

# *Research on the Dynamic Mechanism and Realization Path of Expanding the Digital Ability of College Teachers under the Digital Pattern of Education*

Qingpeng Huang

Automobile College, Guangdong Mechanical & Electrical Polytechnic, Guangzhou 510550, China

**Keywords:** Digital education; digital ability; dynamic mechanism; implementation path

**Abstract:** The report of the 20th National Congress of China clearly points out that promoting the digitization of education and teachers' digital ability are the inevitable requirements of college education and teaching practice under the guidance of technological change. Based on the national strategic drive of education digitization, the potential growth of digital education, the external driving force of teachers' digital education scene change and the internal driving force of cultivating new talents, updating education evaluation mode and innovating education environment ecology, constitute the influencing factors of the dynamic mechanism of college teachers' digital ability. Standing under the historical pattern of the new era of national education digitization, this paper expands the development path of college teachers' digital ability from four levels of concept, management, resources and practice, and forms a system to support the development of national education digitization, so as to meet the objective needs of improving the modernization ability of education governance and promoting the construction of high-quality education system.

## 1. Introduction

The report of China clearly pointed out that by 2035, we will basically realize informatization, promote the digitization of education, and build a learning society and a learning country for lifelong learning<sup>[1,2]</sup>. Since the 18th National Congress, China has begun to promote the digital development of education. The "Education Informatization 2.0 Action Plan" issued by the Ministry of Education marks a new model of digital technology-driven education governance. The "14th Five-Year National Informatization Plan" (Central Network Security and Informatization Committee) clearly proposes to carry out lifelong digital education, and makes specific provisions on digital facilities, digital resources, and digital literacy to indicate the direction of digital education development in the new era<sup>[3]</sup>. The national intelligent education platform will be officially launched in 2022, providing strong support for promoting the digitization of education. The arrival of the digital era of education reveals that information technology goes beyond the simple use of objects, and it is an all-round, multi-field and deep-level integration and interoperability at the level of higher education. It means that the establishment of two-way interaction between technology and higher education is a leap from the application-driven level to

the integration and innovation level.

## **2. The constituent elements and evaluation indexes of college teachers' digital ability**

### **2.1 Analysis of the elements of digital ability at home and abroad**

The current foreign research on the components of educators' digital competence, first of all, from the EU educators' digital literacy framework based on the education work carried out by the EU General Administration of Education and Culture, determines that the four areas of digital resource design, teaching implementation, teaching evaluation and learner-centered are the core parts of the educators' digital literacy framework. The European framework for educators' digital literacy includes six main components: professional participation, digital resources, teaching and learning, evaluation, enhancing learners' ability and promoting learners' digital literacy. It is one of the more authoritative frameworks for promoting educators' digital literacy and standardized evaluation in international education organizations, and can provide reference for the training process of digital literacy in higher vocational teachers in China.

On the basis of summarizing the previous research, domestic scholars put forward the elements of digital ability. The domestic related research has gone through three stages : the first stage (the 1.0 era of vocational education informatization) : the research mostly involves the initial and application stage of digital technology and education in China, and less on the integration and innovation of digital technology in higher education, especially in the field of higher vocational education. The focus is on how vocational teachers use information technology to promote teaching, as well as the impact of hardware facilities and the use of information technology to carry out interactive teaching. The second stage (vocational education informatization 2.0 construction) : the research focus is that vocational college teachers need to carry out vocational education at a multi-dimensional and dynamic level by using digital technology, and focus on improving teachers' digital literacy to create more powerful effectiveness for the digital development of vocational education. The third stage (the era of digitalization and intelligent technology): it begins to pay attention to the perspective of digital intelligent technology. The research content mostly involves the integration of big data, cloud computing, artificial intelligence and other digital technologies into the background of college learning and life to enable vocational college teachers to carry out educational practice activities. It has become the focus of research in this period to explore how to improve digital literacy and effectively enhance teacher education and teaching<sup>[4-6]</sup>.

### **2.2 Interpretation of the evaluation index of digital ability of university teachers**

The first stage is the forming stage of the evaluation index theory of teachers' digital competence. The representative research on the evaluation index of foreign teachers' digital literacy is the 'Digital Literacy Framework for Educators 2.1' of the European Commission in 2017. The framework proposes six literacy fields and professional cooperation from the three dimensions of educators' professional ability, teaching ability and learners' ability, including 22 digital literacy fields such as professional participation field, digital resource field, teaching and learning field, evaluation field, empowering learners field, and promoting learners' digital literacy field, such as reflective practice, sustainable development, organizational communication, resource creation, shared resource protection, voluntary choice, autonomous learning, collaborative learning, guidance, teaching, feedback and planning, evidence analysis, evaluation strategies, etc., providing detailed and accurate evaluation criteria for educators.

In recent years, the International Association for Educational Technology (ISTE) has issued the ISTE Standard: Educators, which proposes the different roles that teachers need to play and

identifies the key roles of teachers in the field of digital competence: as learners, digital leaders, digital citizens, digital collaborators, digital learning environment designers, effective digital learning promoters and data analysts, providing a perspective for speculative research. The domestic research on the evaluation of teachers' digital ability in the digital age mainly includes three dimensions: time (stage), subject field and behavior subject. The time (stage) dimension refers to the process of teachers' digital literacy through the initial stage, development stage and deepening stage. Discipline field refers to the literacy requirements of teachers under the diversified and multi-level discipline field evaluation system of higher education. The behavior subject refers to the three subjects of 'university teachers', 'universities' and 'government (higher education authorities)' working together to improve the digital literacy of university teachers. Nowadays, in the era of intelligent technology, the evaluation index of teachers' digital ability has also entered an in-depth stage. One is the transformation of students' learning and towards intelligent learning. This process requires college educators to master knowledge maps, learning algorithms, etc., which can automatically push resources to help learners develop differently. Based on big data and portrait technology, it can not only depict each individual more stereoscopically; the second is the transformation of teacher development and lifelong development. It can use intelligent technology to monitor the educational process in real time and intelligent early warning to help the professional development of the teacher community through various forms of teaching and research organizations such as online teacher studios and online teaching and research alliances.

### **3. Analysis of the dynamic mechanism of university teachers' digital ability**

According to the internal logic of "motivation-behavior," the dynamic mechanism structure of educational digitization to promote the high-quality development of college teachers' digital ability should be composed of two parts: exogenous power and endogenous power.

#### **3.1 External power level**

##### **3.1.1 New Opportunities: Digital education has enormous growth potential**

In the new century, digital technology represented by artificial intelligence, big data, Internet of Things and cloud computing has entered a new era of rapid development. The digital technology revolution in the new era has pushed China's economy and society to a new stage of development. In the new stage of development, educational informatization has also integrated into the new connotation of development, opening a new era of digital development of education<sup>[7,8]</sup>. Based on the deep integration of digital technology and education and teaching represented by artificial intelligence, big data, Internet of Things and cloud computing, promoting education digitization has become a new connotation of the development of basic education informatization in the new era. Basic education informatization has entered a new stage of development with the digitization of basic education as the core. Whether in the educational or academic circles, the society has begun to pay constant attention to digital intelligent technology, involving digital technology in the context of big data, cloud computing, artificial intelligence and other integration into the learning and life of colleges and universities to enable college teachers to carry out educational practice activities, and to explore how to improve digital literacy and effectively enhance teacher education and teaching has also become the research focus of the period.

##### **3.1.2 New policy: the stage goal of implementing the digital education strategy**

Since the 18th National Congress of China, China has embarked on a new journey to accelerate the construction of digital education. The promulgation of the 'Education Informatization 2.0 Action

Plan (2018) ' marks that China's education informatization construction has entered a new stage. The '14th Five-Year Plan for National Informatization' (Central Network Security and Informatization Committee, 2021) clearly proposed to carry out lifelong digital education for the first time, and made specific provisions on infrastructure, digital resources, and teaching reform, which pointed out the direction for the development of educational informatization in the new era<sup>[9]</sup>. China will vigorously strengthen the construction of new education infrastructure and build a digital-based public education service system. The national smart education platform will be officially launched in 2022, providing strong support for promoting the digitization of education. The Ministry of Education of the People 's Republic of China issued a notice on the education industry standard of " teachers ' digital literacy, " urging colleges and universities to enhance teachers ' awareness and ability to use digital technology to optimize, innovate and change education and teaching activities.

### **3.1.3 New requirements: to meet the practical needs of teachers' digital teaching**

Since the outbreak of COVID-19 in 2020, some colleges and universities in China have made full use of the new generation of digital technologies such as 5G, big data and intelligent technology to carry out online course teaching activities and academic guidance, network recording courses and classroom attendance, which has reduced the impact of the epidemic on education and teaching to a certain extent and brought into play the unique advantages of the integrated development of digital technology and education industry. With the continuous introduction of the digital strategy of education, the development of economy and the improvement of people's living standards, college students' demand for learning cultural environment and products is gradually moving towards personalized, differentiated and experiential changes. It is urgent to supply large-scale educational digital products to meet the learning choices of college students. Good digital ability requires effective control of various information technology environments, platforms, tools and resources to provide strong technical leverage for the transformation of teaching and learning methods.

## **3.2 Endogenous power level**

### **3.2.1 Strong connotation: cultivate innovative talents of digital technology in the new era**

The development of digital society has promoted the development of educational informatization into a new era with the connotation of educational digitization. The expansion of college teachers' digital ability is inseparable from the development of modern educational digitization pattern and the deep integration of information technology and education and teaching. The rapid development of modern information technology and its popularization and application in education and teaching have promoted the rapid development of college teachers' digital ability and made digital ability constantly have new connotation and characteristics<sup>[10,11]</sup>. At the same time, college teachers can optimize the allocation of educational resources, promote the reform of teaching paradigm, boost the construction of teachers, improve the level of educational governance, and cultivate a large number of innovative talents needed for the construction of digital China by empowering education and teaching. To improve the digital ability of college teachers and promote the implementation of digital education strategic actions will help to build a high-quality education development system and form a new connotation of realizing education modernization.

### **3.2.2 Advantages: Improve the evaluation model of teachers' digital teaching ability**

Most of the traditional evaluation methods of higher education and teaching adopt the traditional test method, which is time-consuming, labor-intensive and prone to deviation. Therefore, digital

technology can formulate digital literacy evaluation indicators for different subjects, highlighting the comprehensive evaluation of college teachers' higher-order thinking ability and digital literacy. Strengthen the process evaluation method, embed the evaluation into the teaching and learning process, and examine the digital literacy as the subject teaching goal ; using the intelligent teaching platform and sensing system, the multi-modal data such as behavior, cognition and emotion generated by teachers and students in the information-based teaching activities are collected in an all-round and whole process, and a data-driven digital ability evaluation model is established to realize the accompanying evaluation. Establish a digital ability development file for teachers and students for lifelong learning, form an objective, standardized, mature and fair digital ability evaluation implementation process, and realize long-term tracking evaluation and feedback of college teachers' digital ability.

### **3.2.3 Re-innovation: Innovate the new environment ecology of college teachers' education and teaching**

Digital technology enables college teachers to explore the needs of teachers and students through intelligent means, accurately locate target users, fully tap value needs, and carry out intelligent recommendation and accurate service. At the same time, digital technology is used to accelerate the penetration of core scenarios such as teaching, learning, management, examination, and evaluation, helping to reduce costs and improve education efficiency. Secondly, human-machine collaboration can achieve optimal operations based on intelligent decision-making and increase benefits. Big data, artificial intelligence and other technologies can more accurately and efficiently record the development process of teachers, provide more targeted guidance, help teachers self-diagnose and reflect on the evidence-based management of educational decision makers. Finally, intelligent technology can monitor and warn the education process in real time, help front-line educators find problems in time, implement emergency plans, and promote safer management.

## **4 The realization path of promoting the development of college teachers' digital ability**

The educational informatization in the new stage of development has also integrated the new connotation of development, opening a new era of digital development of education. Based on the deep integration of digital technology and education and teaching represented by artificial intelligence, big data, Internet of Things and cloud computing, promoting the digitization of education has become a new connotation of the development of basic education informatization in the new era. Basic education informatization has entered a new stage of development with basic education digitization as the core <sup>[12]</sup>. To give full play to the advantages of digital technology integration and innovation, it is necessary to vigorously promote the development and improvement of college teachers ' ability, build a high-quality basic education system supported by digital technology, promote the implementation of basic education digitization strategy, and help realize the modernization of basic education.

### **4.1 Concept: to cultivate the subject consciousness of digital literacy of college teachers**

Teachers' subjective consciousness is the core layer to ensure the improvement of their digital literacy. Therefore, it is necessary to stimulate teachers ' awareness of self-improvement of digital literacy and highlight teachers' subjective status in digital literacy training. The subject consciousness of college teachers to improve their digital literacy includes four core dimensions: information consciousness, computational thinking, digital learning and innovation, and information social responsibility. First of all, in the face of explosive and disorderly information

sources, college teachers can actively screen information and identify the authenticity and value of information. In daily life and teaching activities, teachers should take the initiative to discover and use positive, real and accurate digital information to improve efficiency, enhance sense of gain and happiness; secondly, teachers should learn to actively abstract problems, decompose problems, construct models and algorithms for solving problems when facing real problems, analyzing problems and solving problems, and make good use of iteration and optimization to form a paradigm for efficiently solving similar problems. Thirdly, teachers should not only use digital resources, tools and platforms to improve the efficiency of learning and the happiness of life, but also take them as the basis of exploration and innovation, and constantly develop the thinking habits and working habits of exploration and innovation. Teachers can use digital resources, tools and platforms to establish the goal of exploration and innovation, design the route of exploration and innovation, the process of practical exploration and innovation, exchange the achievements of exploration and innovation, and gradually form the consciousness of exploration and innovation, accumulate the motivation of exploration and innovation, and reserve the ability of exploration and innovation. Even in the digital environment, teachers should maintain their love for the country, the awe of the law, the recognition of national culture, the pursuit and love of science, the active maintenance of national security and national dignity, the promotion of good and evil in various digital scenes, and the active maintenance of the healthy development order and ecology of the digital economy.

#### **4.2 Management: Establish the evaluation criteria for the level of digital ability of college teachers**

In recent years, the International Educational Technology Association (ISTE) has issued the "ISTE Standard: Educators." This standard puts forward the different roles that teachers need to play, and determines the key identity of teachers in the field of digital competence<sup>[13]</sup>. The State Council issued the "14th Five-Year Plan for National Economic and Social Development and the Construction of the 2035 Vision Goals" and proposed to "accelerate digital development." This provision provides policy support for the development of digital literacy frameworks for college teachers. Facing the new stage of information technology development, on the basis of referring to the digital competency framework of teachers at home and abroad and combining with the actual situation of our country, the education authorities should formulate and promulgate the digital competency standard of college teachers as soon as possible, and design the digital competency evaluation index system, which is helpful for teachers to plan their own professional development reasonably and clearly, and to formulate digital competency and digital ability of college teachers in different stages of digital ability. At the same time, it is necessary to improve the evaluation method of college teachers' digital ability, innovatively add digital analysis technology to teaching evaluation, change the traditional evaluation mode with result evaluation as the main body, make full use of big data, artificial intelligence, diagnosis and improvement platform to record, track, detect and analyze teachers' learning behavior, realize dynamic process evaluation, create 'digital + education' evaluation mode, and carry out teaching feedback from time to time, so that teachers can adjust teaching strategies and continuously improve teaching effect. Finally, the development archives of college teachers' digital ability for lifelong learning are established, and a set of objective, standardized, mature and fair implementation process of digital ability evaluation is formed to realize the long-term tracking evaluation and feedback of teachers' digital ability.

#### **4.3 Resources: improve the multi-coordinated digital ability cultivation mechanism of college teachers**

Resources are the demand layer to ensure the improvement of digital literacy of teachers in vocational colleges. The traditional teacher training is easy to fall into the disorder and fragmentation of training resources, the lack of pertinence of training content, the independence of training subjects, and the reality of single fighting, which leads to the lack of timeliness and effectiveness of training. The digital ability training mechanism for college teachers should fully establish its diversified and collaborative characteristics. Colleges and universities in promoting the training mechanism involves the coordination of different departments and resources. We should enhance the awareness of strategic synergy, establish a synergistic promotion mechanism, and form a synergistic effect. On the one hand, we must establish a multi-collaborative cultivation mechanism. Education administrative departments at all levels should implement the national curriculum of information technology according to the overall planning of the "Compulsory Education Information Technology Curriculum Standards (2022 Edition) " and develop relevant series of courses with local characteristics. University researchers should aim at the forefront of digital development of education and cooperate with relevant enterprises to develop high-quality digital resources covering teaching, research and management<sup>[14,15]</sup>. The teaching department of colleges and universities should explore and develop a variety of digital literacy school-based courses based on the actual school-running situation and characteristics, integrate digital ability cultivation into subject courses, and establish a sound and perfect home-school co-education mechanism. On the other hand, we should carry out multi-level and diversified teacher research and training activities. At the local and regional levels, we should carry out various forms of teacher digital ability training activities such as lectures, seminars, high-quality class displays, teaching competitions, etc., and set up online and offline courses integrating digital technology and subject teaching; we should give full play to the leading role of the backbone teachers of the famous teacher studio, and regularly carry out cross-school teaching and research activities combining online and offline. At the school level, we should actively carry out on-campus teaching and research activities integrating digital technology and teaching to help improve the overall level of teachers.

#### **4.4 Implementation: Constructing the environmental ecology of lifelong learning of college teachers ' digital ability**

The ecology of education and teaching environment is the carrier to realize the high-quality and balanced development of college teachers ' digital ability. On the one hand, improve the national digital education environment public service system and expand the coverage of high-quality resources. Based on the national smart education public service platform, relying on digitalization to build a huge resource base, improve the communication efficiency of high-quality education and teaching resources, and build a digital ecological environment system. Using emerging technologies such as big data storage and blockchain, we can effectively integrate educational resources in heterogeneous environments and build a three-level shared digital ecological environment system of ' national + regional + school '. Make full use of emerging technologies such as artificial intelligence, virtual reality, and extended reality, build a 'national + regional + school-level ' collaborative development platform, form a development team involving multiple parties such as government, schools, and social organizations, and carry out exchanges and dialogues across time and space to ensure the effective connection of resource libraries at all levels and enhance the full flow and utilization of ecological and environmental resources. On the other hand, in order to cope with future technological changes, higher vocational teachers must constantly reconstruct professional skills in the process of professional development to achieve lifelong learning. The

learning of digital technology and the improvement of professional skills should be an alternating process. Mastering digital technology can not only improve teachers' comprehensive ability and digital teaching skills, but also provide teachers with more abundant learning methods and resources. The continuous improvement of professional skills will encourage teachers to consciously seek higher digital literacy to arm themselves. Only the mutual support and symbiosis of the two technical skills can achieve the high-quality development of professional teachers' career.

## 5. Conclusion

College educators in the new era should conform to the trend of the times. Therefore, based on the country's top-level deployment of education digitization, it is necessary to analyze the mode and path of improving and expanding the digital ability of college educators under the strategic pattern of education digitization, and it is urgent to cultivate the digital ability of teachers in colleges and universities.

## Acknowledgements

This paper is the initial result of the school-based project 'Research on the Essentials, Evolution Path and Framework Construction of Digital Literacy of Teachers in Vocational Colleges' (Project Number: YJYB20230001) of Guangdong Mechanical & Electrical Polytechnic.

## References

- [1] Li Xiaojuan, Wang Yi. *Technical empowerment: the essence, challenge and improvement of teachers' digital literacy in vocational colleges*. *China Vocational and Technical Education*, 2021,000 (023):31-37, 45.
- [2] Wu Junqi, Ren Feixiang, Li Meng. *Teachers' digital ability: connotation, evolution path and framework construction*. *Heilongjiang Higher Education Research*, 2021 (9): 83-90.
- [3] Hao Shuixia, Wang Gejuan. *Research on the development strategy of digital literacy of college teachers in the era of big data*. *Software guide. Educational Technology*, 2018, 17 (10): 4.
- [4] Lu Xiaozhong, Wang Shenglan. *The historical reflection and future direction of the development of educational informatization in China - from the perspective of the relationship between educational informatization and educational modernization*. *Jiangsu Higher Education*, 2019, (12): 1-8.
- [5] Chen Lin, Liu Xuefei et al. *Educational informatization upgrading: motivation, characteristic direction and essential connotation*. *Electrified education research*, 2018, 39 (8): 15-20 + 33.
- [6] Wan Kun, Ren Youqun. *Technology empowerment: the development direction of basic education informatization transformation in the era of education informatization 2.0*. *Electrified education research*, 2020, 41 (6): 98-104.
- [7] Hu Xiaoyong, Zhu Long, etc. *Informatization teaching mode and method innovation: trend and direction*. *Electrified education research*, 2016, 37(6): 12-19.
- [8] Victor Mayer-Schönberg, Kenneth Cookye. Sheng Yangyan, Zhou Tao translated. *Big data era: great changes in life, work and thinking*. Hangzhou: Zhejiang People's Publishing House, 2012.27.
- [9] Jia Tong, Gu Xiaoqing. *Data technology-driven reshaping of educational form: path and process*. *Electrified Education in China*, 2021, (3).
- [10] Gu Xiaoqing, Bai Xuemei. *A new path to promote educational informatization: building a design-centered research-practice community*. *Open Education Research*, 2019, 25 (6): 66-74.
- [11] Zhu Zhiting, Xu Qiuxuan, etc. *Requirements and action suggestions for new infrastructure standards for educational informatization*. *China Distance Education*, 2021, (10): 1-11 + 76.
- [12] Hu Xiaoyong, Zeng Xiangyi, etc. *Innovation and practice of information-based teaching and research to enable teachers to cluster high-quality development*. *Electrified education research*, 2022, 43 (2): 5-10 + 18.
- [13] Wu Di, Li Huan, etc. *Digital transformation of education: international background, development needs and promotion path*. *China Distance Education*, 2022, (7): 21-27 + 58 + 79.
- [14] Hu Qintai, Lin Xiaofan, etc. *Smart education-driven education system innovation*. *China Distance Education*, 2022, (7): 13-20 + 78.
- [15] Zhang Shuangzhi, Zhang Longpeng. *Innovation of educational governance structure: the perspective of blockchain empowerment*. *Electrified Education in China*, 2020, (7): 64-72.