

The Challenges, Motivations and Countermeasures of Higher Vocational Teacher Cultivating in the Post-information Age

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Abstract: Global mega-trends such as automation, digitalization, green transformation and ageing population are bringing structural changes to labour markets around the world. However, most of existing researches are functional and cannot deal with the structural issue of vocational teacher training in the post-information age. This study focuses on the cultivation of higher vocational education teachers, analyzes the specific impact of the challenges and motivations of the cultivating of higher vocational teachers in the post-information age, and further discusses the countermeasures of the training path. The study proposes that the rapidly changing labour market, the aging of the teachers, the profound linkage with the labor market, and the increasingly complex system of higher vocational teachers' skills are all challenges to the cultivation of higher vocational teachers in the post-information era. The methods of enhancing teachers' motivation, focusing on teachers' teaching skills, fostering their innovative pedagogical methods and strengthening the top-level design of their human resources will promote the cultivation and development of vocational teachers' resources.

Keywords: Vocational Colleges; Post-Information Age; Human Resources; Higher Vocational Teachers

1. Introduction

After decades of stepping into information technology, the unexpected scene is that information management is not easier, but more complex. Nicholas Negroponte, a professor and co-founder of the MIT Media Lab, wrote in his 1995 book "Being Digital": "We are entering a post-information age. In the information age, the world is getting bigger and smaller simultaneously." The

post-information age is about being recognized over time: it is not humans who need to understand machines, but machines that must understand humans. The revolutionary design of AI has made it necessary for machines to comprehend Natural Language through artificial neural networks. The limitations of geography will gradually be removed, digital life will become less and less dependent on being in a specific place at a specific time, and the transmission of information itself will begin to become possible.

The transformation of information is the transformation of knowledge; The transformation of knowledge implies changes in the paths and forms of knowledge dissemination. Contemporary education attempts to inform learners in a scholastic tone that the certificate of socialization requires years of study and testing. However, criticism of outdated academized education is rampant within the industry to the extent that "Academy" has developed a stigmatizing trend. As Walter Lippmann once observed, people do not first understand something and then define it, quite the opposite is often the case, people define it first and then understand it from that definition.

The process of labor force cultivation in vocational colleges is particularly obvious. Trends in globalization such as automation, digitization, green transformation and population aging are reshaping labor markets around the world and triggering structural changes. These changes not only affect the demand and supply of labor, but also change the nature of work and the way of work. A review of previous studies shows that there have been extensive studies on the cultivation of vocational college students, but few studies on the cultivation of vocational teachers in the post-information era. Most studies are still on how to improve teachers' digital literacy ability, which are more functional rather than structural. It is a structural issue to sort out the

challenges, motivations and countermeasures of higher vocational teacher cultivating in the post-information age.

In sum, this study aims to rely on the research of enhancing intelligent development of educational practices in the post-information age to discuss specific issues related to the construction and development of the vocational college teacher, analyze the challenges and driving factors in higher vocational teacher training, and further explore the corresponding strategies to promote the cultivation and development of higher vocational teacher resources.

2. Literature Review

The issue of teacher team construction and development has become a hot topic in the field of vocational education in recent years. The transmission of information is the essence of education. The post-information society, also known as the byte age or digital age, is a new era following the industrial and information ages. This is a new concept proposed by Nicholas Negroponte, an MIT professor, in his book "Being Digital." It is bound to bring about profound changes to the education system. Related literature has carried out research on the construction of teachers in higher vocational colleges, the construction of evaluation index system and the development and utilization of part-time teacher resources

The post-information age means that information becomes an indispensable infrastructure rather than a novelty. Huakaosheng [1] believes that innovation of student management in the information age has spurred a reform of management methods, breaking down the drawbacks of traditional student management, making it more targeted, and promoting the individualized development of students. Wang Meiqian [2] argues that there has been a shift in educational practice in the post-information age. Traditional education is an objectification practice mediated by information and based on conversation. Teachers objectify their essential strengths onto students and students objectify their essential strengths into the external world. However, the development of informatization has made it no longer serve as the driving force. Information is not something novel any more, but a basic tool on which education

relies. As a result, the intelligent development and embodiment shift in educational practice are almost unstoppable.

Xu Jiayang [3] believes that in the context of technology-empowered education, digital teaching reform is key to promote the quality revolution of vocational education. Based on the keyword co-occurrence and cluster maps, the essential attributes of digital teaching reform are deconstructed from the dimensions of teaching mode, school-enterprise cooperation, talent training and teaching resources; and through timeline maps and emerging word detection maps, he analyzes the evolutionary characteristics and development trends of digital teaching reform. Guo Rifeng [4] conducted a questionnaire survey of 6,973 teachers from 226 higher vocational colleges in 28 provinces across China and found that the the current information teaching scene in higher in vocational colleges has seen significant improved in terms of "innovation," "support," "guarantee," and "development". However, there are problems such as "integration cold" behind "technology heat", lagging usage of digital education resources, and the evident "shortboard" in teachers' information-based teaching ability.

Some scholars believe that teachers' capabilities are irreplaceable in the face of technological change. Long Ping and Xiang Linfeng [5] argue that teaching by teachers is irreplaceable, and teachers' teaching ability is key to the quality of teaching. Based on the philosophical definition of ability, combined with existing research and standards, they propose the philosophical level meaning of teaching ability and create a four-dimensional evaluation model for the teaching ability in higher vocational colleges. Li Mengqing [6] contends that higher vocational colleges urgently need to improve their overall governance level to reduce and overcome the digital divide, environmental deficiencies, and the empowering effects of digital technology on teachers' professional development due to poor governance. It is necessary to address issues such as teachers' weak digital literacy, outdated infrastructure for intelligent campuses, and imperfect incentive mechanisms to enhance digital technology capabilities. This will guide teachers to reshape their professional qualities through digital

technology, strengthen professionalism, demonstrate professional identity, and become "double-qualified" teachers with high-level digital skills, integrating ethics with talent, teaching with learning, and knowledge with practice. This is vital for meeting the demands of high-quality development of higher vocational education. Xu Yuan [7] and others believe that the "job-lesson-competition-certificate" comprehensive education model integrates the various elements of vocational education from a systems theory perspective, achieving an organic intergration of the industrial chain, talent chain, education chain and innovation chain, and promotes the supply-side reform of talent cultivation. The innovative teaching ability of higher vocational teachers is an important guarantee for the "job-lesson-competition-certificate" comprehensive education model to be effectively promoted.

However, despite the existing literature on digitization and teacher capacity building, it can still be seen that it is more similar to functionalist construction than structuralist analysis. In the field of vocational education, teachers play a core role. They play a vital role in improving learners' skills according to the needs of the labor market, not only teaching professional skills, but also involving training in general skills such as basic skills and social and emotional skills. Changes in skill requirements such as digitization and automation require changes in school-based learning and work-based learning in vocational education and training courses, and thus a change in the skills of vocational college teachers. But most researchers tie digital proposals to pale concepts, without analyzing the causes, risks, and opportunities driven by these challenges. In summary, this study delves into the changes in educational skill requirements, analyzing the main challenges and opportunities faced by vocational college teachers, and drawing on OECD data as an international example to propose development strategies suitable for vocational colleges to achieve a more comprehensive vocational education system.

3. The Challenge and Motivation of Higher Vocational Teacher Training in the Post-Information Age

In 2016, Pew Research Center and Elon University's Imagining the Internet Center conducted a survey on the internet, which canvassed about 1408 experts on their expectations for the development of vocational education. The results indicated that the majority expect that the education market, especially online learning platforms, will continue to transform to meet the emerging extensive needs. This pattern has led to a deeper structural imbalance; the qualifications required for vocational education may be impacted by diversified certificate sources. Even though traditional educational certificate has a relatively stable credibility, they still struggle to produce enough labor to meet the demands of the labor market. In contrast, an alternative vocational qualification certification mechanism will emerge, replacing procedural educational performance review conditions with results-oriented performance recognition. According to the National Academy of Sciences, "The education system needs to adapt to the constantly changing labor market and prepare for individuals. Meanwhile, recent advances in information technology have provided new and potentially broader access to education."

Despite the obvious benefits of using digital technology, it also brings significant challenges—especially in vocational colleges that normalize practical learning. Despite the obvious benefits of using digital technology, it also brings significant challenges—especially in vocational colleges that normalize practical learning. In higher vocational colleges, the role of teachers is not only to impart knowledge, but more importantly, to combine teaching skills with the skills and knowledge of specific industries to effectively impart professional theory and practical knowledge to students. Moreover, vocational school students generally have higher diversity, which includes different learning styles, cultural backgrounds, educational levels, and career goals. These differences may pose specific pedagogical challenges, but may also become a valuable resource for promoting innovation and practical applications. Teachers in higher vocational colleges play a crucial role in motivating students and helping them overcome learning barriers. At the same time, the demand of the labor market is dynamic, and vocational teachers need to constantly

update their skills and knowledge to ensure that students can acquire skills that match the market demand.

3.1 Rapidly Changing Labor Market

Digitization, automation and changes in the global economy have had profound effects on the Labour market, particularly in the Organization for Economic Cooperation and Development (OECD) countries. With the advances in technology, especially the development of information technology and artificial intelligence, and the pursuit of a low-carbon economy, vocational education and training systems face an urgent task to accommodate new skills needs.

Digitization has created many jobs and altered existing ones, including those requiring vocational education qualifications [8]. The impact of automation is changing the face of all industries, including those traditionally trained by vocational education. As technology advances, some traditional occupations may decrease, while other emerging ones may grow. This challenges vocational education systems by requiring them to adapt to new skill needs and employment trends. For example, with fewer traditional occupations, automation may lead to fewer jobs for some manual operations and repetitive tasks, such as construction workers or factory operators. These changes require vocational education institutions to reconsider how to prepare students for a future work environment. The growth of new occupations, with the development of technology, new careers continue to appear. In the United States, for example, job growth for wind turbine technicians is expected to reach 61%. This demonstrates the great potential in the renewable energy sector and the need for related skills. Skills upgrading, for those occupations that remain within the vocational education system, a higher skill level may be required. This means that the vocational education curriculum needs to be updated to contain more technical knowledge and management skills. With the growth of non-traditional vocational education programs, as the industry changes, vocational education also needs to expand beyond the traditional fields, providing training related to emerging industries, such as information technology, biotechnology, environmental science, etc. These change in skill requirements will require

adjustments in vocational education curriculums, as well as adaptations in the training and professional development of higher vocational teachers. These changes may also mean a change in the recruitment strategies of higher vocational teachers if more industry experience is needed.

According to OECD data, According to OECD data, many occupations with a higher risk of automation (i.e., most jobs are likely to be automated) have a higher proportion of young workers with vocational education graduates. This is the case in the metal and machinery industry and electrical and electronic industry. In the OECD countries, an average of 28% of young people unfinished high school education, they work in a higher proportion of automation risk, about 22% of ordinary high school education graduates and 21% of vocational education graduates engaged in automation higher risk, only 9% of higher education graduates engaged in high-risk work, suggesting that higher education may provide more protection, make graduates not easily threatened by automation. However, the differences between countries is significant, with more than a third of young vocational education graduates in Greece, Lithuania, Slovak Republic and Slovenia engaged in highly automated work. In Denmark and Norway, it is less than 10%. In Denmark, South Korea, Mexico, and the United States, but not in Belgium, Lithuania, and the Slovak Republic. This phenomenon reflects the association between the level of education and the nature of the work and its sensitivity to automation.

The impact of digitization and automation has not only changed the labor market, but also driven changes in the education field, especially vocational education. With the rapid development of the industry and the continuous progress of technology, vocational education programs need to be constantly updated and upgraded to match the needs of the labor market. This requires teachers to continue learning and maintain a close integration with practice. Higher vocational teachers need to use modern teaching methods, such as virtual reality (VR) and augmented reality (AR), to improve the teaching effect and students' learning experience. These technologies can simulate the real work environment and provide students with

opportunities to practice them. Affected by the COVID-19 outbreak, vocational education has had to turn to distance learning to ensure the continuity of education. This shift requires the ability to teach online and use digital tools. However, teachers in different countries and readiness to address these changes differ educational institutions. Some teachers may lack the necessary technical training and resource support. For example, according to the 2018 TALIS data, vocational teachers in Denmark, Portugal and other countries are poorly prepared for digital technical support, ranging from 9% to 40%. The UK survey showed that in July 2020, 98% of the 109 universities reported that the vast majority of teachers felt confident about using digital platforms for distance learning, reflecting good technical support and effective training measures. Similarly, in November 2020, further surveys showed that 98% of 97 universities stated that the vast majority of university teachers felt confident and proficient in online / blended teaching, indicating that they had adapted to the new teaching model. Higher vocational teachers in Denmark and Germany also reported a smooth transition smoothly to remote teaching. Higher vocational teachers in Denmark and Germany also reported a smooth transition smoothly to remote teaching.

3.2 The Aging of Teacher: A Microcosm of an Aging Society

The aging of higher vocational teachers is a global problem, especially in the OECD countries. This phenomenon has had profound effects on the education system and on the future labor market. In OECD countries, 44% of teachers in high school vocational education programs were over 50 in 2018, up from 41% in 2013. This is higher than the 39% of general education teachers. Data from Europe show that 46% of vocational teachers have an average age of 50 or older, compared with 29% of all higher education workers and 32% of the total workforce. From 2011 to 2019, the aging rate of higher vocational teachers increased by 5 percentage points, while that of all workers and higher educators increased by only 2-3 percentage points.

The impact of a shortage of teaching staff could be significant. Even a slight shortage of vocational education and training teachers can

have long-term effects. Through the impact on students, vocational education and training teachers also have an impact on industries and the economy. A shortage of vocational education teachers can undermine the stable provision of specific occupational courses as well as the sustainable supply of qualified workers in related occupations. A shortage of vocational teaching staff may also increase the cost of running vocational education institutions. It reduces the time for professional development for existing staff and increases the need for training lower qualified staff. Reliance on temporary or substitute personnel can lead to low retention and high turnover rates, thereby disrupting teaching continuity. In the long term, a teacher shortage may result in a reduction in the supply of vocational education courses or a narrowing of the range of courses and choices offered to learners.

Task automation seems to be able to alleviate personnel shortages in certain professions or sectors, but overall, the demand for teaching professionals in the education sector is unlikely to be easily affected by increased automation and the application of technology. It is estimated that among all educational sectors, teaching has the lowest risk of automation because the work performed by teaching professionals is not easily replaced by technology. In the context of the increasing application of technology in vocational education and the rise of online courses, teacher-led instruction remains crucial. Online and remote vocational education courses are still learning opportunities mediated by teachers: they need to design and support courses, teach and assess students.

Attracting industry professionals to join the higher vocational teaching team is an effective strategy to alleviate the shortage of vocational education teachers. Industry professionals have hands-on work experience, can provide students with real industry cases and solutions, they understand the latest industry trends and technologies, can help students master the most cutting-edge skills, they can provide students with guidance and advice on career development, and help students better prepare for employment. Some countries offer alternative approaches to teacher certification, allowing industry experts without a traditional educational background to become teachers,

with the aim of recognizing the different levels of expertise and experience needed for teaching in the profession. But these approaches often recognize individual work experience and expertise rather than traditional education degrees, and industry professionals often lack teaching skills, including classroom management, instructional design and student assessment, and their transition from industry environment to educational environment takes time to adapt to the teaching role.

3.3 Strengthening the Close Links among Industry, Education, and Research: From Learning to Employment

Compared to other forms of education, vocational education requires closer ties to the labor market and adjustments in response to changes in the labor market. Therefore, various forms of interaction and exchange between vocational education schools and industry are encouraged, including the work and learning of students and teachers, is encouraged. Providing such learning opportunities for teachers is more difficult than for students: teachers' work-study not only requires a good relationship between vocational education and training schools and industry but also needs support, allowing teachers time off to teach, as well as financial and other incentives. Ultimately, the industry experience of higher vocational teachers will be rewarded by supporting students in more effective learning and a smoother transition to employment.

Another potential benefit of close ties between vocational education schools and industry is to encourage experienced professionals in the industry to become higher vocational teachers. As noted above, this not only helps reduce the shortage of vocational education and training teachers but also increases the proportion of teachers whose skills and knowledge are synchronized with industry practices. In addition, their connections with the industry also help strengthen the ties between vocational education and training institutions and the workplace.

In the era of "Internet +", as a professional platform for delivering talent to society, colleges and universities should adjust the traditional mode of education and regard industry-education-research collaborative education as an important mode for cultivating

talent [9]. The close connection between the vocational education sector and research institutions (such as universities or vocational education research and innovation centers that provide initial and specialized teacher education and training) also helps provide high-quality vocational education. Through close cooperation with universities and research centers, and through technological and pedagogical innovation, higher vocational teachers can become tools for driving innovation in the vocational education and training sector and industry, and equip the future workforce with new skills required by the labor market.

3.4 The Increasingly Complex Higher Vocational Teacher Skill Systems

In today's vocational education environment, teachers are facing unprecedented challenges and opportunities. With the rapid development of technology and the constantly changing needs of the industry, higher vocational teachers need not only specific vocational skills and technical skills, but also stronger basic skills, digital skills and soft skills. Soft skills such as critical thinking, collaboration, and communication are particularly important for teachers. They not only help teachers work more effectively with students, colleagues and industry experts, but also develop students' these abilities to make them more successful in their future work. Literacy and computing skills are the cornerstone of all areas of education.[10] For vocational teachers, these basic skills not only help teaching, but also help students understand and analyze complex information. Vocational teachers need to have diverse skills and abilities to meet the needs of the changing educational environment and labor market.

At the same time, leadership within vocational education institutions is more important than ever before. Vocational education plays a critical role, from nurturing and supporting teachers to attracting employer and stakeholder participation, as well as improving the quality of vocational education through technological and pedagogical innovation. Administrators face increasing challenges in recruiting well-prepared teachers and establishing incentives to retain them. In South Korea, leadership assessments of vocational education institution managers have a

significant statistical impact on the teaching capabilities of professional teachers in vocational education schools.

4. Countermeasures of Vocational Teacher Training in the Post-Information Age

4.1 Enhancing the Enthusiasm of Higher Vocational Teachers

Targeted financial incentives and support can encourage industry professionals to join the field of vocational education and training in a shortage areas. For example, vocational teachers who receive widespread support through training courses are more likely to gain a sense of achievement and recognition. Highly experienced teachers, on the other hand, are more likely to be promoted to management and senior management through management training to stay in the profession

Increase close ties with the industry. Due to the inherent closure of previous schools and industrial fields, students often faced mismatches with industry demands, and industries had difficulty recruiting suitable talent. Teacher capability is the supply side of student training. However, most industry teachers lack the required teaching qualifications and skills, making it difficult for them to join the teaching ranks. Opening industry entry permits as needed and even promoting flexible teaching can mitigate this problem. Nevertheless, this should not come at the expense of the inherent conditions of higher vocational teachers; instead, cooperation should be strengthened to promote experience sharing.

4.2 Focusing on the Teaching Skills of Higher Vocational Teachers

Teacher training programs should cultivate future vocational teachers' teaching skills as well as their basic skills, digital skills, and soft skills. Vocational institutions must constantly update their curriculum, collaborate to provide practical teacher training, and conduct research and innovation in teaching methods. As part of vocational and technical education and training, providing work-based learning opportunities in the industry is particularly helpful for those without an industry background.

The ever-changing teaching and learning environments, as well as the dynamic needs of

the labor market, mean that vocational teachers need to continue developing their skills after leaving vocational and technical education and training. This skill requires attractive, customized services rather than broad digital learning tools. Complex participation from various institutions such as schools, teacher communities, companies, and social organizations can effectively enhance the level of digital participation.

4.3 Cultivating Innovative Teaching Methods for Higher Vocational Teachers

Innovative teaching methods can improve the quality of vocational education teaching and promote the development of horizontal skills, including soft skills and digital skills. Vocational education can benefit from the flexibility, cost-effectiveness, security, and other advantages of new technologies such as online learning, virtual/augmented reality, robotics, and simulators. Encouraging the adoption of these methods can begin with training vocational teachers to utilize new and existing technologies. Opportunities should be provided for training and networking to help vocational teachers regularly update their teaching knowledge and digital skills and adjust their teaching methods.

To encourage the effective use of innovative teaching methods, strategic guidance and institutional support should be provided to vocational teachers. This can include guidance on how to select effective teaching methods and improve access to digital devices, high-tech equipment, and technical support. Innovation in vocational education and training can also be promoted by establishing partnerships between the vocational education sector and industry, thereby improving the procurement of materials and equipment based on teaching needs. More broadly, it is necessary to raise awareness of the importance of innovation, information and communication technology (ICT), and soft skills in vocational education, encouraging relevant stakeholders to cooperate and make vocational education more innovative.

4.4 Strengthening the Top-Level Design of Vocational Teachers' Human Resources

The human resources of higher vocational teachers need to prepare the top-level design adequately. Leaders must understand both the

vocational education sector and the labor market, as well as possess the organizational and instructional skills needed to improve teaching and learning. To ensure that vocational college managers can effectively fulfill their complex and diverse responsibilities, opportunities for initial training and professional development should be provided to ensure they possess the right skills, and this should be part of a coordinated skill development strategy. It is also important to make vocational education positions more attractive by developing middle management positions and teams to assist people in fulfilling responsibilities, allowing suitable external candidates to enter the profession, and supporting vocational educators through peer learning, thereby making positions in vocational education more attractive and laying a resource foundation for the top-level design of vocational teacher development.

5. Conclusion

This paper has conducted a thorough analysis of vocational teacher training in the information age and linked it to existing literature, emphasizing that teacher team building is crucial to the development of vocational colleges. The degree of concentration of a teacher team can fully reflect the strength of a college. Therefore, mastering intelligent teaching technology and methods is of great significance to the training of vocational teachers. Currently, as the development of information technology is shifting toward intelligence, the strengthening of higher vocational teacher training inevitably need to innovative. Only through innovation can make educational practice better meet the training needs of contemporary vocational skills talent while adapting to social development.

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