

Research on the Current Situation of Teachers' Digital Literacy

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Abstract: In recent years, artificial intelligence technology has developed rapidly and has been widely used in the field of education. In the new era, the digital transformation of education is an important content of the development of education, and as the core and key link of the digital strategy of education, the cultivation of their digital literacy has become a hot topic of educational research at home and abroad. In the process of digital teaching in China, teachers play an important role, and the improvement of their digital literacy has been regarded as a "required course". This paper makes a comprehensive analysis of the research results of teachers' digital literacy through the literature review method and the retrieval and analysis of the relevant literature at home and abroad. On this basis, this paper also analyzes the existing problems of teachers' digital literacy and puts forward corresponding improvement strategies, in order to provide some reference for the digital literacy training education of teachers in China.

Keywords: Digital Literacy; Teachers; Digital Literacy Cultivation; Education Digitization.

1. Foreword

The new round of scientific and technological revolution and industrial transformation is accelerating, and the global digital trend is becoming more and more significant. Every industry is changing the traditional kinetic energy, and tapping out the innovation potential of the new generation of digital technologies such as artificial intelligence, big data and the Internet of Things. Driven by the external power of digital technology innovation and the internal power of the change of talent training demand, with the development of education digitalization, education has also entered a period of rapid development[1]. The ultimate destination of the digital transformation of education is the digitalization of the entire educational ecosystem. From the perspective of teaching environment, teaching resources and teaching thinking, it not only digitized educational content, but also applies educational practice to educational practice. This requires teachers to effective, reasonable and creative use of digital technology, reconstruct the teaching content, reform of teaching mode, innovative teaching methods, accurate teaching decision, to stimulate students' learning initiative and enthusiasm, achieve the purpose of personalized guidance, so as to improve the teaching quality, promote the all-round development of students [1].

As the first resource in education, teachers are the main force to promote the digital development of education. In the digital age, teachers play a vital role in promoting high-quality talent training[2]. China's Ministry of Education promulgated the Teacher Digital Literacy Framework in November 2022, aiming to improve the application level of teachers' digital technology and promote the industry standard of education and teaching innovation and reform. As the promoter of digital transformation of education, teachers are also the breeders of digital talents. Their digital literacy level has a direct impact on the process of digital transformation of basic education and the training quality of digital talents, and is closely related to the implementation of China's education modernization and the strategy of strengthening education

power. In the current teacher education, it is of great practical significance to carry out the research on teachers' digital literacy[3].

2. Teacher's Digital Literacy Concept

2.1. Digital Literacy

Exploring the origin and evolution of the concept of "digital literacy" can help us to better understand the meaning and constituent elements of the concept of "teacher digital literacy". With the development of digital technology, the concept of digital literacy has also emerged and developed. Yoram Elachet-Alka first proposed the concept and structure of "digital literacy" in 1994, and in 2004 further defined the structure of "digital literacy", namely "picture literacy", "copy literacy", "branch literacy", "information literacy" and "social emotional literacy"[4]. The concept of "digital literacy" was formally proposed by Paul Gilst in 1997 in "Literacy of Digital", and defined as the ability to acquire, understand and integrate digital knowledge. The European Commission, UNESCO, and a number of other organizations, manage, understand digital knowledge and see it as a capability[5].

Wang Youmei et al. believe that digital literacy is a comprehensive, dynamic and open concept, which is a process of the development of media literacy, computer literacy, information literacy, network literacy, and gradually evolved. Shi Ge believes that digital literacy is the extension and deepening of information, science and media literacy, and it is a basic ability and an attitude that contemporary citizens must have. According to Li Degang, digital literacy refers to the ability to recognize, comment on digital content, multimedia language, digital media and conduct interactive communication in the context of digitalization[6]. In general, from the perspective of talent training needs in the digital age, digital literacy refers to a comprehensive ability that people need to survive, work, learn and develop in the digital social environment. It involves the understanding, use, evaluation and creation of digital technology in economic and social development, mainly including information management,

communication and sharing, cooperation, creation of content and knowledge, moral responsibility, evaluation and problem solving, technical operation and other basic elements[7].

2.2. Teacher Digital Literacy

The research on the connotation and components of teachers' digital literacy has been started very early in foreign scholars and research institutions. According to Krumschwick, teachers' "digital literacy" refers to their ability to use ICT in a professional background; the Spanish General Digital Capacity Framework for Teachers divides their digital competence into five aspects, namely, information and data reading, communication and cooperation, digital content creation, security and problem solving; the European Union' digital literacy is composed of 22 basic abilities in six aspects, namely, teachers' professional ability, teachers' teaching ability and students' learning ability[8]. Most of the domestic studies introduce the concept of digital literacy into international projects, standards and reports. In 2015, Liu Qingtang, Wu Lixia took the lead in our country put forward the concept of "digital literacy", using the development of the "digital teaching ability" model, build the "digital literacy, digital teaching preparation, digital teaching ability, digital teaching evaluation and evaluation, digital teaching management, professional cognition and development, organization and social ability" evaluation and evaluation system[9]. Yang Shuang and Zhou Zhiqiang put forward an evaluation system of "including digital technology application, digital information management, digital content creation, digital community construction, digital security capability, software application capability, information retrieval capability, task collaboration capability, and 18 indicators"[10]. Li Xiaojuan and Wang Yi's understanding, application and innovation of higher vocational teachers' "digital literacy", application and innovation of various new digital technology methods, including artificial intelligence, Internet of Things and big data.

According to the research of Yi Ye and Xue Feng, teachers' digital literacy is composed of five factors: attitude and consciousness, the utilization and development of digital resources, digital teaching skills, the empowerment of digital learners, and digital research development. According to He Jian, the digital literacy of teachers includes eight factors in three levels, namely: "basic" level (digital office, digital social networking, digital security); "professional" level (the digitization of the professional); "identity" level (digital teachers, digital technicians, digital social workers, digital science and technology workers) on the connotation of digital literacy of teachers, we can get a basic conclusion: the digital literacy of teachers is a comprehensive, dynamic, complex, crossover, open concept, including knowledge, skills, methods, thinking, concept, consciousness and other multiple levels, multiple dimensions[10].

This article tries to the following interpretation of teachers' digital literacy connotation: teachers' digital literacy refers to the teacher in the optimization, innovation and change education teaching activities, appropriate use of artificial intelligence, Internet of things, big data and other emerging digital technology, is a kind of acquisition, processing, application, management, innovation, evaluation of comprehensive ability. Its main contents include: basic literacy (emphasis on teachers in the application of digital ethics, digital thinking, digital skills and digital security ability), teaching literacy (teaching resources selection,

teaching design, teaching organization and teaching evaluation ability) and developmental literacy (digital technical support of collaboration and autonomous learning ability, digital consciousness, digital content, digital application critical thinking, digital problem solving ability) and other elements.

2.3. Teacher's Digital Literacy Framework

The construction of the framework system is a high level of abstraction and decoupling of teachers' digital literacy. At present, teachers' digital literacy education has become a hot topic in the international and domestic education circles. When constructing the framework mode of teachers' digital literacy, it is necessary to master the research context of the connotation system of teachers' digital literacy. When designing and constructing the connotation system of teachers' digital literacy, it is necessary to have both an international vision and local feelings.

IIS released the Digital Capacity Framework (2016), which consists of six components: IIS level, information materials, and media reading; digital products, problem solving, innovation; digital communication, cooperation and participation, digital learning and development; digital identification and health, and further divided into 15 items, including practical skills, critical application, creative creation, participation, development, and self-knowledge. The European Union (2017) issued the EU Digital Literacy Framework for educators (EU), which refined 22 levels (domains) into 6 levels and constructed 6 levels (layers), and on this basis constructed a teacher ability evaluation model based on 6 levels[10]. The Framework for Digital Literacy for Teachers released in Norway (2017), Highlighting the two core goals of "focusing on the professional growth of teachers" and "focusing on the professional operation of teachers", From the three dimensions of "knowledge", "skill" and "ability", From "discipline" and "basic skills", "school" and "society", "morality", "teaching method" and "subject" teaching, "leadership" and "learning", "interaction" and "communication", "change" and "development", From the three aspects of "knowledge", "skill" and "ability" respectively, For the ISTE Standards (ISTE) published by the International Institute of Educational Technology (2017): "Subject" and "Basic Skills", "School" and "society", "Ethics", "Ethics", "Teaching Methods and Subject Teaching", "Leadership and Learning", "Interaction and Communication", and "Change and Development", Seven identities (learners, leaders, citizens, qualified, designers, assistants, and analysts) and 24 specific "digital abilities" were divided into seven levels. Among them, the learning ability is mainly reflected in: exploring the teaching method of science and technology, actively learning network technology, understanding the development direction of science and technology; the quality of designers is mainly reflected in: how to design can promote deep learning activities according to the different needs of learners, and how to create a creative digital learning environment. UNESCO released in 2018 the teachers' information and communication technology ability framework (third edition), the framework covers three improving teachers' development level, six and teachers' professional activities (field) related six aspects, and established the 18 specific application ability, in order to apply the digital technology in education[11].

The Standard of Information Technology Application Ability for Primary and Secondary School Teachers (Trial)

(2014 edition), according to the two major needs of teachers' digital literacy training (basic needs and developmental needs), they are divided into 5 aspects, corresponding to 5 aspects, a total of 25 aspects. The education industry standard of the People's Republic of China "teachers digital literacy" (2022), the system is mainly composed of five level dimension, 13 secondary dimension, 33 tertiary dimensions, respectively is: "digital consciousness", "digital technology knowledge and skills", "digital application", "digital social responsibility", "professional development" five system, the five system will effectively promote the implementation of the national digital strategy[12].

3. Current Status and Practical Dilemma of Teachers' Digital Literacy Research

The digital literacy of teachers is produced from the information literacy of their teachers, which is a sublimation and extension of the era of intelligence. In the era of intelligence, what we face is the "objective reality". Only by actively facing it, can we get the opportunity to "survive" and gain strength. The digital literacy of teachers is a dynamic, open, dynamic and constantly improving concept[12]. "When a life behavior or way becomes more popular and its influence becomes more profound, the role or value of traditional teacher literacy content becomes more marginal, and its educational effect becomes worse and worse, which objectively requires us to put forward and advocate a new literacy requirement to match it". Digital literacy of teachers means that under the premise of following information ethics, they can skillfully use various digital tools and technologies related to life, work and study, and can creatively use technology, carry out interdisciplinary and cross-field

research, and constantly improve their ability. Analyze the research hotspots of teachers' digital literacy education at home and abroad, and examine and grasp them, so as to promote the in-depth exploration of the connotation of teachers' digital literacy and the construction of the framework paradigm[12].

3.1. Research Status of Teachers' Digital Literacy in China

The number of published papers can reflect the theoretical level and research progress of a discipline to some extent. Using the literature searched in the CNKI, the statistics were made according to the order of years, and then the annual publication volume map of the digital literacy research literature in China in Figure 1 is obtained. We can see from the chart that the research on digital literacy just started from 2006 to 2011, and the number of articles published was only small; Since 2012, more and more papers have been published, especially since 2015, because the Horizon Report (Global Review) represented by the American New Media Alliance (New Media Association of Agency) has promoted the attention and research in this field[13]. 39 in 2016 and 58 articles in 2017, This is related to the 2014 Horizon Report (General Media University of International Report of the International of Digital Report) and the ITU Digital Literacy Declaration (International Media Institute), published in 2017. As can be seen from the increase of the number of literatures, this field is gradually getting the attention of the academic community. On the whole, the research of digital literacy shows a rising trend, and its level has also been significantly improved. Especially since 2015, the research on the topic of "digital literacy" has entered a period of rapid development and shown a significant development trend[14].

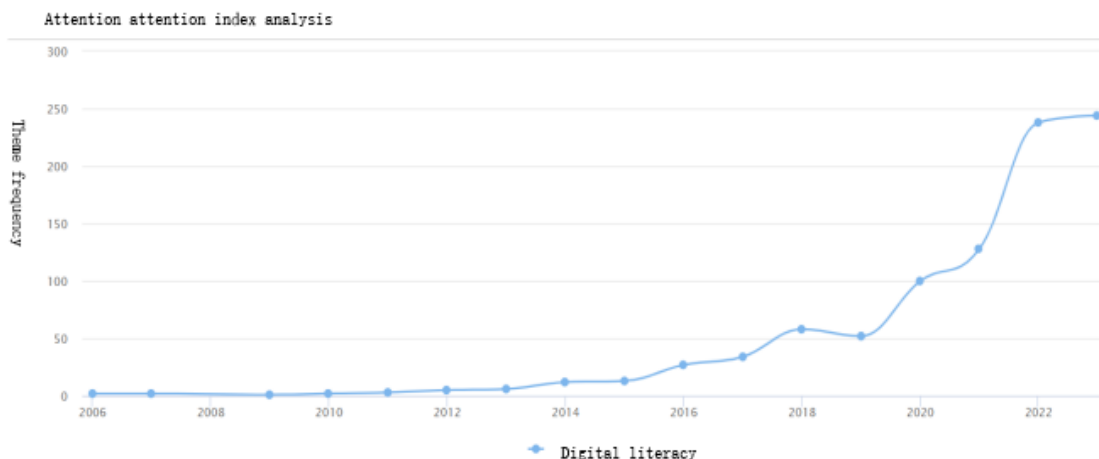


Figure 1. Digital literacy annual publication collection

Figure 2 Distribution map of the number of academic papers published about teachers' digital literacy in each region of the country. From the chart, we can see that China's teachers' digital literacy papers mainly distributed in 2021,2022,2023 three years, in 2021,2022 respectively, a paper, basically no related research in this field, and in November 2022, because the Ministry of Education issued teacher digital literacy education industry standards, so in 2023 the number of papers on teachers' digital literacy has significant growth, by August 2023, teachers digital literacy literature from 1 to 19, and entered a period of rapid development.

3.2. The Research Status of Digital Literacy of Foreign Teachers

Digital literacy refers to a person's ability to use digital technology to obtain, evaluate, organize, create and disseminate information in a digital environment. Many foreign countries have established the policies and framework of digital literacy education in order to ensure that teachers have the required knowledge and skills in the field of digital technology. These include training programmes, curriculum standards, and assessment methods. Teacher training and career growth, many overseas colleges and universities have set up teacher digital literacy training programs to help

teachers improve technology integration and educational science and technology capabilities[15]. The main contents include: the application of educational technology means, online teaching method, data analysis and so on. In terms of research and evaluation tools, researchers have developed a series of digital literacy evaluation tools and evaluation methods. At present, most of the research on teachers' digital literacy focuses on the discussion of teachers' digital literacy. Literacy education mainly includes the following aspects:

first, connotation; second, structure; in order to comprehensively improve the digital literacy of Chinese teachers, the European Commission developed a complete set of digital literacy framework, digital literacy development model and digital literacy evaluation tool in 2017. This theoretical system has not only been widely disseminated in the member states of the European Union, but also in some African countries, such as Russia and Morocco[16].

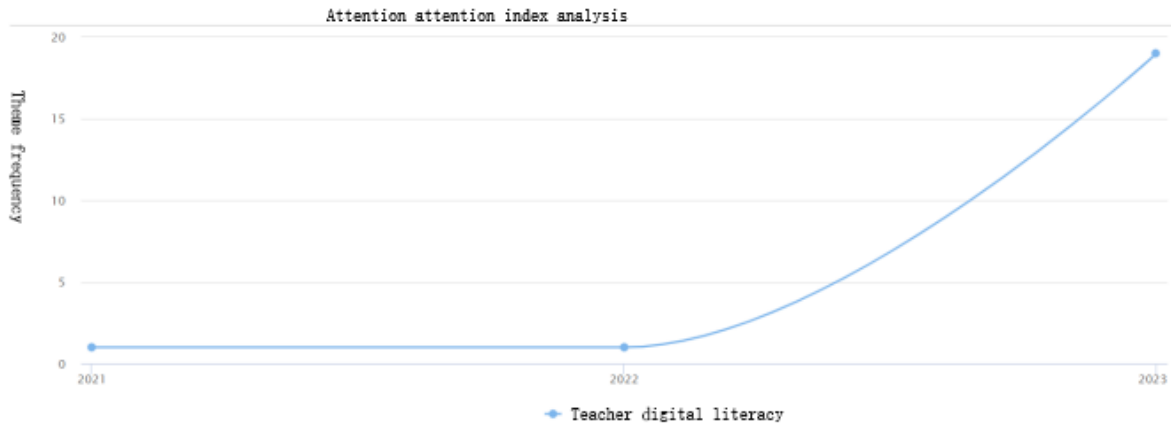


Figure 2. Number of academic papers on teachers' digital literacy

Searching Web of Science for a series of literature related to teacher digital literacy education, The search rules are "teacher" and "digital literacy", The search range is the core collection, The search found 105 papers, Searching for the keywords in these papers by Citespace, Found that they spread around "digital literacy", From the three directions of

"education", "teacher education", and "technology", Diffusion around, From the analysis shown in Fig, Foreign research on teacher digital literacy has mostly focused on teacher education, And how to educate teachers to use technology to promote education.

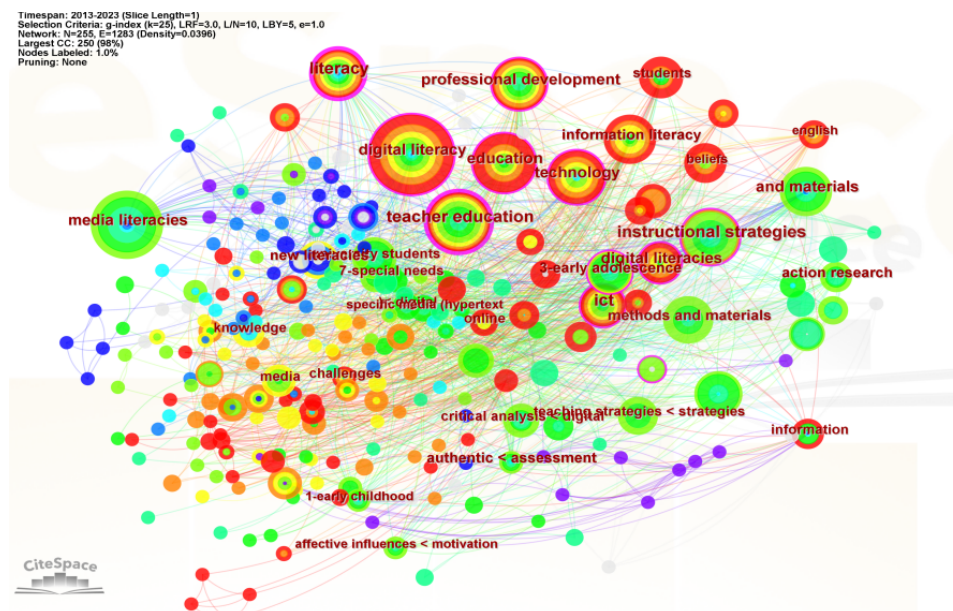


Figure 3. Research hotspot map of foreign teachers' digital literacy

3.3. The Practical Dilemma of the Development of Digital Literacy in China

3.3.1. Lack of an Intrinsic Driving Force

Teachers' willingness to improve themselves is low, and their own views on various professional development activities, especially their subjective cognition of their advantages and disadvantages, will affect their enthusiasm for professional development. At present, some teachers have

shown their inability or unwillingness to learn and cope with sexual learning, which have become practical obstacles to their professional development. Therefore, the problem of weak willingness to improve their digital literacy is obvious. Because of the long-term traditional education and the rejection of new things, teachers' understanding of the ease of use of digital technology has become very low, and even have a feeling of rejection of the availability of digital technology. In the face of the impact and challenges of digital technology,

teachers are more inclined to maintain a respectful attitude.

3.3.2. Lack of External Force

The cultivation of teachers' information teaching ability has been highly valued by the national education administrative department. It is hoped that their information literacy and digital literacy can be effectively improved through the teacher training. Teachers' training and training are of important theoretical and practical significance for promoting teachers' professional development and improving their digital literacy. In the face of tedious teaching affairs, low salary, difficult professional title evaluation and other problems, it is necessary to improve the enthusiasm of teachers to participate in training and learning. At the same time, teachers themselves have insufficient understanding of the application of digital tools, and some teachers feel that the cultivation of digital literacy is time-consuming and laborious, and they are not willing to accept it. There are still some practical limitations in the research of teachers' digital literacy. The quality of research needs to be further improved, and the research mode needs to be further innovated. The object of research needs to be improved is the digital literacy of teachers, and the object of research is teachers.

3.3.3. Difficulty of Assessing the Characteristics

At present, there are some problems in accurately evaluating and representing the digital literacy of Chinese teachers, the lack of evaluation standards, the evaluation means and methods are too dependent on subjective judgment, and the coverage of evaluation practice is not wide. In the era of digital literacy, in addition to alleviating the deficiencies of evaluation standards with the introduction of standards, there are still many problems. Therefore, at the practical level, how to accurately evaluate and depict teachers' digital literacy is still facing some practical problems. Because literacy is different from knowledge and ability, evaluating it is naturally difficult[17].

3.3.4. The Training Content and Mode of Teachers' Digital Literacy are Old

Most areas of teacher digital literacy training in China are surface, Not on the basis of the subjects, In the first line of practice, On the basis of teachers, considering the content and mode of their training, There is on paper, Unpractical and other issues, When teachers don't want to train, I think the training is time-consuming and laborious and meaningless to my teaching, It is difficult to apply it to the practice of all subjects, So, right now, Change to the content of the training, Reduce the scale of the training, Training and teaching with subject and background knowledge, Changing the traditional ways of teacher training, Pay more attention to it in your daily life, subtly changing teachers' digital literacy, Teaching also uses online and offline use, Design the development of the classroom way, Gradually changing the teachers' stereotype of teacher training, Fundamentally solve the problems of teachers in teaching, Improve teachers' digital literacy[19].

4. Improve Teachers' Digital Literacy and Training Ways

The digital literacy training of teachers is not only a change of the training objectives, but also requires the digital transformation of the whole training scene. On this basis, based on the focus of existing research, this project will supplement and improve the digital literacy training strategies of teachers to help the digital transformation of teachers.

4.1. Establish a Micro-Ability Index to Provide a "Scaffolding" for Teachers' Digital Literacy Training and Evaluation

Micro ability is a complex skills into a number of "small and real" basic ability, pay attention to the ability in the actual work situation, not only can break the current teacher training and practical phase separation, and can also break the past to standardized test and questionnaire from the regular assessment method, establish a set of effective professional ability assessment model. On this basis, the establishment of the "ability-centered" teachers' micro-ability index can provide support for the cultivation and evaluation of teachers' micro-ability. On the one hand, the micro-ability evaluation focuses on the reality, with the actual operation results and the actual operation behaviors such as teaching videos and design works as the evaluation standards. Such a form can promote teachers to consciously apply digital technology, improve the digital teaching ability, and make up for the gap of abstract literacy and practical ability., On the other hand, the micro ability index system to clear, specific, observable ability, and combined with specific teaching scenario, will match the ability of literacy requirements index, thus clear need to collect specific assessment data, to accurate evaluation support for teachers' digital literacy[19].

4.2. Pay Attention to the Diversity of Teachers and the Integration of Teachers

The digital literacy of teachers is a long-term task. In the process of teachers' professional growth, teachers' digital literacy is a curriculum consisting of both pre-professional and post-professional stages, which should be carried out in the whole curriculum system. Teachers should start from the early stage of their career and pay attention to the development of their career. The cultivation of normal university students should pay attention to the study of courses and the training of teaching practice, and include the content of digital technology in their compulsory subjects, so as to improve their ability to find, understand and apply information[19]. In order to improve the students' use of digital technology to improve the teaching level, we must strengthen the practical training of digital technology. In terms of in-service training of teachers, attention should be paid to teachers of different educational levels, classify teachers, vocational school teachers and university teachers, and develop a set of digital literacy improvement programs suitable for teachers, vocational school teachers and university teachers. At the same time, according to the ability level of different teachers, they are graded setting, and their phased literacy training, so as to design a set of feasible teacher training plan.

4.3. Based on the Resources of the Platform, Build an Immersive Atmosphere of Improving the Quality

It provides support for the "quality teacher training" resources of various learning section and categories, and provides conditions for teachers to conduct independent selection and training. For example, the National Smart Education Platform is characterized by resource diversity and rich activities, which can meet the needs of improving teachers' professional quality after pre-job services. On the one hand, teachers can use the expert lecture resources, special research resources and subject teaching cases in the

platform to carry out independent learning. Teachers can choose the content they are interested in according to their own needs, flexibly arrange the learning time and schedule, and cultivate the awareness of digital learning. On the other hand, to actively participate in the national wisdom education platform based on national teachers training activities, on the basis of the platform research group function of discipline training activities, for example, in "national teachers summer training activities" "collective lesson preparation activities", etc., through the teacher guide, peer discussion, case show, review reflection, finally produce high quality teaching case, in the process of digital learning practice, improve their teaching practice ability, promote their own professional development[20].

4.4. Discuss the Mechanism of Large-Scale Improvement of Teachers' Quality and Solve the Problem of Unbalanced Service Supply

At present, the digital literacy training of teachers in China is faced with problems such as narrow supply side of training services and imperfect research and training community. How to build a high-level training service supply system that can meet the needs of large-scale teacher growth has become an urgent problem to be solved. In order to solve the difficult problems in the system, this topic puts forward the construction idea of dual cooperation. On the one hand, with cross-sectoral university research institutions, regional teachers inquest into departments, primary and secondary schools education main body to coordinate, integrate the elements of the subject and aggregation, through the guidance of district, linkage, form a point with surface dynamic research network, so as to expand the supply of teachers' digital literacy training services. For example, based on the "virtual teaching and Research section", teacher training institutions in various schools and regions are connected with schools, and teachers with common interests are gathered together to give play to the leading role of famous teachers and first-class courses, build a demonstration platform, and improve the "utilization rate" of excellent teachers. On the other hand, to give full play to the artificial intelligence, big data, Internet technology can assign function, build a high quality resources sharing platform, the high quality case display and sharing, let high quality teaching resources, teaching methods can benefit more teachers, break the barriers of intercollegiate resources, flow online education resources in different time and space, to optimize the allocation of education resources.

5. Tag

Based on China's local national conditions, the current mode of digital literacy training for domestic teachers is updated, so as to improve the quality of teachers' digital literacy training and fundamentally change the digital literacy of teachers. At the same time, through the promotion of education information, from the perspective of training mode, training scenarios, evaluation standards, to achieve the comprehensive, real-time, dynamic, accurate improvement. Under the dual influence of the new generation of scientific and technological revolution and the current education digitalization strategy, the promotion of teacher training is also to better adapt to the new situation and new needs of the new era.

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