Research on Strategies and Implementation Pathways for Higher Vocational Digital Talent Cultivation

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Abstract. The vigorous development of the digital economy has spurred the emergence of numerous new industries, new business models, resulting in an explosive growth in demand for digital skilled talents. Higher vocational education is a crucial source of digital skilled talent. Currently, there exist problems such as structural mismatch between cultivation objectives and job market demand, outdated digital educational philosophy, lagging knowledge systems without continuous dynamic updating capabilities, and evaluation systems that can't effectively feedback to teaching research activities in time. Therefore, this paper studies the practical ways to construct a job skill knowledge graph based on job market demand, proposes measures to update educational philosophy, organizes knowledge system hierarchically and modularly within one major, and build an evaluation system for continuous tracking based on dynamic data during teaching activities. Finally, these new measures were applied to software engineering majors. The results showed that it could significantly improve students' learning enthusiasm and ability to solve coding issues.

Keywords: Hierarchical Knowledge System, Evaluation System, Cotinuous Tracking Based on Dynamic Data, Educational Philosophy

1 Introduction

In the era of informatization, artificial intelligence and cloud computing, the cultivation of digital talents has important significance and far-reaching impact on the development of social economy[2]. As one important link in education system structure, higher vocational education provides talents for social and economic development.

Based on the preliminary survey analysis of a research project funded by the strategy and implementation pathway for digital talent cultivation in vocational colleges during the era of digital economy, it was observed that higher vocational education has problems as follows: outdated training objectives not keeping pace with job market demands; too much reliance on traditional teaching methods, lagging educational concepts; out-of-date knowledge systems, lack of continuous dynamic updates; Static data in teaching evaluation systems, inability to form a closed loop, unable to dynamically

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track, and it is difficult to timely and effectively evaluate the quality of feedback education.

2 Digital Talent Cultivation Targets are Adapted to job Market Demand

According to investigation, there is a total shortage of about 2.5-3 million digital integrated talents int the current job market[1], and this gap continues to expand. The talent shortage has become an important factor restricting the development of digital economy. "Structural imbalance" is becoming the main manifestation feature of supply-demand relationship between enterprises and talents in the era of digitization[3].

2.1 Analysis of Structural Mismatch Between Supply and Demand for Talents

From the perspective of technology, the big data of digital job demand is not timely and comprehensively conveyed to the supply side of vocational education talent cultivation. As shown in Fig. 1, under the background of booming frontier technologies such as informatization, artificial intelligence (AI), and cloud computing, the digital economy is experiencing unprecedented rapid growth. With the emergence of new technologies and knowledge system updates, market demands for digital professional skills are also changing accordingly. However, traditional educational systems, including schools and higher education institutions, often lag behind in adapting to this fast-changing environment, with their training programs failing to keep pace with market trends.

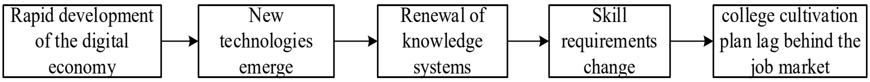

Fig. 1. The talent cultivation plan of higher vocational colleges lag behind market developments

From the perspective of Teaching ideology, there are two issues. First, some teachers rely too much on traditional main educational methods and focus more on theory but less on practice. Traditional education methods often emphasize knowledge input with teachers as the main educators and students as the main learners. However, in the rapidly developing digital era, this is very unfavorable for student career development. How to motivate students' self-driven learning growth initiative so that they can achieve integration between service-oriented economic and social development and human development is an issue we must face. Second, teachers lack opportunities for professional development training and have an unreasonable teacher team structure. Under these constraints, it leads to teachers being detached from practical production for too long, lacking relevant job skills, becoming disconnected from related industries, missing core knowledge, unable to explain key points through life-production case-based teaching, which deviates from the higher vocational education emphasizing skill-based practices.

2.2 The Talent Cultivation Targets Follow Market Improvement Implementation Plans

In terms of digital talent cultivation strategy, it is based on industry and enterprise[4]. It adheres to job market-oriented, demand-oriented and job skills-oriented concepts, improves the fit between education and employment markets, promotes effective allocation of human resources, and drives the development of digital economy.

1. Technical implementation plan of dynamic updating of skill knowledge system

In terms of specific implementation paths, the improvement plan is shown in Fig. 2.

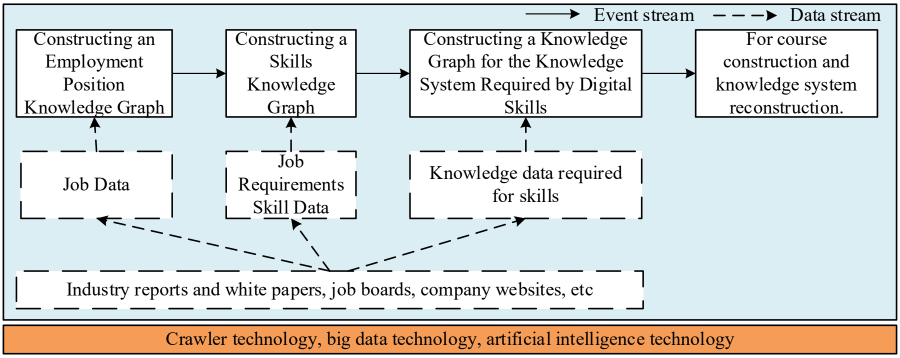

Fig. 2. The implementation path for updating the knowledge system in curriculum development

The dynamic update architecture of the skill knowledge system relies on existing technology platforms such as crawlers, artificial intelligence, big data, cloud platform, etc. First, select typical industries and enterprises that recruit digital talents for higher vocational colleges, industry reports and white papers using crawler technology to regularly capture job requirements, skills required, knowledge systems and other related data. Second, apply big data technologies to clean up the extracted data through ETL (extract, transform, and load). Finally, use AI intelligent analysis to build employment position knowledge graph, position-required skill knowledge graph, and skill-required knowledge system knowledge graph successively. Ultimately forming a digital knowledge system that matches job market demand, which can be used for course construction and knowledge system updates, "targeted" training of digital talent. Under this system structure, changes in job market demands can be timely and dynamically reflected within the higher vocational education system. During the major cycles of technological upgrades within an industry, it is essential to undertake a reconstruction of the knowledge system. Within the minor cycles of technological shifts within the same industry, dynamic adjustments should be made to focus areas in order to cultivate digital skilled talents who are closely aligned with job market demands.

2. Renewal of educational philosophy

The lagging educational concept not only affects the employment competitiveness of students, but also limits the innovative development of the school itself. The main problems faced, improvement implementation paths, and expected improvement effects are shown in Fig. 3.

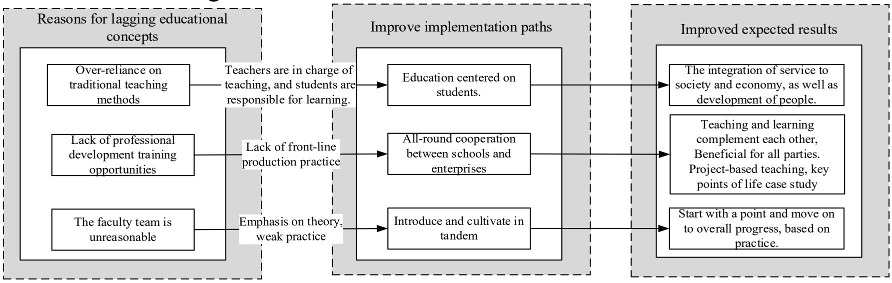

Fig. 3. Lagging educational philosophy, Improvement pathways, Expected improvement outcomes

To update the educational concept of digital talent cultivation[6], the first thing to change is to change the teacher centered teaching concept into the student-centered teaching concept. Digital knowledge and new technologies are rapidly updated, so teachers and students must establish the concept of lifelong learning in order to make common progress with this era. First of all, we need to change from the teaching method of knowledge inculcation to the ability to guide students to think and solve problems by themselves. In this era of AI popularization, AI will trigger a historic change in productivity. Teachers use AI to assist teaching, guide students to learn to use AI to learn and solve problems, which is also an essential link in teaching. On the one hand, it can stimulate students' self-driven learning and growth, and more importantly, it can achieve the integration goal of higher vocational education serving economic society and serving people's career development under the historical trend of people-oriented thought.

In addition, higher vocational colleges and enterprises carry out comprehensive school enterprise cooperation. The subject of cooperation not only includes the infrastructure construction such as base construction and cloud platform construction, but also the employment cooperation between students and enterprises, such as the order class mode, should include the cooperation between teachers and enterprises. Teachers need to establish the concept of lifelong learning, strive for and strive to undertake the projects of enterprises, so as to improve and maintain the digital skills and abilities that fit the current situation for a long time. The skills and abilities are fed back to students through the link of teaching behavior, forming a closed-loop of school and enterprise, teacher and student, skills and job market, and ultimately achieving the goals of mutual promotion between teaching and learning, benefiting both enterprises and schools. It is worth mentioning that the key and difficult points of the abstract and obscure can be explained and practiced through the cases in real life. For example, through the function of Taobao in daily life to recommend people to browse or intended goods, explain the process of personalized recommendation; By opening Taobao e-commerce website again in our lives, we don't need to log in repeatedly to tell the role and mechanism of cookies and sessions.

Finally, in view of the problems caused by unreasonable teaching staff, such as inappropriate age structure, teachers lacking practical experience in a major and so on, we can achieve the goal through the way of talent introduction+ cultivation, or both, or from point to area.

3 Build a Hierarchical and Modular Knowledge System of Major

In order to enhance the adaptability of talent cultivation, reflect students' autonomy and teach students in accordance with their aptitude, build a set of hierarchical knowledge system within a specific major. The level is modular and relatively independent. The module used in teaching projects are pluggable and can be dynamically adjusted according to the job market demand in order to follow the market.

3.1 Build a Hierarchical Knowledge System

Digital knowledge possesses typical characteristics of dynamism and immediacy. Dynamism is reflected in that digital knowledge can be quickly updated, with new content being added and improved as technology develops; immediacy is demonstrated by the fact that users can obtain the latest information and data at any time through the Internet and various digital platforms, reducing the cost of knowledge acquisition. Therefore, digitalized knowledge often presents a characteristic overall feature of abundance and complexity. However, within specific subfields, it exhibits typical hierarchical features. Using software engineering major as an example, on the application level, complex and changing scenarios require continuous emergence of new technologies, but these are usually integrations, encapsulations, adaptations, or modifications based on existing technologies. Hence, within the professional field itself, there needs to be constructed a hierarchical knowledge system.

Within a profession, knowledge systems reflect an underlying shared structure, middle-level separation and high-level mutual selection. The bottom layer is shared: representing common basic knowledge in this professional field; the middle level is separated: representing different employment directions requiring distinct knowledge, which reflects differences here; the upper level of mutual selection: reflecting students' autonomous choices, that is, students choose specific knowledge according to their talents, interests, personality traits for expected employment direction, entering deep learning, practice and training based on these selections.

In terms of specific implementation, from the perspective of students: uring their first year, students undertake foundational knowledge system learning that is common across various employment orientations within the same major. In their second year, based on their natural talents and personal characteristics, they identify their preferred knowledge directions, reflecting their employment preferences. By the third year, students finalize their career paths and focus their learning, training, and practical operations solely on the knowledge and skills required for targeted employment positions, thereby enhancing their core competitiveness. From the perspective of teachers: for sophomores who show employment tendency, we should give affirmation and encouragement, and give follow-up learning plans and suggestions; For junior students who have chosen the direction of employment, teachers help them to tackle key technical problems and overall control of core skills and knowledge.

The construction of a hierarchical knowledge system within the major is in line with the increasingly refined division of labor trend in society[5], and also in line with the role orientation of enterprises for the work of newly graduated college students. It is more able to carry out targeted learning in a critical period of time to enhance the core competitiveness of students.

3.2 Modularization of Internal Knowledge at Hierarchical Levels

For a specific layer within the knowledge system of professional internal expertise mentioned in the previous section, it is necessary to construct relatively independent knowledge modules. Follow changes in job market skills required knowledge and dynamically update or delete corresponding knowledge modules, add new knowledge, in order to increasing adaptability between knowledge systems and job markets. This not only reduces students' learning burden, but also enhances their motivation and sense of accomplishment, enabling them to learn effectively and put what they have learned into practice. Take the middle-level discrete layer knowledge modules in software technology majors as an example, as shown in Fig. 4, ten years ago, it was necessary to study the JSP and Servlet knowledge module, which has long been abandoned; five years ago, the Spring technology was a required knowledge module, but now it has been replaced by the upgraded Spring Boot technology stack. For important principles and mechanisms that still need to be studied, these can simply be integrated into relevant courses. Dynamic adjustments to knowledge modules can better respond to job market demands.

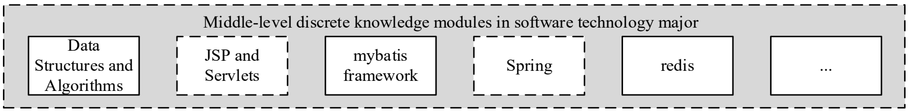

Fig. 4. Knowledge modules at the intermediate level for software technology specialization

4 Build an Evaluation System for Continuous Tracking Based on Dynamic Data

The current evaluation system of most institutions is still dominated by static indicator data. This approach has two shortcomings: first, it cannot provide timely and effective feedback on the digital talent education effect; secondly, there is a lack of continuous tracking over time, such as pre-employment status assessment tracking for students and post-employment status assessment tracking. Building upon a big data platform, with students as the main focus of tracking, we can construct an evaluation system that incorporates multiple entities and continuously tracking by dynamic data. This system can transcend the limitations of time and space, promptly and effectively providing feedback to the strategies and implementation pathways for digital talent cultivation, thereby forming a closed loop. The specific implementation pathway is shown in Fig. 5.

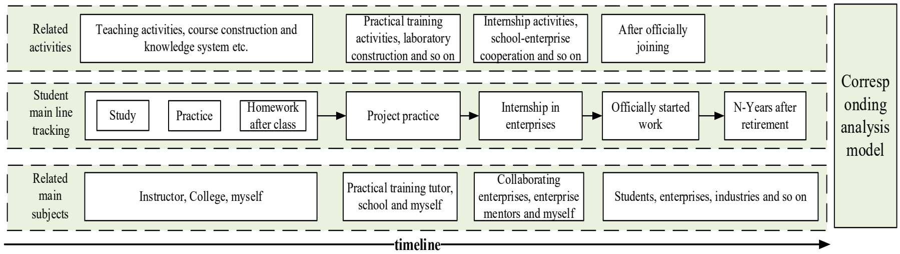

Fig. 5. Student-centered dynamic data tracking evaluation system

This evaluation system tracks students as a main line, tracing according to the timeline from learning to work for N years. The major subjects involved in this process are taken as multi-dimensional evaluators. Major activities such as teaching activities, practical training activities, internship activities, school-enterprise cooperation and order classes etc., which involve in this process, are considered as evaluation target units. In this process of continuous, dynamic, and data-driven tracking and evaluation, based on the results of the evaluation target units, timely and effective feedback is provided to specific stages of digital talent cultivation strategies and implementation pathways, allowing for adaptive adjustments. For instance, in teaching activities, we collect data on students' learning, practice, and homework assignments, as well as results from periodic assessments. By analyzing and providing feedback on this data, we evaluate the teaching activities of instructors and suggest areas for improvement. During students' internships with enterprises and their post-employment stages, by gathering evaluations from corporate mentors and the students themselves, and by designing appropriate questions, we can ascertain whether the current curriculum and knowledge system can be effectively applied in practical production to meet market demands and whether it is conducive to students' long-term development.

This evaluation system can effectively solve the problem of delayed feedback in static data evaluation systems, and connect the isolated islands of relative independent activities in digital higher vocational education to form a data closed-loop.

5 Comparison of Test Results

Select software technology as a typical professional for digital application and conduct comparative experiments. Conduct comparison experiment on students of Software Technology major in Guangdong NanHua Vocational College of Industry and Commerce, Class 1 and Class 2 from the same grade. There are 60 people in Class 1 and 62 people in Class 2. Class 1 is the control group. Collect job requirements for software skills from Boss Zhipin and Zhilian Zhaopin websites to build corresponding skill knowledge systems. In the first semester of senior year, collect statistics on students who have an interest in software technology direction. In this stage, students of class 2 abandon conventional course teaching and focus on learning skill knowledge system required by employment positions, conducting skill training, and cultivating students for using AI tools such as Tongyi Zero Code (AI-assisted coding tool), Wenxin Yiyan, Tongyi Qianwen, etc., to solve practical problems. By the end of the first semester of senior year, count the number of those securing jobs or internships that match with their majors. The ratio between the numbers of matched work or internship and the number of students interested in software technology will be used as evaluation results. Results are shown in Table 1.

Table 1. Comparison of Experimental Results

group / number of student	Control group 1	experimental group 2
Total	60	62
Number of student intending to work in the software industry	42	43
Number of Employments or Internships in Software Direction	13	24
normalized ratio	13/42=30.9%	24/43=55.8%

It is obvious that the ratio of professional employment or internship to willing students in experimental group 2 class was significantly higher than that in experimental group 1, which indicates that market-oriented skill knowledge system and improved teaching plan are more likely to be recognized by enterprises. In addition, most students who were employed according to their majors in experimental groups expressed satisfaction with what they learned, and had a better overall experience compared to those in control group 1.

6 Conclusion

This study explores strategies and implementation pathways for cultivating digital talents in higher vocational education, addressing the structural mismatch between educational objectives and job market demands. By constructing a dynamic skill knowledge graph, updating educational philosophies, organizing a hierarchical and modular knowledge system, and establishing a continuous tracking evaluation system based on dynamic data, the research demonstrates significant improvements in students' learning enthusiasm and problem-solving abilities. The application of these strategies in software engineering majors yielded positive results, with a notable increase in students securing relevant internships and jobs. These findings underscore the importance of aligning vocational education with market needs, fostering lifelong learning, and leveraging technology to enhance educational outcomes. Future research should focus on expanding these strategies to other disciplines and evaluating their long-term impact on students' career development and the digital economy.

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