Research on the Construction of Dual-qualified Teacher Teams in Vocational Colleges under the Background of Digital Intelligence Transformation—— A Case Study of Vocational Colleges in Shanghai

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Abstract: *This study focuses on Shanghai's vocational education, focuses on the current situation of the construction of the "dual-teacher" teaching force, comprehensively utilizes the literature research method and the quantitative analysis method, and deeply analyzes the existing problems, such as insufficient teachers' mathematical and intellectual literacy, insufficient depth of industry-teaching integration, lagging evaluation and incentive mechanism, mismatch between the competence structure and the development needs, and incomplete collaborative education mechanism between schools and enterprises. Incomplete mechanism of school-enterprise cooperative education, etc. Based on this, the study proposes systematic countermeasures: it is urgent to change the educational concept and role perception, strengthen teachers' digital skills and practical teaching ability, improve the selection, training, evaluation and incentive guarantee mechanism, accurately promote the matching degree between teachers' individual qualities and the requirements of digital teaching, and focus on constructing a long-term collaborative education mechanism for the in-depth integration of schools and enterprises, so as to provide key teacher support for the transformation of Shanghai and even vocational colleges and universities nationwide to promote the transformation of digital literacy effectively. Provide key teacher support.*

Keywords: *Digital intelligence, Dual-teacher teachers, Vocational colleges and universities, Teacher team building*

1. Relevant Theoretical Connotations

1.1 Core Connotations of Digital Intellectualization

With the increasing development and wide application of technologies such as big data and artificial intelligence, a new model of digital intelligence with the connotation of "digitalization + intelligence" is rapidly emerging. The term "digital intelligence" was first proposed by the "Knowledge-based Consortium" group of Peking University in the report of "Thinking Engine Design Solution" in 2015, and its basic understanding is the combination of digital intelligence and intelligent digitization[1]. There are a total of 1,255 papers on digital intelligence in China Knowledge Network journals, among which there are only 51 papers on vocational education, accounting for 4.1% (as of August 2024); these papers are more about the research on talent cultivation mode and curriculum reform, and there is little research on the construction of dual-teacher teacher team in vocational education in the context of digital intelligence.

There is no uniformity in the definition of the concept of digital intellectualization. Nie Yunxia et al. define digital intelligence as "big data + artificial intelligence"[2], and Wang Zhuli et al. propose that digital intelligence is the use of digital technology to achieve intelligent, efficient, and automated lifestyles and work styles[3]. Digital Intellectualization covers a variety of fields such as artificial intelligence, Internet of Things, cloud computing, big data, etc., aiming to improve productivity, improve people's lives and promote social progress. In the author's opinion, the understanding of digital intelligence can be distinguished into broad digital intelligence and narrow digital intelligence in terms of conceptual depth and scope of application. Broad digital intelligence is the use of a new generation of information technology, enterprises, governments and other organizations in the strategy, operation,

production, management and other all-round changes and upgrades; narrow digital intelligence is the use of digital technology and intelligent algorithms to carry out refined management and optimization in specific business scenarios. Both of them have their own focuses, the broad sense of digital intelligence focuses on comprehensive change and overall upgrading, while the narrow sense of digital intelligence focuses more on fine management and optimization in specific business scenarios.

1.2 The Core Connotation of Dual-Teacher Teachers

The concept of dual-teacher teachers is becoming clearer from the academic research level to the national policy level. The concept of dual-teacher was first proposed by Wang Yicheng in 1990[4]; Li Juntao et al. believe that a dual-teacher is a "lecturer + other intermediate or higher technical position (or vocational qualification)"[5]; Wang Xiaosha et al. believe that a dual-teacher refers to an educator who possesses both in-depth theoretical professional knowledge and rich practical experience[6]; Cao Li believes that dual-teacher includes two aspects, individually.[6]; Cao Li believes that dual-teacher teachers include two aspects, individually, the "dual-teacher" quality of teachers, i.e., the quality of theoretical teaching and the quality of practical teaching and operation; collectively, it is the dual-teacher structure of the teaching team, i.e., it consists of "dual-teacher" teachers and external teachers[7]. Collectively, it is the dual-teacher structure of the teaching force, which consists of "dual-teacher" teachers and external teachers[7]; Yin Xixiang et al. believe that dual-teacher teachers are the teachers of higher vocational colleges and universities who have an intermediate or higher vocational qualification that is recognized in the field, and who are able to not only apply the advanced technology and practical experience of the enterprise to the teaching practice, but also participate in the enterprise work on a continuous basis[8].

In recent years, the state has introduced a series of relevant policies to promote vocational education and improve the construction of dual-teacher teachers, which makes the connotation of dual-teacher teachers continuously improved at the national policy level, see Table 1.

The attention paid by academics and national policies to dual-teacher teachers has made the connotation of dual-teacher teachers clearer and clearer. And in the development of digital intellectualization today, the construction of digital intellectualization dual-teacher teacher team has become an important part of the reform and development of China's vocational education, and digital intellectualization gives new connotation to dual-teacher teachers. The author believes that digital intelligence dual-teacher teachers are teachers who have both theoretical and practical ability, and can skillfully use information technology and digital teaching tools, with data-driven teaching decisions, continuous learning and innovation.

Table 1 National policies related to dual-teacher faculty development

Year	Policy Documents	Core Points
1995	"Circular of the State Education Commission on the Work of Building Model Vocational Universities	The first proposal of dual-teacher teachers
1999	"Decision of the CPC Central Committee and State Council on Deepening Educational Reform and Comprehensively Promoting Quality Education"	Dual-teacher teachers are recognized as possessing the qualification of teacher and other professional and technical qualifications.
2000	"Opinions on Strengthening Talent Cultivation in Higher Vocational and Specialized Education"	Dual-teacher teachers should have a high level of teaching skills and rich practical experience.
2002	"Opinions of the General Office of the Ministry of Education on Strengthening Opinions of the General Office of the Ministry of Education on Strengthening the Construction of Higher	Vocational (Higher Education) Institutions Dual-teacher teachers need not only solid professional theories, but also the ability to apply skills.
2004	Several Opinions on Further Strengthening the Work of Vocational Education	Enrichment of dual-certification teachers by means of "dual certification"
2019	Implementation Plan for Deepening the Reform of the Construction of Dual-Teacher Teaching Teams for Vocational Education in the New Era	Improvement of the dual-teacher system in terms of qualification access, assessment system and safeguard mechanism
2022	Circular of the General Office of the Ministry of Education on the Recognition of Dual Teachers in Vocational Education	Clarify the basic criteria of "two levels and three grades" for dual-teacher teachers.

2. The Current Situation of Dual-Teacher Teaching Team Construction in the Context of Math and Intelligence Transformation

2.1 Actively Responding to the Call of the State and Introducing Relevant Policies

The Shanghai Municipal Government has promulgated a series of policies on the construction of a dual-teacher teaching team oriented by the state policy and aiming at the cultivation of dual-teachers, combining with the reality of Shanghai's vocational colleges and universities and aiming at the construction of a dual-teacher teaching team of the new era of vocational education with Shanghai's characteristics and possessing a high-quality team of dual-teachers, as shown in Table 2.

Table 2: Policies related to the construction of dual-teacher teaching force in Shanghai

Year	Policy Documents	Core Points
2010	Outline of the Medium- and Long-Term Education Reform and Development Plan of Shanghai (2010-2020)	Increase the proportion of part-time teachers from enterprises, and form “dual-teacher” teaching teams combining both specialized and part-time teaching; set up special funds for the professional development of vocational education teachers; and encourage professional teachers to obtain professional and technical qualifications or vocational skills qualifications and become dual-teachers.
2016	Thirteenth Five-Year Plan for the Construction of the Shanghai Municipal Teaching Corps	Studying and issuing guidelines on dual-teacher teams in vocational education, and clarifying the criteria for recognizing dual-teachers and the access mechanism as well as the assessment and evaluation standards for dual-teachers
2018	Implementing Opinions on Comprehensively Deepening the Reform of Teaching Personnel Construction in the New Era	Proposing a system to strengthen the training of dual-teacher teams, requiring teachers to go to enterprises for practice, and linking enterprise practice to teachers' appraisal
2019	Action Plan for High-Quality Development of Vocational Education in Shanghai (2019-2022)	Require a 60% ratio of dual-teacher faculty to the total number of full-time professional course instructors
2020	On Doing a Good Job in Declaring the 2020 Municipal Teaching Innovation Teams for Teachers in Shanghai Higher Vocational Colleges and Universities.	To do a good job in the school selection of the municipal teachers' teaching innovation team and the team's declaration, and to accelerate the construction of the dual-teacher teaching team.
2021	Shanghai Municipal Education Development “14th Five-Year Plan”	Establishing a “dual-teacher” quality-oriented access mechanism and assessment and evaluation system for new teachers, and exploring a mechanism for mutual recognition of school and enterprise titles.
2022	Essentials of Vocational Education Work of Shanghai Municipal Education Commission in 2022	Reinforcing the importance of vocational education
2023	Work on the Recognition of Two-Type Teachers in Vocational Education in the Municipality	Creation of Shanghai Dual Teacher Recognition Criteria and Assessment Platform

2.2 The scale of the dual-teacher teacher team is expanding, and the quality structure is optimized.

In 2023, there were 77 independent vocational colleges and universities in Shanghai, including 21 higher vocational colleges and universities (including one vocational undergraduate degree) and 56 secondary vocational colleges and universities. In the 21 higher vocational colleges and universities, there were 6,896 full-time teachers, and the proportion of dual-teacher teachers was 64.31%[9], and the teachers' education was based on master's degree and above; in the 56 secondary vocational colleges and universities, there were 6,942 full-time teachers, and the proportion of dual-teacher teachers was 75.46%[10], and the teachers' education was based on bachelor's degree and above. In short, the proportion of dual-teacher teachers in vocational colleges and universities has improved somewhat

compared with previous years, and the quality structure has been optimized, see Figure 1.

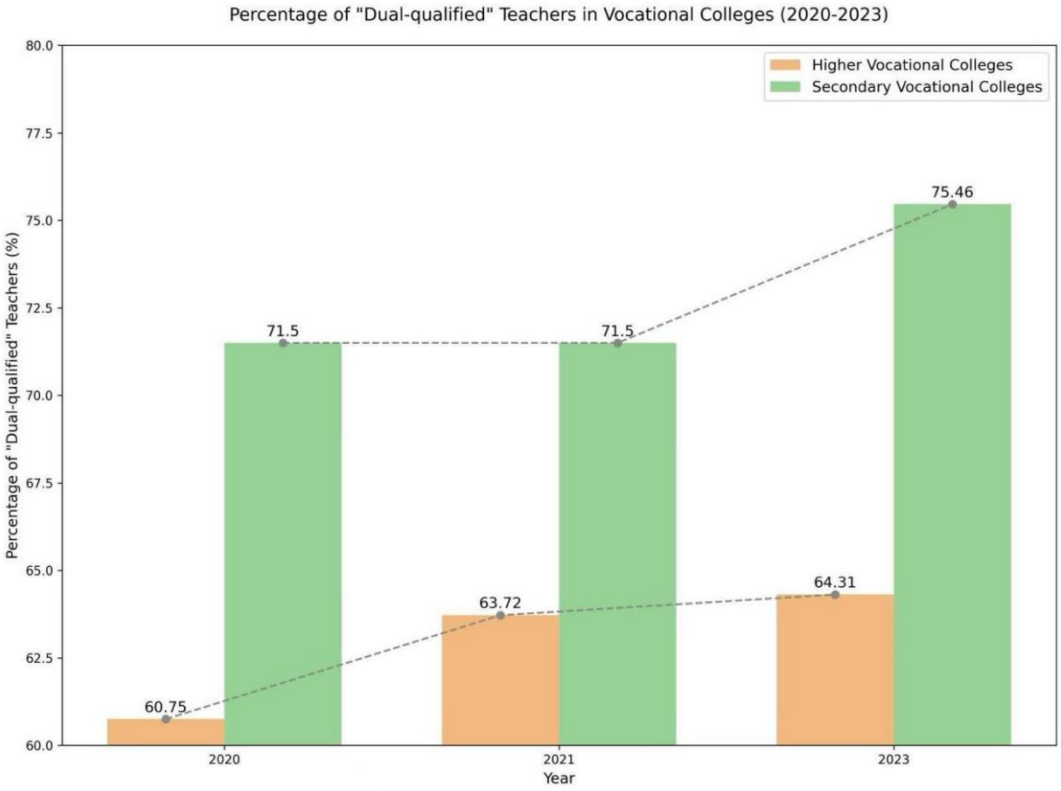

Figure 1. Percentage of Dual-Teacher Teachers in Shanghai Vocational Colleges and Universities in the Past Three Years

3. Problems in the Construction of Dual-Teacher Teaching Team in the Context of Numerical Intelligence Transformation

3.1 Lagging Cognitive Concepts

For a long time, the vocational education field has formed more traditional teaching concepts, and teachers are resistant to promoting the integration of numerical intelligence technology and education and teaching, worrying that the application of the new technology will consume too much time and energy. Traditional concepts have bound teachers' innovative thinking and practical ability, making it difficult for them to adapt to new teaching modes and methods. On the other hand, teachers have a limited understanding of the role of digital technology in leading educational change, insufficient knowledge of the importance and urgency of digital transformation, and are unfamiliar with the application scenarios and modes of digital technology in education and teaching. This lagging conception leads to teachers' lack of sufficient motivation in the face of digital intelligence transformation.

3.2 Inadequate resources and support system

Digital-wise transformation requires a large amount of investment in capital, technology and human resources. In fact, most vocational colleges and universities have not invested enough in the construction of dual-teacher teams to meet the needs of digital-wise transformation. In the process of digital-intelligent transformation, the construction of dual-teacher faculty requires a perfect support system, including technical support, institutional guarantee, and incentive mechanism. The technical support system is not yet sound, the adaptive support for the development of teachers' digital literacy is not in place, and it is difficult to effectively drive lasting changes in teachers' behaviors and habits by relying solely on limited centralized training or experts' guidance in schools. Teachers have difficulties in the application of digital technology, are not proactive enough to effectively apply new technologies to empower subject teaching, and have a sense of “technological vertigo” in the face of a multitude of

digital tools, resources and platforms, which in turn gives rise to the negative emotions of technological use anxiety.

3.3 Inadequate coordination and assessment mechanisms

The multi-sectoral coordination mechanism is not yet sound, and there is a lack of overall coordination among vocational colleges, teacher training, education and research departments, so they cannot provide all-round support for the development of dual-teacher teachers and the use of digital technology. Although teachers are aware of the inadequacy of their digital skills, the lack of systematic and effective training makes it difficult for them to rapidly improve their digital literacy. Meanwhile, training resources for dual-teacher teachers are relatively scarce, and there is a gap between the training content and actual teaching. In addition, the existing assessment mechanism of teachers' digital literacy emphasizes too much on the evaluation of teachers' digital skills and neglects the assessment of the effectiveness of digital application, which leads to the fact that the practice of digital application is superficial and difficult to bring actual results for education and teaching.

3.4 The problem of matching the qualities of dual-teacher teachers

Teachers in vocational colleges and universities, first, are fresh graduates from universities and colleges, who are more focused on theoretical teaching and academic research, but relatively weak in practical teaching; second, are business backbones and managerial talents recruited from enterprises, who are outstanding in practical teaching and industry experience, but are still insufficient in theoretical teaching and academic research ability. This makes the teachers of vocational colleges and universities mismatch between theoretical teaching and practical teaching.

4. Countermeasures for the Construction of Dual-Teacher Teaching Team in the Context of Mathematical Intelligence Transformation

4.1 Change the Concept and Enhance the Cognition

Strengthening the publicity and guidance of teachers, the school publicizes the importance and urgency of the Mathematical Intelligence Transformation as well as the prospects and advantages of the application of Mathematical Intelligence technology in education and teaching by organizing lectures and seminars to help teachers set up a correct concept of Mathematical Intelligence education. To address the problem of teachers' insufficient knowledge of digital intelligence technology, special training can be organized, and experts can be invited to give lectures to help teachers master the basic knowledge and application skills of digital intelligence technology, and improve their ability to apply the new technology in teaching.

4.2 Strengthening Practice and Enhancing Competence

To establish a practice platform, schools can cooperate with enterprises to jointly establish a practice platform for digital intelligence education to provide teachers with practice opportunities and venues, so that they can learn, explore and apply digital intelligence technologies in practice. Encourage teachers to actively participate in research projects and teaching projects related to digital intelligence, and improve their digital intelligence teaching ability through project practice.

4.3 Improve the mechanism and provide guarantee

Establish a synergistic mechanism to strengthen the synergistic cooperation among multiple departments of schools and enterprises, teacher training, education and research, and form a synergy to jointly promote the transformation of dual-teacher teaching force in digital intelligence. Optimize the assessment mechanism, improve the assessment mechanism of teachers' digital literacy, and assess both teachers' digital skills and the effectiveness of digital application to ensure the comprehensiveness and scientificity of the assessment.

4.4 Promote the matching of traits of dual-teacher teachers

Strengthen school-enterprise cooperation, promote exchanges and cooperation between school

teachers and enterprise talents by means of joint cultivation and mutual assignment of teachers, and enhance the practical ability and education and teaching ability of teachers. Reform the title evaluation mechanism, and incorporate practical ability and education and teaching ability into the title evaluation system, so as to make the title evaluation more in line with the characteristics and needs of dual-teacher teachers.

Conclusion

The transformation of digital intellectualization has brought new opportunities and challenges for the construction of dual-teacher teaching team. Through the implementation of measures such as changing concepts, strengthening practices, improving mechanisms, promoting the matching of dual-teacher traits and establishing a long-term cooperation mechanism, we can provide ideas for solving the problems in the construction of dual-teacher teams. With the continuous development and application of digital intelligence technology, dual-teacher teachers will play a more important role in vocational education and contribute to the cultivation of more high-quality digital intelligence talents.

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