainers, universities and enterprises.

At present, most of the training curriculum design is in the artificial design stage, and it is difficult to fully meet the needs of the trainees for skills and knowledge improvement. This is because the trainers focus on the education of knowledge itself, but has insufficient number of actual application scenarios, and lack top-level plans to explore the actual skills in the aspect of talent needs; on the other hand, the trainer needs various exposure, knowledge update, training needs, and then summarize the general requirements of training content to fit them into relevant learning content. This process requires the integration of information from multiple fields to complete the learning objectives and content.

However, the knowledge required by the trainees is distributed in different data sources. In the internet environment of information explosion, multi-platform retrieval and learning need to consume a lot of time and energy. Too much redundant information may also lower training efficiency and reduce the learning initiative. How to organize and analyze these data, help them locate the training content model, identify the relevant training resources is a topic for the paper.

The process of integrating training related information and making it into training content is a scientific task of knowledge management through analysis. Curriculum design research based on knowledge graph needs to rely on a large number of past training data to enrich the training information, build a knowledge graph-based training system, connect the needs of the trainees and training resources and tap its implied semantic information. To provide effective training design for the trainees is an important problem to be solved.

C. Methodologies and Research plan

This paper aims to establish a new hybrid curriculum design system based on knowledge graphs, to obtain the training content required by the trainees from a large amount of information, materials,

literature, training data, and to identify the need entities in the training field, and then form the needs model, integrate it into the knowledge graph, and provide the trainees with training curriculum design services around the core areas.

This paper focuses on the needs of trainees and academic resources, and constructs a training knowledge graph including technical fields, papers, trainees and training entities. The training data refer to the general training needs in different fields. In order to mine the semantic information of the data and implement the construction of the knowledge graph, this paper not only addresses the general needs but also the specific needs of the training field from the training papers and materials. The information that corresponds to the trainers' needs, through entity recognition and word co-occurrence matrix analysis, extracts the training ability model for each field, and uses the acquired training hot words as keywords to filter through relevant academic paper information, and finally complete the knowledge graph-based curriculum design.

II. Literature Review

This section mainly introduces the related theories and technical background in the thesis, including the knowledge graph architecture, knowledge extraction and storage query and other related technology applications, training design, evaluation and other related theories, onsite training, online training and hybrid training models, adaptive learning, phenomenology and the application of psychology in education and training, etc. The content lays the theoretical foundation for the following research.

A. Knowledge graph

At present, the development of artificial intelligence (AI) is in the ascendant, empowering various industries and promoting the era of human intelligence. There are many definitions of artificial intelligence, one of the classic definitions is: a system's ability to correctly interpret external data, to learn from such data, and to use those learning to achieve specific goals and tasks through flexible adaptation[7].

The knowledge graph began in the 1950s, and now it is an important branch of the development of artificial intelligence. The concept of knowledge graph was proposed by Google on May 16, 2012 [8]. Google aims to build a next-generation intelligent search engine based on this[9]. Knowledge graph technology creates a brand-new information retrieval model to solve information retrieval

problem provides new ideas. In essence, the knowledge graph is a semantic network that reveals the relationships between entities and can formally describe things in the real world and their relationships. The knowledge graph is a collection of all facts, concepts, rules or principles obtained and summarized by humans through observing, learning and thinking about various phenomena in the objective world. Knowledge graph has become an important way to promote machines to acquire cognitive abilities based on human knowledge and will gradually become an important means of production for the future intelligent society. Knowledge graph is not only an important cornerstone of artificial intelligence, but also promotes the development of intelligence and is one of the core driving forces for the development of strong artificial intelligence.

In recent years, with the rise of the semantic web, ontology technology has received extensive attention. Many large multinational companies have begun to study ontology technology. Google proposed a knowledge graph project aiming to use ontology technology to improve search accuracy and smarter knowledge browsing. Chinese Internet companies, such as Baidu and Sogou, have also launched projects in this area. Microsoft proposed the Probase project, which aims to build a large-scale ontology by crawling information in web pages[10]. IBM uses semantic web technology to handle the integration of heterogeneous medical data and more accurate query answers. Ontology technology has played an important role in Watson, IBM's famous question answering system[11]. Oracle has implemented a powerful semantic data reasoning and indexing system. Ontology technology is also supported by European and American governments. There are many achievements in the ontology research in the academic field, especially in the field of computer science, where many practical technologies have been developed. The European Union has invested over hundreds of millions of euros on scientific research funds in ontology-related research in the past five years.

Knowledge graph has become an important way to promote machines to acquire cognitive abilities based on human knowledge and will gradually become an important means of production for the future intelligent society. The knowledge graph aims to describe the entities that exist in the real world and the relationships between entities. With the development and application of artificial intelligence technology, knowledge graphs, as one of the key technologies, have been widely used in fields such as intelligent search, intelligent question and answer, personalized recommendation, and content distribution. In terms of scope of use, knowledge graphs are divided into general knowledge graphs and domain knowledge graphs. General knowledge graphs emphasize breadth. Most of the data comes from the Internet, while domain knowledge graphs are applied to vertical fields and

become basic data services.

B. Relevant Theory of training Curriculum Design

At present, training courses development models mainly include ISD model, HPT model, CBET model, DACUM model and ADDIE model.

ISD (Instructional System Design) is the design of instructional system, and ISD model is the model of instructional system design. It is based on communication theory, learning theory, and teaching theory. It uses system theory viewpoints and knowledge to analyze teaching problems and needs. ISD aims for a learner-centered rather than the traditional teacher-centered approach to instruction, so that effective learning can take place[15].

HPT (Human Performance Technology) is a model released by the International Society for Performance Improvement in 1992[16]. The HPT model is a wide range of interventions implemented using theories involving behavioral psychology, teaching system design, organizational development, and human resource management. Therefore, it emphasizes rigorous analysis of current and expected performance levels, finds out the causes of performance gaps, provides many interventions to help improve performance, guides the change management process and evaluates its results.

CBET (Competency-Based Education and Training) is a mode for approach to vocational education and training[17]. It relies on the results of professional competence analysis to establish authoritative national competence standards and compares with these standards to determine the level of employees, emphasize that the curriculum and teaching should adapt to the individual differences of the students.

DACUM, Developing A Curriculum (curriculum Development Process)[18], its essence is a method of analyzing and determining the ability required for a certain profession. Now it has become a scientific, efficient and economical analysis method to determine the skills required for a professional position.

ADDIE (A-analysis, D-design, D-development, I-implementation, E-assessment) model is recognized by the training industry as the most widely used course development model. Here we focus on the result-oriented training course design ADDIE model. In this paper, we use the ADDIE model to guide learning to achieve results, focusing on analysis, design and development using a variety of cases and practical exercises. The ADDIE model is described and applied, mainly as

follows:

• Carry out training needs assessment through organizational analysis, performance analysis and trainees' analysis.

• Select and use data collection techniques as part of training needs assessment.

• Construct teaching activities that focus on the psychological learning process.

• Apply the ROPES model (R-review and association, O-overview, P-show, E-exercise, S-summary) to construct effective learning activities.

• Develop complete learning goals based on observable actions and behaviors.

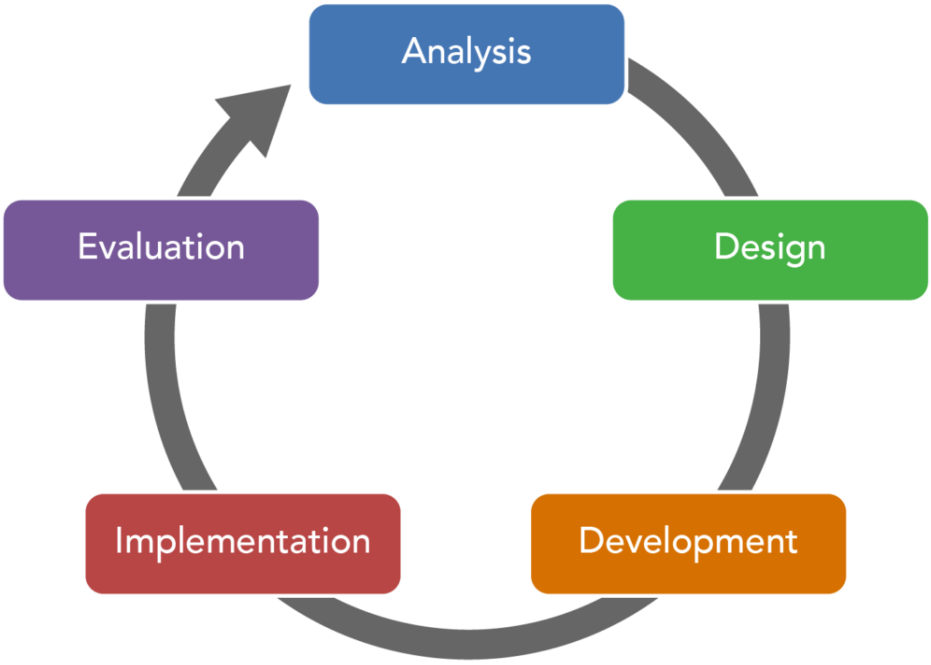

Figure 2 The ADDIE Model[19]

C. The four levels training evaluation

Kirkpatrick Model, also known as the Kirkpatrick four-level training evaluation model, was proposed by the internationally renowned scholar, Wisconsin University Professor Donald. L. Kirkpatrick in 1959[20]. It is the most widely used training evaluation tool in the world, and it has an unwavering position in the onsite of training evaluation. As shown in table 1, Professor Kirkpatrick believes that there are four ways to evaluate training effects: one is to observe the reaction of the trainees (Reaction), the other is to check the learning results of the trainees (Learning), the third is to

measure the performance before and after the training (Behavior), and the fourth is to measure Changes in the company's operating performance (Result).

Table 1 The main content of Kirkpatrick's assessment

Response assessment (Reaction)	Assess the satisfaction of the trainees
Learning assessment (Learning)	Measure the learning achievement of the trainees
Behavioural assessment (Behavior)	Examine the level of knowledge application of the trainees
Outcome evaluation (Result)	Economic benefits created by the training data analysis

D. Onsite, Online and Blend learning

D.1 Onsite Training

For a long time, the training of institutions has mostly used off-line face-to-face training, taught by teachers and experts, allowing communication and interaction on the spot. However, the use of classroom training alone often results in inflexible training time, high cost, boring format, and limited actual effects. At the same time, it is difficult to produce training effects, and it reduces the support and investment of the senior level of the organization. This requires the comprehensive use of classroom teaching, onsite visiting, forums, seminars, action learning at work, tutoring, job rotation, and e-learning and book reading in independent learning to realize a training system to support the effective implementation of training content and promote the development of organizational strategy.

D.2 Online Training

Online training is a training method and form created by the application of network technology and human resources as long as the field is developed. The online training system mainly conducts courseware resource management, learning, assessment and result analysis through the internet. It is a combination of online teaching evaluation and traditional models. There are two forms of online training: one is synchronous training, where teachers and students go online at the same time, and the teacher teaches courses and instructs students online; the other is asynchronous learning, where teachers can first put the teaching content and reading materials into the network system, students

can arrange learning according to their own time[21]. Online training also has some shortcomings. For example, the initial investment is large, some courses are not suitable for online training methods, the interaction is not strong, and the learning process is not easy to monitor.

A Massive Online Open Courses (MOOC) is a one of free online course hosted on the web which allows for large number of participants to enroll the course from anywhere in the world[22]. MOOCs often include interactive learning components, in addition to traditional course materials. MOOC platform is a specific type of software that support such course. Most of existing MOOC platform focus on functional design of course to deliver to large population of online users. However, such platform may lack of human factor design, such as affective, motivation, preservation, collaboration, etc., limiting its usage and efficacy.

In 2019, the unexpected COVID-19 accelerated the process of online education. The sudden closure of university campuses around the world has spawned a large number of demands for virtual courses, and training has also shifted from on-site training to online training. The universities and organizations require to make a quick decision to adapt the unexpected change and find a suitable solution to resolve problems and copy with the crisis. The trainers need to build and develop new distance-learning platform or system (Zoom, Microsoft Teams, Tencent Meeting etc.) to conduct the on-line seminar, lectures and executive development training for students and trainees.

A group of scholars conducted a comprehensive study of remote meeting and potential impact through an analysis of a large-scale telemetry dataset collected from February to May 2020 of US Microsoft employees and a 715-persons diary study. The result shows that a lot of peoples have the conducting a multitasking behavior during the remote meetings, and the multitasking can lead to both positive and negative outcomes[23].

The analysis results of online learning show that the a lot of factors that affect the learning effect of students: poor network, teachers' online teaching ability of teacher, the quality of platform resources and students' autonomous learning ability etc..[24]

D.3 Blended Training

Blended learning, also known as hybrid learning, are learning environments that allow for both onsite and online interaction. Typically, blended learning meet in person several times during a semester and provide for computer–based communication in between those face-to-face sessions[21]. As mentioned above, there are many shortcomings in online training. In 2020, the

COVID-19 pandemic promotes online and mixed-mode education as the new normal of training methods. The pandemic has accelerated the popularization of online learning models. Singapore Institute of Adult Education had investigated in cooperation with the University of Bristol from May to June 2020, hoping to understand the views and adaptability of educators from local higher education institutions and adult education and training institutions on online learning under the new crown epidemic, and how this model affects teaching and training methods.

The research team sent a questionnaire survey to public universities, polytechnics, technical education colleges, and private training institutions, and received feedback from more than 1,500 scholars, lecturers, and internal training employees of the company. The survey found that 63% of respondents said they frequently used online platforms during the epidemic. The probability of teaching and training on online platforms has increased four times compared to before. The most commonly used digital tools are the Microsoft Teams and Zoom video platforms[25].

Although the survey found that more than half of the faculty and staff in the fields of higher education and adult education believe that online learning is a major trend in the current epidemic and need to improve online teaching skills, the respondents did not agree with the full implementation of online classes, as this would have a negative impact on students' learning effects and physical and mental health. 59% believed that the combination of online and offline learning is better than simple online courses[25].

Blended learning mode, combined with online and physical teaching, is ideal compared to online learning. Face-to-face interaction has a certain effect on enhancing the learning effect. The survey also found that online teaching usually encounters many challenges, including unstable network connection, suboptimal digital equipment, limited technology skills in the students. 56% percent of the respondents believe that they have improved their online teaching skills, including better application of educational technology to stimulate students' interest in online learning, and they have designed online training materials.

To ensure that students’ learning will not be interrupted by the COVID-19 pandemic, many educators have made every effort to explore the best way to teach online. This includes upgrading digital skills and equipment, spending more time preparing lessons or redesigning courses, and dividing the learning content into smaller pieces. Block-style videos allow students to conduct online group discussions, use educational game applications to increase the interactivity of online classes,

and some provide additional online tutoring for students.

The original classroom was a combination of students squeezing in their seats and teachers teaching on the podium, but now suddenly it has become a combination of an online Zoom classroom plus family guidance. In fact, this form provides a viable foundation for the so-called "flipped" classroom. Flipping the classroom is a pedagogical approach where students first explore new course content outside of class by viewing a pre-recorded lecture video or digital module or completing a reading or preparatory assignment[26]. In other words, the courses that are usually taught in the classroom are now taught online, video, audio or written materials. Students can learn this content at their own pace and can pause and replay the courses as needed to grasp the key points.

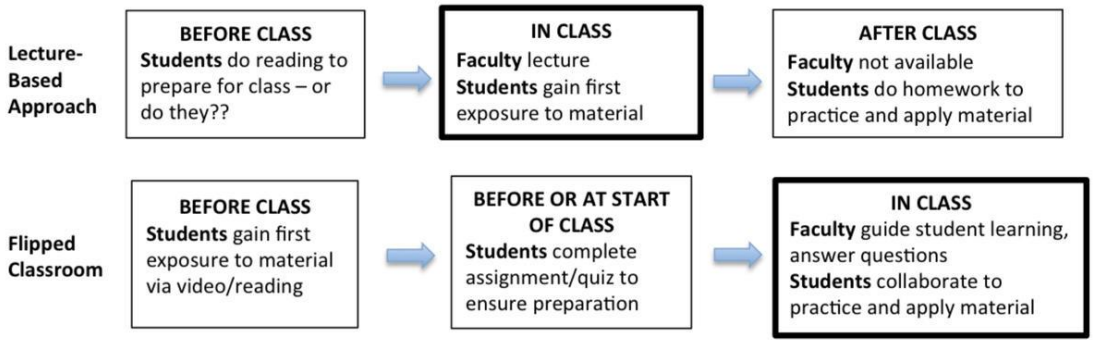

Figure 3: Flipped Classroom Introduction[27]

When students return to school, class time will be used for things that are traditionally "homework", such as discussing problems or research projects, and teachers can provide assistance and guidance from the side. At the same time, when needed, students can complete tasks individually or in academic groups.

How to evaluate students' online learning performance is also an ability that many interviewees think should be strengthened. Many interviewees have adjusted their assessment methods during this period, including changing the written test to homework, reducing the weightage of the summary test, using online tests and verbal questions more frequently, and allowing students to submit videos to assess students' daily routines and learning progress. The survey found that Singaporean adult educators have basic online teaching capabilities, but the ability to use new technologies such as Virtual Reality and Artificial Reality for experiential or immersive teaching needs to be strengthened[25].

E. Phenomenological Pedagogy

Phenomenological pedagogy was produced under the influence of the phenomenological philosophy movement in the 20th century. Professor Van Menan of the Faculty of Education of the University of Alberta in Canada is one of the pioneers of "phenomenological pedagogy". Van Menan's explanation of phenomenological pedagogy is: "phenomenological pedagogy wants us to get rid of theories and presuppositions, put aside our prejudices and existing opinions, and carry out useful reflections to form a kind of specific education that reflects the sensitivity and decisiveness of the situation."

Implying some basic ideas and methods of phenomenological pedagogy in China's schoolmasters' training has great reference and inspiration on the reform and innovation of modern schoolmasters' training. Therefore, it will result in the possibility of the paradigm transformation of the schoolmasters' training[28].

Phenomenology, as a research method, has now become an important research method. Applied phenomenological methods can analyze the design and teaching practice of training courses, sum up experience and encourage applications.

F. Adaptable Education

Adaptive learning is based on behaviorist psychology and cognitive psychology. Adaptive learning technologies provide an environment that can intelligently adjust to individual learner needs by presenting appropriate information, instructional materials, scaffolds, feedback, and recommendations based on learner characteristic and particular situation[29]. It begins to explore the human self to adapt to a learning mode, and produces a habitual conditioning information processing system, which is called "adaptive learning construction model system ". In general, people's learning can be divided into three different types according to different learning content and methods. They are mechanical learning, teaching learning and adaptive learning. Adaptive learning usually refers to a learning method that provides learners with corresponding learning environments, examples, or fields, and through the learners themselves discover and summarize in learning, and finally form theories and can solve problems on their own.

Adaptive learning, also known as adaptive teaching, is an educational method that uses computer algorithms to coordinate interaction with learners and provides customized learning resources and

learning activities to address the unique needs of each learner. Pearson define digital adaptive learning tools as education technologies that can respond to a student's interactions in real-time by automatically providing the student with individual support[30].

In a professional learning situation, individuals can "test out" some training methods to ensure that the teaching content is updated. According to the learning needs of students, the computer generates educational materials adapted to their characteristics, including their answers to questions and completed tasks and experiences. The technology covers various research fields and their derivatives, including computer science, artificial intelligence, psychological testing, pedagogy, psychology, and brain science.

Adaptive learning is dedicated to transforming learners from passive information receivers to learning collaborators in the education process. Adaptive learning systems are mainly used in education, and another popular application is business training.

G. Educational Psychology

Educational psychology is mainly a science that studies the effect of education on human learning intervention. Today's educational system is highly complex. psychologists working in the field of education are focused on identifying and studying learning methods to better understand how people absorb and retain new information[31]. Educational psychology conducts research on the teaching psychology of educators and the learning psychology of students and applies relevant research results to actual educational work. Its application can play a very positive role in promoting the design of the institute's curriculum, the improvement of teaching methods, and the help of students' mental health growth. Educational psychology is based on psychology and has systematic research on the design of teaching programs, guidance of educational methods, and management of teaching classrooms. The introduction of psychology elements into the actual teaching courses of vocational training can help teachers better grasp the dynamics of students' thoughts and enable them to adjust relevant curriculum arrangements in a targeted and timely manner, thereby enhancing students' interest in learning.

III. Knowledge Graph Curriculum Design Model Construction- Hybrid Training Interactive Design System

Constructing curriculum design based on the knowledge graph proves the feasibility and effectiveness of automatic generation, establishes specialized knowledge graph for different fields

and intelligently recommends relevant learning and training resources for a variety of personalized training. Meantime, the research on educational modeling language applies the concept of "learning scenario" to provide trainers with "learning" in the environment and solving problems in actual scenarios Training curriculum require system designers to have a good understanding of the field of knowledge to be trained, define, analyze, and solve problems. This paper will integrate the concept of digital technology with the "learning scenario" to target the precise goal of knowledge acquisition[32].

A. Training Module Design

At present, artificial intelligence and knowledge graph applied to the analysis and integration of multi-source data can instantly illustrate the relationship between concepts and entities and contribute to the rapid development of the training field, which is of great theoretical and practical significance [33]. As an integrated data repository, knowledge graph integrates a large number of training course data and learning process evaluation data in the field of training, extracts training needs, training process, training objectives and other concepts, interconnects different training data, identifies the links among concepts, and constructs training recommendation system based on knowledge graph, including technology field and training entity (See Figure 4).

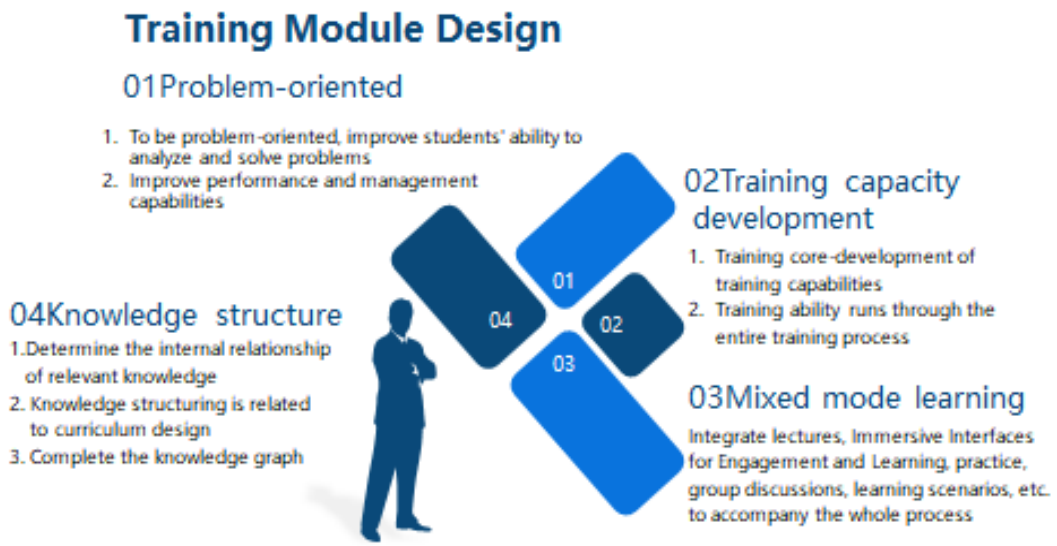

Figure 4

B. Hybrid Training Curriculum Design Model

This system uses the training project data of years in a training institution as one of the main supporting data sources. For many years, this training institution has organized and conducted training based on the First Principles of Instruction of David Merrill[34], the Four Levels of Training Evaluating of Kirkpatrick Model[35] and the Phenomenological Pedagogy and other theories. Combined with the training entities and closely linked to the goal of teaching, this institution pays attention to problems, and makes efforts to promote learning, and actively achieves the training objectives of good effect, high efficiency and large participation. The system will study and analyze different types of training data in the corresponding year, including training form, topic, content, background information of trainees (trainees' countries development status, students' knowledge level, professional level, management ability etc.), training evaluation and feedback, ability improvement and knowledge application after training, etc. And the system integrates the training data over the years, classifies and summarizes the data, extracts the relationship between training concerns and concepts contained in the data, evaluates the quality of classified data and solves the practical problems in training curriculum design.

The system uses the database and relative training subjects to form the infrastructure, and creates the functions of knowledge graph construction, personalized (customized) training course design, training course retrieval, training evaluation and training achievement display for multi-level and multi-disciplinary in classified training areas. Trainers can extract key terms and topics from the constructed knowledge graph, adjust them from bottom to top according to the needs of the trainees, focus on the problem solving before, during and after training, and generate the final curriculum design embodied with integrated professional training. It provides an intelligent interactive application system to help trainees demonstrate new knowledge, improve guidance, take the needs, thinking, skills and cognitive ability of trainees into account, and help trainees apply new knowledge and improve efficiency.

In constructing the knowledge graph of training field, in order to ensure the comprehensive, accurate and highly targeted original data, this paper takes an institution's training project since 2005 as the basic data source, combines with the function of online training platform, classifies the training data and obtain "keywords". This paper extracts relevant training papers, uses the function of VOS viewer to deal with "keywords", and presents a knowledge graph with reference significance in relevant training fields. Based on the training experience of the training institution for many years,

the immersion learning experience is introduced into the project training process, and the relevant training list is formed (see Figure 5).

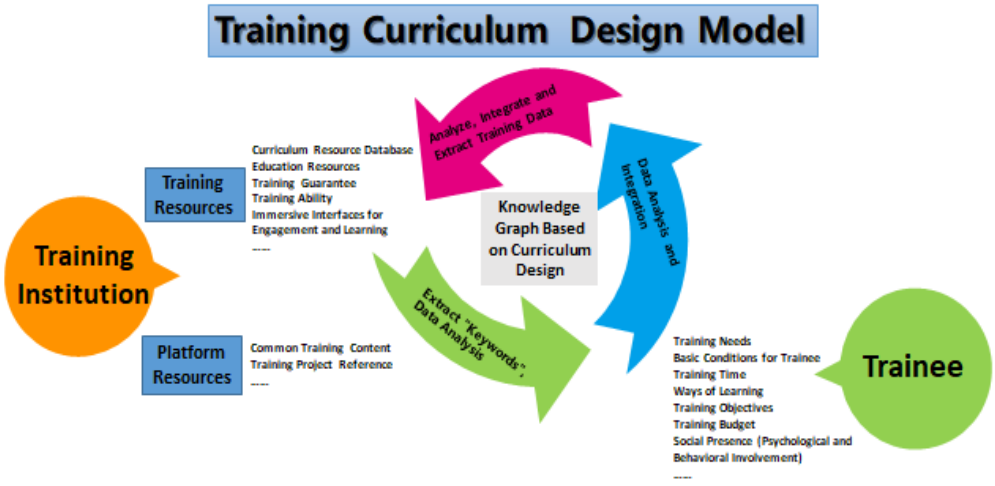

Figure 5

Referring to a large training data and the need analysis of the trainees, this study establishes a set of curricula concepts and continues to expand, determines the sequence, clarifies the interdependence between knowledge concepts, uses natural language technology to design an interactive recommendation system, and aims to construct a depth-first training knowledge graph reasoning model to obtain training information from the system quickly and accurately. The system combines the training content and the relationship of training subjects to display the training design and effects in a variety of chart forms. The specific elements are as follows:

a. Training knowledge representation and reasoning.

b. Acquisition and completion of training data: define the physical model of trainers, trainees and training resources, including external resources and existing curricula resources, teaching instruction, learning behaviors, known optimized curricula plans etc.

c. Training content analysis: combined with years of training results, a training experience questionnaire is proposed before the design, to quantify the trainees' experience. The questionnaire has a modular structure, including pre-training training needs, training capabilities, expected effects etc.; fluency and interaction during the training; post-training feedback and efficiency of application in practice. The system aims to focus on the problem, evaluate the training objectives of the trainer's known conventional knowledge, learning goals, ability and interests, excavate hidden information and recommend new training contents.

d. Training curriculum storage and chart analysis.

e. Curriculum design representation based on knowledge graph.

f. Future development hotspots: setting up of remote training platforms, describing the function, quality, software and hardware architecture of the remote training platform through knowledge graph.

V. Conclusion and Future Work

With the rapid development of information technology, the overall demand for talents is growing rapidly. The training field lacks planning and design from the perspective of talent demand. Greater research is needed to filter and retrieve training information and learning resources on multiple platforms, followed by processing them into applicable knowledge. The design of the training system based on the knowledge graph technology focuses on the relationship between the two entities of the training. It is one of the main methods to solve the above problems and can effectively organize and integrate multi-source heterogeneous knowledge. In recent years, many scholars have devoted themselves to constructing a knowledge graph of the academic field to help users better discover the connections between knowledge. Most of the research questions are developed around the exploration of the academic field and the relationship between entities. However, talent demand and training resources can be related to each other, and the semantic information implicit in the training needs can be deeply mined, and the position ability requirements of the trainees can be extracted from them, and the training resources can be connected through the concept of the domain. A one-stop for the trainees to provide knowledge question-and-answer services in the field of knowledge graphs can help trainees to reach the training goals and learning content based on society's needs for talents, reduce information search costs, and improve learning efficiency.

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