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Problems and Countermeasures for Improving Teachers' Professional Competence in Vocational Education in the Context of Technological Change

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Abstract:

With the rapid development of information technology, the field of education is experiencing unprecedented changes. Vocational education, as an important position for cultivating technical and skilled talents, is particularly important for the improvement of key competencies of its teachers. The purpose of this paper is to explore the requirements of technological change on the professional competence of teachers in vocational education. It also discusses the problems faced by teachers in vocational education in terms of the enhancement of their professional competence, such as the insufficient ability to absorb the key technologies of enterprises, to integrate cross-disciplinary and cross-professional knowledge, and the need to improve the ability to integrate and applying digitization and to put forward the proposals of promoting the key technological competence of teachers by multi-agency synergy, enhancing the key technological competence of teachers with systematic training. Also, putting forward corresponding countermeasures to promote teachers' key technical competence through multi-principal collaboration, to enhance teachers' interdisciplinary knowledge integration ability through systematic training, and to enhance teachers' digital application ability through a lifelong learning system, to promote the professional development of vocational education teachers.

Keywords:

Technological change

Vocational education teachers

Professional competence

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1. Introduction

Under the rapid advance of the wave of information technology, the field of education is entering a period of profound and extensive transformation. Vocational education, as a key form of education closely aligned with the needs of economic and social development, has made the professional competence of its teaching force a core element in shaping the quality and competitiveness of technical and skilled personnel. However, against the backdrop of rapidly changing technology, vocational education teachers have encountered multiple challenges and bottlenecks on their way to improving their professional competence. Therefore, starting from the requirements of technological change on the professional competence of vocational education teachers, we systematically analyze the main problems constraining their improvement and put forward-looking and effective strategies to solve them, to adapt and lead the future society's higher requirements for technically skilled talents by promoting the professional growth of individual teachers and the development of vocational education as a whole [1].

2. Requirements of technological change for the professional competence of teachers in vocational education

2.1. Vocational education teachers should adapt to new technological changes

In the accelerating pace of technological change, vocational education teachers need to have the ability to adapt quickly to change and to be able to adjust their teaching strategies and methods promptly to adapt to the challenges brought about by new technologies and new modes. Firstly, vocational education teachers need to have a keen sense of change, be able to perceive the trend and direction of technological development and foresee the far-reaching impact it may have on the field of vocational education. This forward-looking vision requires teachers not only to pay attention to the specific application of current technologies, but also to think about the logic and law behind the technological changes, and how they will reshape the content, methods, and modes of vocational education.

Secondly, in the face of the emergence of new technologies, vocational education teachers must have a strong technical learning ability and be able to quickly grasp the basic principles, operation methods, and application scenarios of new technologies. This requires teachers to maintain a lifelong learning attitude, actively participate in all kinds of technical training and exchange activities, and constantly improve their knowledge structure and technical skills. Simultaneously, teachers also need to establish an effective technology updating mechanism to ensure that their technical skills can keep pace with technological development and provide strong technical support for teaching [2].

More importantly, vocational education teachers need to effectively integrate new technologies into their teaching practice and realize the deep integration of technology and teaching. This requires teachers not only to master the teaching application skills of new technologies, but also to have the ability to teach innovation, according to the characteristics and advantages of the new technologies, redesign the teaching program, optimize the teaching process, enrich the teaching resources to stimulate the student's interest in learning and creativity, and to enhance the effectiveness and quality of teaching [3].

2.2. Vocational education teachers should integrate interdisciplinary teaching and collaboration

Driven by technological change, the content and methods of teaching and learning in vocational education are becoming increasingly interdisciplinary and integrated. Vocational education teachers need to strengthen their comprehensive interdisciplinary teaching and collaborative skills to adapt to and lead this trend of change. Interdisciplinary teaching ability requires teachers not only to be proficient in their own professional fields, but also to have a broad knowledge vision and profound integration ability, and to be able to skillfully integrate the theories, methods, and skills of multiple disciplines to build a multi-dimensional and three-dimensional teaching system, to promote the overall improvement of students' comprehensive quality.

Concurrently, interdisciplinary cooperation among teachers has become the key to achieving optimal allocation and innovation of educational resources.

Vocational education teachers should actively seek in-depth cooperation with teachers of other disciplines, through the formation of interdisciplinary teaching teams or participation in interdisciplinary research projects, to jointly explore new knowledge at the intersection of disciplines, and design, and implement innovative teaching programs [4]. This mode of cooperation not only helps to break down disciplinary barriers and promote mutual penetration and integration of knowledge but also stimulates teaching creativity and research potential, injecting new vitality into vocational education.

Additionally, close cooperation with industry experts and technology developers is an important way to enhance the effectiveness of vocational education. Vocational education teachers need to take the initiative to connect with the frontiers of the industry, establish a long-term communication mechanism with industry elites, and jointly develop interdisciplinary teaching projects and curriculum resources that are close to the market demand. Through the introduction of industry standards, practical cases, and the latest technological achievements, the teaching content can be made closer to reality, and students' vocational adaptability and innovation ability can be enhanced. In parallel, this mode of cooperation also helps teachers to keep abreast of the industry dynamics and technological development trends, providing strong support and guidance for teaching [5].

2.3. Vocational education teachers should integrate the application of digital resources

The rapid development of artificial intelligence technology has brought new opportunities and challenges to vocational education. Teachers need to understand the basic principles and application scenarios of Artificial Intelligence (AI), and master the integration and application methods of AI in teaching, such as intelligent-assisted teaching and personalized learning recommendations to improve the intelligent level of teaching. Digital resources are an indispensable part of vocational education teaching.

With the continuous enrichment of digital teaching resources, teachers need to have the ability to integrate and utilize digital resources, such as electronic teaching materials, online courses, and virtual experiments to enrich the content of teaching and improve students' learning interests. Being able to develop or select appropriate digital teaching resources according to teaching needs and students' learning needs, screening out suitable teaching content from the vast amount of digital teaching resources, and integrating and utilizing them effectively. Vocational education teachers need to have the ability to adapt to these new teaching modes and be able to flexibly use online and offline resources to design and implement teaching activities that meet students' needs. Meanwhile, teachers also need to be familiar with the functions and operations of various digital teaching platforms (e.g. catechism platforms, online education platforms) and be able to flexibly use these platforms for teaching design and implementation to improve teaching efficiency and effectiveness [5–7].

3. Characterization of problems constraining improvement

3.1. Inadequate capacity of teachers to absorb key technologies from enterprises

Teacher communities in the field of vocational education face significant challenges in embracing and updating key technical competencies in their profession. As the wave of the new technological revolution continues to advance, new technologies, processes, and methodologies are emerging in an endless stream, placing urgent demands on Vocational Education and Training (VET) teachers to keep abreast of the times in terms of technological mastery and knowledge base. On the one hand, new technologies, techniques, and methodologies are springing up, which not only change the mode of production but also profoundly affect the mode and content of education and teaching. This requires VET teachers not only to have a solid professional foundation but also to have a keen insight, to be able to quickly capture the cutting-edge dynamics of the industry and to integrate new technologies and processes into their teaching to cultivate high-quality skilled personnel to meet the needs of the future society [8].

However, the reality is not optimistic. For a long time, the educational background of the teacher group has often been biased towards the teaching of traditional theoretical knowledge, with limited exposure to new technologies and learning opportunities. Additionally,

the accumulation of professional experience is mostly based on the past technical system, in the face of the rapid iteration of the technological environment, teachers in the technology acceptance and updating is particularly difficult. Moreover, the inadequacy of training resources exacerbates this dilemma. Existing training systems often struggle to cover all new technologies and lack the systematicity and relevance to meet the individualized and differentiated learning needs of teachers. The great tension between the speed of technological iteration and the relative stability of teachers' educational background and professional experience has become a key constraint on the improvement of teachers' technological competence. This lack of synchronization not only weakens the core foundation of teaching quality but also makes it difficult for students to seamlessly match what they learn in school with market demand. It also limits, to a certain extent, the space for teachers to develop their individual careers, making it difficult for them to maintain competitiveness in a rapidly changing educational environment [9].

3.2. Inadequate integration of teachers' interdisciplinary and inter-professional knowledge

The insufficiency of teachers' ability to integrate interdisciplinary and inter-professional knowledge in the field of vocational education has become a key factor restricting educational innovation and adapting to the transformation and upgrading of industrial structure. This status quo is firstly reflected in the singularity of teachers' knowledge structure, that is, the professional knowledge system of some teachers is relatively closed, lacking interdisciplinary breadth and depth, and it is difficult to effectively cross the disciplinary boundaries for comprehensive application and integration of knowledge. The inherent barriers and significant differences between disciplines make the organic integration of knowledge from different disciplines a difficult task, making it difficult to build a comprehensive and coherent interdisciplinary knowledge system. As a result, when teaching interdisciplinary courses, these teachers often feel that they are unable to provide comprehensive and in-depth academic analyses and explanations, which in turn limits the further improvement of teaching quality.

Furthermore, the lack of interdisciplinary thinking and innovative approaches among teachers cannot be ignored. This lack of ability hinders teachers' in-depth exploration and innovative practice in interdisciplinary fields and makes it difficult to provide strong intellectual support for the innovative development of vocational education. Teachers' lack of interdisciplinary competence and common thinking paradigm and innovative methodology make it difficult for them to effectively link and integrate the knowledge points of different disciplines when teaching courses involving multiple fields of knowledge, thus making it difficult for students to construct a complete knowledge framework, which affects the effectiveness of learning and the systematic construction of the knowledge system.

Moreover, teachers' interdisciplinary teaching and research activities are not sufficiently collaborative, and teachers' ability in interdisciplinary cooperation is insufficient, making it difficult for them to communicate and collaborate effectively with teachers from other fields. The communication barriers and collaboration dilemmas faced by teachers between schools, industries, and enterprises in interdisciplinary cooperation do not only stem from the differences in knowledge structure but also from the imperfect interdisciplinary cooperation mechanism and the lack of an effective communication and collaboration platform. This dilemma hinders the smooth progress of interdisciplinary projects, weakens the foundation of trust and the atmosphere of cooperation among teachers, and poses a potential threat to the overall effectiveness and sustainable development of the vocational education ecosystem [10].

3.3. Teachers' capacity for in-depth integration and use of digitalization needs to be improved

The acceptance and use of digital technologies by teachers in the field of vocational education need to be strengthened to adapt to the ever-changing technological landscape. Specifically, this phenomenon is characterized by multiple limitations. Firstly, there is a significant cognitive lag in teachers' acceptance of digital technology. Most teachers still regard digital technology as an auxiliary means of multimedia teaching, failing to gain a deep insight into its core value in deepening pedagogical reform and promoting educational innovation, and thus tend to be conservative in their acceptance of new technologies. This constrains teachers' willingness to

actively explore and integrate into higher-level digital education practices and hinders their digital literacy, professional growth, and overall expansion of their social service functions.

Secondly, the limitations of teachers' digital skill levels are significant. Although some teachers are willing to explore the application of digital technology in teaching, due to the lack of systematic learning paths and practice platforms, their skills mastery mostly remains at the primary stage, making it difficult to fully explore the potential of digital technology. This, coupled with the learning threshold of digital technologies, poses a challenge to teachers who are older or have a weak foundation in information technology, further exacerbating the barriers to skills upgrading. Furthermore, teachers displayed a shallow approach to the level of digital technology application. Particularly in vocational education, although digital technologies have been introduced into the classroom, they are mostly used as pedagogical aids rather than as a core force driving innovation and personalization in teaching and learning. Advanced applications such as learning data analysis and personalized teaching strategies are seldom touched due to the high technological threshold, limiting the full play of digital technologies in teaching interactivity, instant feedback, and other features.

Finally, the continuous learning and self-renewal mechanism of teachers is not sound. Vocational education is a type of education that is closely related to the dynamics of the industry, and teachers need to have the ability to continuously update their knowledge and skills. However, the heavy teaching load, the lack of learning resources, and the lack of intrinsic motivation constitute major obstacles to teachers' continuous learning and updating in the field of digital technology [11].

4. Strategies for improving the professional competence of vocational education teachers under technological change

4.1. Promotion of teachers' critical technological skills through multi-agency synergy

The problem of insufficient teachers' ability to absorb key technologies from enterprises is a complex and systematic project that requires the joint efforts and collaboration of the government, schools, enterprises, and individual teachers to build an all-round, multi-level support system, starting at multiple levels. Firstly, investment in vocational education teacher training should be increased, resources from all parties should be integrated, and a more systematic, flexible, and efficient training system should be established.

Secondly, school-enterprise cooperation should be encouraged to promote teachers' in-depth practice in the front line of enterprises, so that they can experience the changes and challenges brought by technological innovations, thus enhancing their sensitivity and acceptance of new technologies. Simultaneously, we should also establish a long-term mechanism for the improvement of teachers' technical skills, and stimulate teachers' internal motivation for self-improvement using regular assessment and incentive mechanisms.

Additionally, we should also pay attention to the psychological health and career development needs of the teacher community. Facing the pressure and challenges of technology iteration, teachers should have good psychological adjustment ability and career planning awareness. Schools and society should provide appropriate psychological support and career development guidance services to help teachers establish a correct view of career and development, and respond to the challenges and opportunities brought by technological change with a more positive and proactive attitude. Only through continuous reform and innovation can we promote the continuous improvement of the technical ability of vocational education teachers and lay a solid foundation for cultivating more high-quality skilled personnel who can meet the needs of the future society [12].

4.2. Enhancing teachers' ability to integrate interdisciplinary knowledge through systematic training

The enhancement of vocational education teachers' ability to integrate interdisciplinary and inter-professional knowledge should focus on building a systematic training system, promoting the construction of a platform for teaching and research cooperation and exchanges, implementing a mechanism for project-based learning and pedagogical reflection, and integrating information technology tools to broaden knowledge boundaries.

Firstly, build a diversified knowledge training system. Broaden the content scope of teacher training, design a curriculum system that covers basic knowledge and cutting-edge developments in multiple disciplines, and encourage teachers to participate in interdisciplinary training programs to enhance their knowledge base in multiple fields. By organizing interdisciplinary workshops and seminars regularly, knowledge exchange and experience sharing among teachers can be promoted to break down disciplinary barriers and enhance interdisciplinary understanding and integration.

Secondly, establish an interdisciplinary research and practice platform. Setting up interdisciplinary research centers or laboratories within the school or in collaboration with external institutions provides teachers with a platform for interdisciplinary research and practice, which helps them deepen their understanding and application of interdisciplinary knowledge in actual practice.

Thirdly, cultivate interdisciplinary thinking and innovative methods. The introduction of interdisciplinary teaching methods, such as case teaching methods and project-based learning, helps to guide students to think about problems from multiple perspectives and dimensions, and at the same time prompts teachers to master and apply these new teaching methods. Concurrently, strengthening the training of innovative thinking, enhancing teachers' innovative awareness and ability, and encouraging them to explore and practice in interdisciplinary fields are of great significance in promoting the innovative development of vocational education. Furthermore, strengthening interdisciplinary teaching and research collaboration is also an aspect that cannot be ignored. Establish an interdisciplinary cooperation mechanism, clarify the cooperation process and division of responsibilities, and provide institutional guarantee for interdisciplinary teaching and research. The use of modern information technology means building an interdisciplinary communication and collaboration platform to promote real-time communication and resource sharing among teachers [13,14].

4.3. Enhancing teachers' digital competence through a lifelong learning system

Enhancing the ability of vocational education teachers to integrate and apply digitalization in-depth first requires strengthening teachers' knowledge and training in the concept of digital education. By organizing thematic seminars and workshops and inviting education technology experts, industry leaders, and teachers who have successfully applied digital technology to share their experiences, we can help teachers deeply understand the core value of digital technology in teaching reform and innovation and break the cognitive lag.

Secondly, it is crucial to build a systematic learning and practice platform. Establish a digital skills resource base, and integrate high-quality online courses, teaching videos, practical cases, and other resources to provide teachers with a hierarchical and systematic learning path. Build a practice exchange platform and make use of social media, online forums, and other tools to promote experience sharing and mutual assistance among teachers. Additionally, a "master-apprentice system" or "mentorship system" is implemented to accelerate the growth of novice teachers in the application of digital technology through one-to-one guidance. To promote the in-depth application and innovation of digital technology, teachers should be encouraged to explore advanced applications such as learning data analysis and personalized teaching strategies, to enhance the interactivity of teaching and the ability of immediate feedback.

Thirdly, improve teachers' continuous learning and self-renewal mechanism. Establish a lifelong learning system, incorporate continuous learning of digital technology into teachers' career development planning, encourage teachers to formulate personal learning plans, and regularly assess and feedback on their learning results, to stimulate their intrinsic motivation for continuous learning and self-renewal. Increase investment to provide a strong guarantee to comprehensively improve teachers' digital competence and promote the professional development of vocational education teachers [15].

5. Conclusion

The reshaping of the professional competence of vocational education teachers by technological change is an inevitable trend of the times. Teachers are not only required to master advanced teaching techniques and methods, but also emphasize interdisciplinary knowledge

integration and the ability to use digitalization. This comprehensive enhancement of professional competence is an important cornerstone to ensure that vocational education keeps pace with the needs of the industry and promotes the all-round development of students. Looking ahead, the enhancement of the professional competence of vocational education teachers will enter a new phase with the continuous innovation of technology and the deep integration of education. It is expected that through the continuous optimization of the multi-principal synergy mechanism, teachers will be able to work more closely with enterprises and grasp the dynamics of cutting-edge technologies. The improvement of the systematic training system will promote the reconstruction and deepening of teachers' interdisciplinary knowledge structure and enhance their comprehensive application ability. At the same time, teachers will be incentivized to embrace new technologies on their initiative and enhance their digital teaching capabilities. Together, these efforts will promote a qualitative leap in the professional competence of vocational education teachers, laying a solid foundation for cultivating more high-quality skilled personnel who meet the needs of the times.

Disclosure statement

The author declares no conflict of interest.

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