Research on the Construction of Diversified Integration between Industry and Education Course Content Based on Information-Based Artificial Intelligence

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Abstract: *Given the problems of deep integration between educational digitalisation and industrial intelligence, the old curriculum system can no longer meet the demands for change in the industry and the different learning needs of students. The purpose of this paper is to organise all kinds of forms of industrial-educational cooperation based on information-driven artificial intelligence. Clarify the application model of intelligent technology in education and the essential components of the curriculum, and explain how they are integrated and work together. According to the ability framework, intelligent integration of all kinds of knowledge resources and dynamic path generation have been added to the construction mechanism of reverse design. Many other places have also begun to apply this technology in various ways to develop human-computer collaboration, personalised recommendations, data-driven evaluation, etc. The goal of this paper is to offer some theoretical support and practical ideas for building an intelligent, future-oriented new-generation curriculum system that integrates industry and education.*

Keywords: *Information-driven Artificial Intelligence, Integration of Industry and Education, Course Content Construction, Competency Framework, Personalized Learning, Dynamic Generation*

Introduction

With the rapid development of the industrial technology system and the profound changes in the model of knowledge production, the timeliness, adaptability and relevance of traditional course content, which are based on a fixed disciplinary logic, have been greatly reduced. Although the aim of the diversified integration of industry and education is to narrow the gap between education and industry, dynamic construction, precise alignment and scaled personalised implementation of its course content have always been the main problems in theoretical exploration and model innovation. Representative examples of information-based artificial intelligence technology that can solve the problems mentioned above are machine learning, natural language processing and knowledge graphs. Given that they are good at collecting data, cognitive computing and intelligent decision-making can be used to change the form of course content from fixed assumptions to dynamic creation, and provisions can be made more precisely according to changes in the demand for industrial talents. Therefore, researching the construction theory and implementation path of diversified integration for industry and education in course content, driven by information-based artificial intelligence, has significant theoretical value in promoting the application of intelligent education and advancing the development of curriculum theory, and it is also an urgent practical need for achieving the co-evolution of education and industry and cultivating future-adaptive talents. This paper will present all the contents and cover both the construction mechanism and the implementation guarantee in theory and practice.

1. The Connotation and Theoretical Correlation of Information-Based Artificial Intelligence and Diversified Integration of Industry and Education Courses

1.1 The Technological Core of Information-Based Artificial Intelligence and Its Characteristics in Educational Application

1.1.1 Technological Architecture Based on Data Perception and Cognitive Computing

The foundation of technology for information-based artificial intelligence is to organise and explore the various data from all over the world in education. There are two levels of data awareness and cognitive computing. Collect all the relevant data from all places and through all links in the perception stage. Using the technology of machine learning and knowledge graphs, the cognitive layer will perform pattern recognition and relationship mining on the data, imitate humans' analysis and decision-making, and thus give the machine some "understanding" and processing ability for the complexity of education.

1.1.2 Features of the Intelligent Transition in the Educational Application Paradigm

The three main attributes of change in educational applications for the new technological system are as follows: First, it will be personalised and adaptive; that is, based on the different needs of students, the learning path can be adjusted dynamically. Second, it is immersive and embodied; with the help of VR/AR technology, very realistic practical scenarios can be created for students to learn by doing. Thirdly, it is particular and early; with the help of big data analysis, we can precisely identify which students have dropped in grades and take corrective measures in time[1].

1.2 The Main Components and Value Orientation of Diversified Integration of Industry and Education in Course Content

1.2.1 Content Elements of Cross-Border Integration and Dynamic Evolution

First of all, at the core is cross-border integration of the knowledge system. The content is no longer limited to a single topic; now, it has been extended to cover basic theories, industry technical norms, engineering implementation methods and business operation logic, etc., to form a complete knowledge system that can solve all kinds of problems. Second, there is the problem of the concreteness of skills and competencies. Course modules and project tasks are directly in line with the vocational ability models and job competency requirements of the industry, so the learning goals are in line with the demands of work. Finally, it will be changes in the content that keep it going. In light of the changes in industrial technology, the content of the course should also be updated to keep up with the times.

1.2.2 The Value Logic of Linking Innovation and Capability Generation

Now it is no longer about spreading knowledge, but about building a network of innovation. First, it can link cognitive logic with industrial logic to have learners build a whole cognitive chain that goes from theoretical foundation to technological application and finally to commercial value. Secondly, link learning with the process of innovation and design by giving students micro-samples of innovation practice to inspire them to think innovatively, find problems, explore solutions and build prototypes. The ultimate goal is to align the actual abilities of the people with the changing demands of industrial transformation, cultivate essential talents who can handle future changes in society and drive industrial upgrading.

1.3 Theoretical Basis and Internal Logic of the Integration of Intelligent Technology and Courses

1.3.1 The Theoretical Foundation Provided by Cognitive Science and Constructivism

The first item in the list is the theoretical foundation of integrated learning. Distributed Cognition Theory believes that cognitive activities are spread among people, tools and the environment. Intelligent technology is a type of cognition that has expanded and changed the distribution of human cognitive functions. According to the theory of constructivism, students construct knowledge through interaction with their surroundings. With the application of intelligent technology, people have created an abundant and interactive digital world and forged a new kind of meaning. All of the above theories believe that technology-assisted learning is reasonable and effective[2].

1.3.2 The Integration Logic of Two-way Empowerment and Ecological Reconstruction

It is in the spirit of two-way empowerment and co-evolution. The goal of course empowerment through technology is to improve the adaptability and self-optimisation ability of courses by means of deconstruction, digitisation and precise intervention. Courses can be employed to guide the application of technology in complicated industrial environments and advance the development of technology for deep semantic understanding and human-computer interaction. The goal of deep integration is to build an educational ecosystem that can effectively integrate courses, students, technology and the demands of various industries at all times.

2. Construction Mechanism of Diversified Integration of Industry and Education in Course Content Orientation for Intelligent Technology

2.1 Analysis and Reconstruction of Course Content Elements Based on a Competency Map

2.1.1 Formal Representation of Industrial Competency Demands and Construction of a Competency Map

The first is to systematically break down the requirements for industrial competence and formalise them. Collect all kinds of industrial data, and with the help of natural language processing technology, organise the competencies in an organised way. Based on the domain ontology, a network of hierarchical, sequential and combinatorial relationships will be constructed among these units of competence to build an executable and scalable industrial competency map. The map above shows the organisation and systemisation of hidden occupational demands, and it can serve as a good "demand-side" reference map for curriculum construction.

2.1.2 Refined Mapping and Reverse Design of Educational Content Elements

According to the competency map, the items in the course content have been mapped in reverse design. Each node in the high-level competency is broken down into supporting sub-goals for knowledge, skills and attitudes, and these are further specified as specific, measurable learning objectives. Based on the above goals, the modules of "content-activity-assessment" are constructed by integrating concept explanations, case studies, operational tasks and assessment rubrics, so that the structure of the course content is in line with the demands of industrial competitiveness[3].

2.2 Intelligent Identification and Integration Mechanism of Multi-source Knowledge Streams

2.2.1 Automatic Collection and Semantic Annotation of Multimodal Knowledge Sources

Continue to gather new knowledge from research institutions, open-source communities, industries, etc., and employ special collection technology. Deep learning can be employed to automatically classify and extract information from many kinds of data, such as text and code. Semantic analysis technology is employed to find the main ideas, technical methods and connections among them. First, the information will be annotated and linked to the nodes of the competency map to form basic knowledge fragments with semantic labels, and then it will be deeply integrated.

2.2.2 Ontology-Based Knowledge Fusion and Contextualized Reconstruction

Given the large number of sources for knowledge, some of them are redundant or contradictory; thus, it should be integrated into a teaching plan. The first is to establish a domain ontology for semantics and link terms and relationships among concepts. Based on the above, knowledge fusion is employed to filter and weigh the information based on its reliability and timeliness. Finally, the knowledge is organised in education according to the teaching objectives. For example, one can create step-by-step examples or project scenarios, turn this information into ready-to-use "contextualised knowledge components", and then save them in the course knowledge base.

2.3 The Structured Generation Path of Dynamically Adaptive Course Content

2.3.1 The Real-Time Perception of the Learner's Multi-Dimensional Profile and the Learning Context

The generation logic of the system begins with accurate perception of the learning subject and the environment. According to the history of interaction data, assessment results, behaviour patterns and stated goals, cognitive style tests, etc., build a multi-dimensional dynamic learner model and continuously update this model. The components of the model are the learner's current knowledge, skill level, cognitive interests, metacognition and learning goals. At the same time, the system can also obtain contextual information about the current learning environment, such as available time, learning materials, stage of the course, etc. According to the learner model and actual data, customise the input conditions for content generation[4].

2.3.2 Generation Content Assembly Engine and Synthesis of a Personalized Learning Path

In accordance with the rules of pedagogical logic (such as knowledge dependency, cognitive load theory and optimal learning sequence), adaptive strategies are employed to intelligently retrieve, filter and organise the components of the content in the structured course knowledge base for the main generation engine. Take the current learner model and context as the "query" for the engine, and then have it calculate and generate an optimal content combination solution; this can be a personalised sequence of theoretical studies, a set of targeted exercises, a micro-project suitable for the learner's current ability level, or a specific collaborative task assignment. Keep the internal logic of the knowledge system, and at the same time, adjust the difficulty, scope, speed and form of presentation of the content according to the personalised learning path dynamically.

2.3.3 Data-driven Closed-loop Optimisation and the Evolution of the Content System

Every case of content creation and distribution is not the end, but rather the beginning of an extended optimisation cycle. Automatically collect and analyse the real-time interaction data of learners in the learning path (such as dwell time, frequency of interaction, quality of task completion and emotional feedback) and summative assessment results in the system. Based on the above data, the next piece of content for this student will be changed immediately (a micro-loop). Together, they are also used to evaluate the quality of the components in the content, the accuracy of the learner model and the reasonableness of the generation rules. Based on the above evaluation, fine-tuning will be performed automatically on the component weights, relationships and generation rules in the knowledge base. Gather the supporting materials, and then have the curriculum designers revise the competency map and the core knowledge base (this is a macro loop). Therefore, the creation of course materials is now a living thing that can monitor itself, correct errors, and develop gradually.

3. Implementation Dimensions and Guarantees for Course Content Driven by Information-Based Artificial Intelligence

3.1 The Human-Machine Collaboration Model for Course Content Development and Iteration

3.1.1 The Strategic Design by Human Experts and the Automated Generation by Machine Intelligence

The human curriculum expert and the industry expert are responsible for planning, innovation and valuation of the curriculum in this model. They are responsible for setting the general goals of the course, the overall framework of abilities, the top-level teaching ideas and ethical limits, and also proposing the initial content topics and main project scenarios based on professional knowledge. At the same time, machine intelligence is also a powerful tool for execution and extension that can carry out automated operations according to the frameworks and rules set by people. For example, one can use natural language processing technology to read a large number of papers and cases quickly, help generate an initial explanation of a knowledge point, collect related teaching materials, and automatically create some basic test questions. A machine can automatically generate a simple 3D model or create behaviour scripts for non-player characters according to the scenario description in the development of virtual simulation content. Divide the labour among specialists so that they can focus on high-end design and decision-making, and have machines perform repetitive, computationally intensive work; thus, both the efficiency and the scope of curriculum development will be greatly increased.

3.1.2 Data-driven Dynamic Optimisation and the Collaborative Iteration Process

The periodic updates to course content are no longer based on experience; now, they will be adjusted constantly and flexibly according to teaching data. The intelligent machine will continuously collect and analyse data on how well the students are learning and participating in class, automatically find any problems with the teaching materials or other weaknesses in their learning, and immediately point out outdated knowledge. The results are given to the human experts in the form of pictures and specific advice. Based on their own educational theories and industry knowledge, the experts will interpret and evaluate the patterns produced by the machine, then determine the direction and plan for optimisation. Rearrange the order of the content, add some explanations, update the case studies, and add some practical application parts. Next, the experts will convert the optimised decisions into rules or instructions for the machine, and it will automatically carry out the revision, addition and republication of the content. The closed-loop process above is a cooperative iteration cycle of "machine monitoring and diagnosis - human decision-making and intervention - machine execution and optimisation", and it can promptly adjust the content of the course based on feedback about teaching effectiveness and changes in the external environment.

3.2 Personalised Learning Content Delivery and Feedback Powered by Intelligent Technology

3.2.1 Accurate Content Matching Based on a Multi-Modal Learner Model

At the bottom of personalised delivery is a constantly changing and very detailed learner profile. According to the learner's existing knowledge, current level of understanding, long-term learning goals, behaviour in the system (e.g., clicks and view duration), position in social networks, emotional expression (sentiment analysis of text and voice), etc., the model will also learn about their cognitive style, learning preference, interests, and so on. Based on the multi-dimensional model above, a hybrid method combining collaborative filtering, content-based recommendation and deep learning is employed to calculate and filter, in real time, the most suitable content units from the structured course knowledge base according to the current cognitive needs and interests of the learner. The corresponding content will be updated dynamically; as the learner's model changes, it will be adjusted in real time to keep the provided sequence of content within the learner's "zone of proximal development" and maintain a good balance of learning difficulty and interest.

3.2.2 Real-Time Interaction Analysis and an Adaptive Feedback Mechanism

Problems in students' study habits can be found early on using intelligent technology. At the same time, the system will also track the learner's learning behaviour in real time and determine whether they have grasped the material well, thought about it properly, or are confused about something by observing the steps taken and the words used. Based on the above diagnosis, some automatic corrections will be made. Feedback should not only indicate whether something is right or wrong, but also provide guidance on how to correct it, recommend related learning materials, pose further questions to stimulate students' thinking, offer scaffolding support for difficult tasks at a particular time, etc. In fact, the system can show the guidance information in augmented reality or offer a safe simulation of the dangerous operation and corrections in a virtual environment. Thus, the feedback will not only be a general evaluation at the end but also given more often during the learning process.

3.3 A Quality Assessment Framework for the Continuous Optimisation of Integrated Course Content

3.3.1 Process Data and Multi-dimensional Effectiveness Indicators

The source of the assessment data for this framework is now many places in all parts of the learning process, not just the final results. The above are the content access logs, frequency and extent of interaction, project completion quality, collaborative network data, forum discourse semantics and affective computing data. Based on the above process data, several evaluation indicators have been established. The contents are of high quality, have a reasonable distribution of difficulty, are in line with the competency map, and are rich in resources. The teaching factor is the degree of individualisation in teaching and learning, students' sense of participation, and whether the cognitive load is appropriate. The four levels of the results are the degree and intensity of competency achievement, the effect of knowledge transfer, and learner satisfaction. Taken together, the above indices indicate that there are some problems with the current operation of course content.

3.3.2 Predictive Analysis and Root Cause Mining Based on Machine Learning

The first reason for building the assessment framework is to study the data. Clustering analysis, association rule mining and predictive models are all kinds of machine learning algorithms that can find various patterns and correlations in large amounts of process data. For example, one can predict which groups of students are more likely to drop out of a particular content module, analyse all the effects of different kinds of content presentation (e.g., videos, interactive simulations, texts) on the effectiveness for students with various cognitive styles, and discover common sequences of factors that lead to low success rates in project tasks. Based on the above predictive analysis and root cause mining, we will know why there are problems now and predict future problems to take corresponding data-driven measures that improve the quality of content. Based on the above framework, we will continuously improve the system by evaluating it, identifying problems, correcting them, and re-evaluating in order to better adapt the course content system to changes and achieve a high level of effectiveness and efficiency.

Conclusion

Organise all kinds of plans for the construction and application of all kinds of integration models for industry and education course content in an information-based artificial intelligence environment in this paper. Research has provided some theoretical support and shown that intelligent technology can improve the direction of both senses. As shown above, the content of the courses is organised according to the demands of industrial competency and various sources of knowledge are integrated in an intelligible manner to create personalised learning paths dynamically. Specify the guaranteed scope of application for human-machine collaboration, intelligent recommendation and data-driven evaluation, etc. The goal of the above framework is to change the nature of course content from a fixed "product" to an intelligent "living thing" that can continuously observe changes in people's needs, assimilate knowledge, adjust according to different individuals, and self-optimise.

However, there are still many problems in the construction and development of this system, such as ethical issues and privacy protection of multi-modal educational data, full formalisation of complex industrial contexts, dynamic allocation mechanism of rights and responsibilities between experts and machines in human-machine collaboration, and barriers to cross-organizational data integration and knowledge sharing. Given that we have achieved some success in technology ethics so far, in the future, more research will be conducted on lightweight and explainable adaptive generation algorithms, in-depth modelling of learners' metacognitive and emotional states, and the establishment of standards for open and interoperable educational intelligence systems. According to the above theory, it will be possible to build a good, reliable and large-scale practical environment.

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