# Research on the Professional Development Support Service System for University Teachers in the Digital Era

[1st] Chengyue Jiang[a]*, [2nd] Nan Wang[b]

[a]17866506435@163.com,[b]etwangnan@126.com

Beiing University of Posts and Telecommunications, Beijing, China

**Abstract**—Building a high-quality, professional, and innovative university faculty team is the key to promoting the development of a high-quality education system, and the Faculty Development Center of universities provides a professional development support system for teachers, which is an important support for the construction of the teacher team in the digital age. Based on this, the article interprets domestic policy documents and points out the new requirements, challenges, and opportunities for teacher professional development brought about by the digital age environment. Then, from the aspects of teacher training content, teacher training service forms, teacher professional development resources, and teacher personal development data, this paper conducts literature research and case analysis to summarize the current research status of the university faculty professional development support service system. Finally, through the analysis of the support service system provided by the Faculty Development Center of Xiamen University and National Taiwan University for teachers, the existing problems are analyzed. This paper provides preliminary research support for the construction of a university faculty professional development support service system in the digital age.

**Keywords-**teacher professional development; support service system; university faculty; digital age

## 1 Introduction and Background

On March 31, 2021, Deputy Minister of the Ministry of Education, Song Demin, indicated that the momentum of revitalizing teacher education that was initially formed, and the "14th Five-Year Plan" period will focus on the construction of a high-quality teacher team. Since the Ministry of Education and other departments released the first batch of university teacher development demonstration centers in 2011, several opinions on reforming teacher team construction were issued by the State Council and the Ministry of Education between 2021 and 2023. It has been noted that the support system for university teacher development needs improvement to nurture a high-quality, professional, and innovative university teacher team, thereby advancing the development of a high-quality education system. As an important platform for teacher professional development, the Faculty Development Center of universities needs to accelerate the construction of the support service system for university teacher professional development in the digital age.

ITEI 2023, November 24-26, Zhengzhou, People's Republic of China

DOI 10.4108/eai.24-11-2023.2343654

During the "14th Five-Year Plan" period, as China's education informatization enters the 2.0 era, it marks that the planning of education informatization has entered a mature stage. It is urgent to use the new generation of intelligent technology as the support to build a service system that is intelligent, visualized, accurate, and intelligent in the new era, and to improve the level of modern education governance with informatization as the support. The new generation of information technology such as big data, artificial intelligence, 5G, cloud computing, metaverse, ChatGPT, etc., is driving the transformation and development of the traditional education paradigm towards the new generation of information technology-enabled digital education paradigm. Digital education is transitioning from ideas and models to implementation and practice, and gradually moving towards large-scale development. In the digital age, attention needs to be paid to professional educational services, which are an important foundation for supporting the operation of a smart education ecosystem at the school level. Teachers, as one of the main objects of educational services, play a particularly important role in providing support services.

Based on the current development status of China's informatization and the requirements of teacher development-related policies, this study will explore the current research status of the university faculty development support service system for teachers in the digital transformation background, with the purpose of enhancing teacher capabilities. It will also analyze the reforms and practical projects related to teacher informatization capabilities carried out by domestic and foreign university faculty development centers, in order to provide a foundation for the research on the support service system for university faculty professional development in the context of a digitalized era.

## 2 Research Status of Faculty Professional Development Support Service System in the Digital Age

Currently, there is no unified understanding of the concept of a teacher professional development support service system. Based on the research of scholars such as Pang Haishao, Li Qiong, and Hu Heqiong on teacher development support service systems, this paper proposes the concept of a "teacher professional development support service system in the digital age":

1) The digital learning resources and various digital teaching support services provided by the Higher Education Teacher Development Center, aimed at supporting teachers' teaching development and promoting the construction of digital environments, constitute a comprehensive network of digital teaching support services.

2) The support service system established by universities for promoting excellent teaching in the digital age includes digital skills training for teachers' professional development, the construction of a digital training resource development platform, and projects such as the digital profile and digital portfolio for teachers.

The new era of artificial intelligence technology has brought new challenges to smart education and put forward new requirements for teacher professional development. Teachers need to constantly adapt to their new roles and positions in the digital transformation of education and provide assistance to the inevitable digital transformation of education [1]. The

level of teaching staff is an important guarantee for the high-quality teaching level of higher education. Improving the level of teaching staff is a core driving force for improving the quality of teaching in higher education.

In 2021, the Ministry of Education and other six departments issued the "Guiding Opinions on Strengthening the Reform of New Era University Teacher Construction" [2], pointing out that efforts should be accelerated to build and improve a high-level teacher development support system for universities. Scholars like Pang Haishao proposed the construction of a professional, institutionalized, and normalized university teacher development system from the perspectives of schools, departments, and individuals to address the problems existing in the current development of universities [3]. Scholar Gong Yaling constructs a professional development support service system for vocational college teachers based on school-enterprise cooperation, including four modules: organizational structure, theoretical learning and practice, incentive mechanisms, and self-research [4]. Scholar Du Xizhou uses Hebei College as an example to construct a local undergraduate college teacher development support service system consisting of "one center, two-level management, three-tier groups, four-dimensional projects, and five-dimensional support" [5]. Ehrenfeld, N scholar constructed a framework for teacher professional development based on an ecological perspective with three dimensions:scope, interconnectedness, and temporality[6]. Scholar Wang Mengya uses a certain university in Henan as an example to construct a university teacher professional development support service system model consisting of organizational structure, institutional construction, management guarantee, and teacher training [7]. In recent years, universities across the country have encountered many challenges in the process of implementing the construction of teacher professional development support service systems. However, the current research by scholars on the construction of university faculty professional development support service systems only focuses on policy systems and departmental functions. It is difficult to meet the new requirements of teachers brought about by the

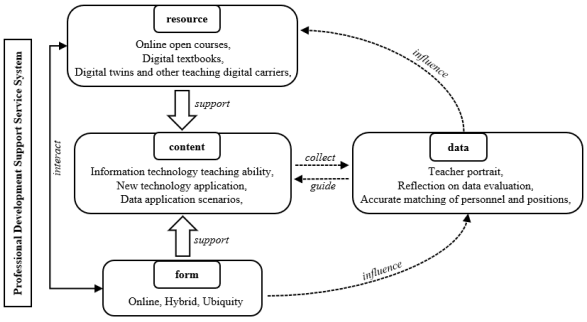


**Fig1** Support Service System for Teacher Professional Development in the Digital Era

large amount of data and rich educational resources generated by the digital era. This paper will examine the current status of the professional development support service system for university teachers from four aspects: content, form, resources, and data. The aim is to provide a research foundation for the construction of a professional development support service system and bring new vitality to teachers' professional development.

In addition, this article constructs a framework for teacher professional development support services in the digital era from four dimensions: content, form, resources, and data, as shown in Figure 1.

### 2.1 Organize Diversified Digital Teaching Ability Training

Under the background of digital transformation, teachers are required to have the ability to deeply integrate and innovate information technology with education and teaching. In response to the important spirit of General Secretary Xi Jinping's "Digital China" construction, China has attached great importance to teacher training in information technology in recent years. It has explored the construction of a talent cultivation mode that focuses on "personalized needs, competency-based, and digital empowerment", aiming to empower education modernization with digital education and support higher education informatization. Hierarchical and classified teacher training has been conducted to continuously enhance teachers' information technology literacy [8]. "China's Education Modernization 2035" proposes the key task of "building a high-quality, professional, and innovative teacher team", and regards "accelerating the training of new teachers who are skilled in applying information technology" as an important measure for "cultivating a high-quality teacher team" [9].

Scholars like Luo Shuhan pointed out that the effectiveness of teacher training in promoting the output of teachers' information technology teaching capabilities should include four dimensions and eight secondary indicators: four dimensions of information technology teaching knowledge, skills, capabilities, and concepts, and eight indicators including information technology knowledge, integration of information technology and curriculum, hybrid teaching skills, application of technology-assisted teaching skills, independent information technology teaching capabilities, use of technology to manage teaching, ability to promote educational reform through technology, and awareness of application technology professional development [10]. Scholar Li Xianwu believes that multi-dimensional training in smart classrooms is a key factor in improving teachers' information technology teaching abilities. It is necessary to relieve teachers' embarrassment of not knowing how to use and being unwilling to use technology. Training should include technology application training to master usage methods, special training on smart teaching to understand concepts and methods, and school-level observation and discussion to promote communication and exchange [11]. Scholars like Liu Ge and others proposed a training model for teachers' data literacy in the era of big data, which aims to help teachers adapt to data application scenarios, answering the three questions of "where data comes from", "where data goes", and "how to use data". It serves as the logical starting point for cultivating teachers' data literacy. By including strategies such as creating a campus data culture and promoting the deep integration of data literacy and subject teaching, a foundation for precise teaching can be laid [12]. Starkey proposed a model which frames digital competence in three different ways: generic digital competence, digital teaching competence and professional digital competence[13].

In order to comprehensively enhance the information literacy and educational information governance capabilities of university teachers, the Ministry of Education held the first special training class for education digital capability enhancement in March 2022. This training combined theory with practice, immersion with experience, and covered cutting-edge theoretical knowledge, national policy interpretation, technology education application, practical case teaching, on-site teaching inspection, and educational experience exchange [14].

China Higher Education Training Center has conducted multiple training courses on themes such as “Construction of University Virtual Teaching and Research Room for Education and Teaching Innovation” and “Enhancement of Information Technology Capability of Virtual Teaching and Research Room” from 2022 to 2023. The center effectively cultivates teachers’ digital learning capabilities, deepens teachers’ mastery and application of digital teaching resources and tools, and promotes the digitalization of higher education teaching methods reform.

In the digital era, in addition to using existing digital technology resources to enhance teachers’ individual professional knowledge and teaching practice abilities, university teachers should continue to explore new methods and models of digital teaching, and achieve professional development through practical research [15].

### 2.2 Enabling New Forms of Teacher Training Services

In February, 2023, the “China Smart Education BlueBook” pointed out that smart education is a new form of education in the digital age [16]. It is necessary to grasp the characteristics of intelligent information technology, empower the innovative development of smart education, support and lead higher education informatization, reshape new forms of higher education, and provide new opportunities for the development of university faculty [17], innovate and explore new forms of teacher training development. Compared with the traditional training mode characterized by collective and standardized features, new technologies provide more technical forms for teacher training. Training can be carried out through various methods such as online, blended, mobile, ubiquitous, and smart classrooms. Training strategies will also integrate content such as data, resources, and technology to promote the improvement of teachers’ data literacy in the digital age and highlight the concept of a “teacher-learner center” from a technical perspective.

Scholars like Lisa Knie have redesigned teacher training programs to provide alternating digital learning and face-to-face hybrid learning formats, with the goal of incorporating computational thinking into the development of teachers’ interdisciplinary abilities[18]. Scholar Hu Xiao pointed out that there are diverse and convenient new ways of teacher training in the new era. With the help of training platforms, teachers can conduct self-diagnosis to understand their knowledge structure and teaching habits, in order to better leverage their teaching advantages to fill in teaching gaps. Training providers can also enter the teaching scene to communicate with teachers in depth. Hybrid training models such as master studios, study groups, and field teaching have formed effective communication and assistance platforms, achieving teachers’ professional development and self-growth through expert guidance and peer assistance [19]. Scholar Wang Rong proposed a “community-based training based on social interactions”, where teachers with common interests and needs form a small learning community that is organizational, collaborative, and interactive [20]. Scholars like Hu Qiuping pointed out the need to construct a teacher training model based on “Internet + self-directed learning”. This can be achieved through an “iSPEED” online platform for teacher self-directed learning, the establishment of a curriculum resource library based on network platforms and regional education resources, and the construction of a mixed ecological system for teachers’ autonomous learning using virtual reality integration [21]. Professor Liu Ge proposed using data collected from teaching systems, academic affairs systems, teaching assistants and smart uniforms to analyze the data generated in teaching

through various technical tools such as data statistics and use data to infer student behavior and create student profiles. This approach, combined with personal teaching practice, can achieve the goal of cultivating teachers' data literacy [12].

The China Higher Education Training Center conducts blended training courses for teachers across the country. Multiple teaching modes are adopted, including offline guidance from experts with rich experience in digital teaching practice, on-site lectures and on-site inspections for teachers who attend offline training. At the same time, live broadcasts and course replay functions are provided for online teachers to learn. In 2021, the Ministry of Education began the pilot construction of virtual teaching and research rooms and plans to build a national virtual teaching and research room information platform. Through online teaching and research activities, cross-school collaborative teaching research based on online technology will be formed, the implementation of virtual teaching and research rooms will be deepened, and a promotable and replicable model will be established to promote the professional development of teachers and educational and teaching reform. Professor Yu Xinjie of Tsinghua University shared MOOC resources with university teachers for free, and through on-site visits to various schools, he developed personalized teaching plans for teachers. Research conducted by Xu Hua found that the most popular training formats for university teachers are face-to-face participatory, network-based self-directed training, and cooperative training [22].

The release of the "Teacher Digital Literacy" standard in February 2023 promotes the creation of a targeted teacher digital literacy training model. It analyzes and explores the current status and training needs of teacher development, and creates a new curriculum system centered around the integration of digital technology and disciplines. It comprehensively enhances the quality of courses and training effects, and conducts teaching research and activities based on digital applications using real scenarios to continuously promote teacher digital literacy. In the era of digitalization, new mechanisms, new scenarios, and new models conducive to the development of teacher digital literacy will be formed [23].

### 2.3 Building Digital Teacher Professional Development Learning Resources

The acceleration of the new generation of information technology has propelled the digitalization of higher education. The content of services provided by higher education digitalization mainly relies on various types of digital teaching resources, including various digital teaching materials, software and hardware tools, and resources. These digital contents involve courses, textbooks, experiments, projects, etc. They take the form of multimedia courseware, massive open online courses (MOOCs), virtual simulation experiments, digital textbooks, online learning materials, metaverse virtual and real-world twins, digital natives, and virtual and real-world integration, serving as carriers for digital teaching [24]. Scholars like Dan Junhao and Yan Hanbing pointed out the transformation path of empowering digital teacher training resources through new educational infrastructure, summarizing three categories of digital teacher training resources, including training assistance, training courses, and resource carriers. These categories cover various resource contents such as teaching tools, digital books/textbooks, VR/AR immersive training courses, online teaching platforms, and more [25].

Since the start of Chinese MOOCs in 2013, and through the end of February 2022, over 50,000 online courses have been launched. In March 2022, the Ministry of Education extensively gathered high-quality course resources from MOOCs and other online courses, building the "National Higher Education Smart Education Platform". In 2021, the Higher Education Department of the Ministry of Education initiated the pilot construction of virtual teaching and research rooms, encouraging universities to create high-quality teaching resource libraries, excellent teaching case libraries, and high-quality teacher training resource libraries. Peking University's School of Continuing Education is building high-quality online course resources for teacher training. Most of the training resources of the China Higher Education Training Center rely on projects, combining online courses and certificate certifications for teacher training. China E-learning Academy for Education Leadership and Administration has established multiple teacher training learning platforms from 2009 to the present, as well as platforms such as the "Vocational Education Teacher Improvement Center" and "Higher Education Teacher Professional Development" in the Smart Education Of China. These platforms contain various digital teacher training resources such as digital libraries, course resources, and expert studios.

Although some higher education teacher training resource platforms have been developed at the national level, compared to training resource service platforms for kindergarten teachers, primary and secondary school teachers, such as the National Primary and Secondary School Online Cloud Classroom of the Central Educational Technology Center, the Open University of China's Online Training Platform, the National Continuing Education Network for Primary and Secondary School Teachers, and the China Teacher Training Network, the development of resource platforms for university teacher training is relatively thin and there is still a significant gap to be filled.

### 2.4 Building Teacher Personal Development Data Portfolio

In the smart education environment, the teacher's professional development data portfolio contains all the teacher's profile data information during the teacher's development process. Teachers can review and reflect on their teaching based on their personal portfolio, which also has evaluation and value judgment functions. Through a series of studies, Lina Feder has found that the use of portfolios has the potential to improve student teachers' reflective writing[26]. The process of constructing teachers' teaching portrait data includes: (1)Collection of school teaching data; (2)Screening for anomalies and duplicate data; (3)Construct labels based on the teaching characteristics of teachers; (4)Using algorithms and models to construct teacher portraits. By collecting data on teacher characteristics, teaching psychological data, social interaction data, teaching behavior data, and teaching research outcome data, a teacher user profile model can be built [27]. The above data can be recorded through methods such as online research, self-performance assessment, self-digital competency assessment, questionnaire self-reporting, system platform teaching research imprints, etc. [28], and can be displayed in the form of instant analysis, analysis prediction, knowledge discovery, etc. [29]. Based on teacher profiles, performance evaluation can comprehensively assess teachers' difficult-to-quantify work behaviors, including teaching ability level, academic influence, and explicit work output, such as teaching hours and student evaluations [30]. In the context of big data, establishing a teacher growth portfolio gives teacher professional development a new perspective. Electronic portfolios promote scientific

decision-making in university human resources development, facilitate "person-job precise matching", scientifically assess teacher performance, enhance the initiative of teacher professional development, and help teachers manage knowledge [31]. Comprehensive evaluation based on teacher digital profiles promotes teachers' self-awareness and reflection, helps teachers improve personal development plans, supports personalized recommendations, promotes teacher management, strengthens teacher team construction, and constructs teacher group profiles in a hierarchical manner [32]. Scholar Zhou Yan used data mining technology to develop a teaching quality monitoring and evaluation system for university teachers, providing convenient data support for university education management work. Through clustering algorithms, an assessment method was established and effectively applied to the human resources assessment and management system, promoting the development and cultivation of university teachers [33].

The University of International Business and Economics used big data to depict the "teacher profile" by analyzing teachers' data information through the school's information system and campus network data. The teacher's data was "digitalized" to construct a "teacher profile" which includes four aspects: teacher self-cognition, goal prediction, personalized recommendations, and interim achievement reports. The University of Electronic Science and Technology of China provided accurate teacher and student profiles through integrated data, building an integrated education big data platform system that can provide information for teachers' academic development. The profile includes a teacher work assessment, a teacher work trajectory analysis assessment, a high-quality talent relationship network providing talent introduction suggestions, research decision support, and an exploration of the research frontier's five aspects.

Currently, only a few universities in China have developed personal teacher development data portfolios, and most of the remaining universities are still in the blank stage of constructing and applying teacher teaching data and teacher personal development data. In today's digital transformation and development, the exploration of university teacher professional development should lean more towards the realization of teacher profiles.

## 3 Teacher Development Center Practice Analysis

The teacher development center in higher education institutions is an important institution that promotes the professio-

nal development of teachers and ensures the quality of teaching. It includes functions such as teacher training, teaching consultation, teaching research, teaching evaluation, and resource supply. It is a key platform to improve the level of faculty and promote teaching development. Conducting research on teacher professional development in teacher development centers has also become an indispensable part of their work. Based on the research on the four aspects of the teacher professional development support service system mentioned above, this section analyzes the content, form, resources, and data of the teacher professional development support service institutions at Xiamen University and National Taiwan University.

### 3.1 Xiamen University Teacher Development Center

Xiamen University Teacher Development Center was selected as one of the seven national demonstration projects for teacher development centers in 2013. In terms of diverse digital teacher training content, Xiamen University Teacher Development Center has conducted various types of teacher training activities for the past decade. However, most of the training content is related to teacher ethics, teaching achievements, educational and teaching reforms, curriculum research, and other topics. Information technology in teaching only accounts for a small part and is limited to basic training content such as flipped classrooms. There is still a significant lack of training on digital teaching capabilities, such as the use of smart classrooms and the application of teaching data. In terms of teacher training services, Xiamen University Teacher Development Center offers various forms of training, such as integrated teaching workshops, teaching salons, teacher summer camps, organizing teacher visits to innovative laboratories, teaching skill competitions, and more. For example, in the spring of 2023, Xiamen University participated in a joint program for the continuing education of young university teachers. One novice young teacher, He Yuying, mentioned, *"In today's rapidly developing AIGC and virtual reality, using digital technology to improve the quality of teaching and enhance education is the biggest gain from the program."* In terms of digital teacher training resources, Xiamen University has developed multiple high-quality courses and shares course resources with Tsinghua University. However, the development of resources is limited to some course teaching resources based on platforms, with very few resources related to digital tools and digital teaching skills. In terms of teacher personal development data, the Digital Fujian-Higher Education Big Data Research Institute includes some online teaching feedback data collected through surveys. However, an integrated education big data platform system has not been constructed, so the available teaching data that can be used to enhance teachers' personal development has not been collected and utilized.

As shown above, Xiamen University, as one of the first batch of national-level teacher development demonstration centers in the "12th Five-Year Plan", provides various forms of professional development support for teachers in the digital age. The training methods are diverse, but the resources and data that can be truly utilized are limited, and there is still room for exploration, development, and improvement.

### 3.2 National Taiwan University Teacher Development Center and Digital Learning Center

The National Taiwan University Teacher Development Center consists of two centers: the Teacher Development Center and the Digital Learning Center. The fundamental goals of the six groups are: Teacher Development Group, Learning Promotion Group, Planning and Research Group, University Course Group, Public Course Group, and Teaching Technology Group. In terms of diverse digital teacher training content, National Taiwan University offers training courses related to the use of information technology tools, future classrooms, information teaching methodology, immersive XR interactive design, and other digital teaching content to support teacher professional development and enhance teaching quality through technological development. In terms of teacher training services, National Taiwan University uses a combination of subject-based communities and online communities to promote teachers' professional learning, share articles, and explore new teaching forms. It also offers online training resources, lecture training, teaching demonstrations, offline visits to

future classrooms with hands-on practice, one-on-one consultation and observation feedback, and online course recording support and consultation. In terms of digital teacher training resources, National Taiwan University provides guidance courses for producing digital teaching resources, develops dedicated digital teaching platforms and open courses, and assists in the production of digital teaching materials for classrooms through a course automatic recording system. In terms of teacher personal development data, although the center provides support for novice teachers and teachers' improvement, there is still a gap in terms of data related to teacher professional development.

The National Taiwan University Teacher Development Center and Digital Learning Center, through digital technology and the integration of internal and external digital resources, have developed a digital teaching platform to assist teachers in using digital resources to improve teaching. However, there is still a gap in the development of teacher personal growth data portfolios.

## 4 Conclusions and Prospects

Suggestions and prospects for the construction of a teacher professional development support service system in the digital age:

1) Teacher development centers in various universities, as the most direct and effective platform for providing professional development support services to teachers, should coordinate the development of the teacher professional development support service system, especially in today's educational digital transformation. With the improvement of digital technology, the support services for teacher development should also be updated and iterated.

2) The development of teacher personal growth portfolios and the construction of teacher profiles in various universities have a lot of gaps. The developed teacher profiles have problems with a lack of dynamism and are more static in nature. The entire process of teacher development should be updated.

3) In terms of the development of teacher training resources and formats, compared to training resources for primary and secondary school teachers, the current training resources for university teachers are clearly lacking. Single online training or offline lectures are not enough to fully immerse teachers. New content and formats of training should be actively developed, such as new technology training, metaverse training, ubiquitous teacher training, etc.

4) The leaders and staff of teacher development centers in various universities should actively develop a teacher profes-

sional development support service system that conforms to the development of the digital transformation era, and researchers should continue to conduct relevant research.

## References

[1] Chen Xiaohui, Zhang Mengjiao, Qin Pengxi, et al.On the Path of Teacher' Self-education in Smart Education [J]. E-education Research 2022, 43(8): 123–128.

[2] Guiding Opinions of the Ministry of Education and Five Other Departments on Strengthening the Construction and Reform of the Teacher Team in New Era Universities - Official Website of the Ministry of Education of the People's Republic of China [EB/OL]. /2023-05-10.
[3] Pang Haishao, Zhang Yixin, Song Wen. Construction and Implementation of the Faculty Development System[J]. Higher Education Development and Evaluation, 2017, 33(02): 50-58+108-109.
[4] Gong Yaling. Research on the teacher professional development and its service support system in higher vocational colleges in the age of big data[J]. Journal of Yuzhang Normal University, 2018, 33(06): 65–69.
[5] Du Xizhou, Li Yongxia. The Construction of Teacher Development Support System in Local Universities--Taking Hengshui University as an Example[J]. Journal of Hengshui University, 2021, 23(01): 85–88.
[6] Ehrenfeld, N. (2022). Framing an Ecological Perspective on Teacher Professional Development. Educational Researcher, 51(7), 489-495. https://doi.org/10.3102/0013189X221112113
[7] Wang Mengya. Research on the Professional Development and Service Support System of University Teachers——A Case Study of a University in Henan Province[J]. Henan Education, 2019(04): 32–36.
[8] Beijing Technology and Business University Accelerates the Development of Educational Digital Transformation - Official Website of the Ministry of Education of the People's Republic of China [EB/OL]. /2023-04-18.
[9] Central Committee of the Communist Party of China and the State Council Issue "China's Education Modernization 2035" - Official Website of the Ministry of Education of the People's Republic of China [EB/OL]. /2023-04-18.}
[10] Luo Shuhan, Lin Shi Yuan, Feng Xiaoying, et al. Teacher Training Helps Improve Teachers' Informational Teaching Ability-- An Annual Comparative Study Based on Training Effectiveness[J]. China Educational Technology, 2021(6): 128–134.
[11] Li Xianwu. The Summary and Reflection about the Smart Classroom[J]. China Modern Educational Equipment 2022(13): 12–14.
[12] Starkey, L. (2020). A review of research exploring teacher preparation for the digital age. Cambridge Journal of Education, 50(1), 37–56. https://doi.org/10.1080/0305764X.2019.1625867
[13] Liu Geping, Chen Ying, Qin Yuchao.Training Mode and Strategy of Teachers' Data Literacy [J]. Journal of Teacher Education, 2021, 8(3): 21–30.
[14] The Ministry of Education Holds the First Special Training Course for Enhancing Education Digital Literacy - Official Website of the Ministry of Education of the People's Republic of China [EB/OL]. /2023-06-01.
[15] Xu Hua. Visual Analysis and Enlightenment of the Research Status of Teacher Training in Colleges and Universities in China[J]. Higher Education Forum, 2021(11): 18–22.
[16] "China Blue Book of Smart Education": Smart Education is a New Form of Education in the Digital Age - Official Website of the Ministry of Education of the People's Republic of China [EB/OL]. /2023-05-15.
[17] Xiong Sidong. New Form of Higher Education in the Era of Numerical Intelligence[J]. Educational Research, 2020, 41(5): 19–22.
[18] Knie L, Schwarzer S. Computational Thinking als Teil einer MINT-Lehrkräftefortbildung im Blended-Learning-Format[J]. CHEMKON, 2022, 29(S1): 183–187.
[19] Hu Xiao. New Trends in Teacher Training in the New Era[J]. Henan Education, 2022(12): 26–27.

[20] Wang Rong. Exploration of New Forms of Education and Training Based on “Internet Plus”[J]. Science and Technology \& Innovation, 2019(5): 15-16+19.
[21] Hu Qiuping, Sang Guoyuan. Construction of Regional Teacher Training Mode Based on “Internet+self-directed learning”[J]. Educational Science Research, 2022(12): 82–87.
[22] Xu Hua. Visual Analysis and Enlightenment of the Research Status of Teacher Training in Colleges and Universities in China[J]. Higher Education Forum, 2021(11): 18–22.
[23] Wu Di, Chen Min. Teacher Digital Literacy: Focus of Teacher Development in the Context of Educational Digital Transformation[J]. China Information Technology Education, 2023(5): 4–7.
[24] Xu Xiaofei, Zhang Ce. The Essentials and Approaches of Higher Education Digitalization Reformation in China[J]. China Higher Education Research, 2022(7): 31–35.
[25] Shan Junhao, Yan Hanbing.The Construction Mode of Digital Teacher Training Resources Empowered by New Infrastructure for Education, 2022, 32(3): 32–41.
[26] Lina Feder & Colin Cramer (2023) Research on portfolios in teacher education: a systematic review, European Journal of Teacher Education, DOI: 10.1080/02619768.2023.2212870.
[27] Hu Xiaoyong, Xu Huanyun. Research on The Pattern of “Internet + Teaching and Research”: Connotations, Characteristics and Trends[J]. e-Education Research, 2020, 41(2): 10-16+31.
[28] Peng Hongchao, Wei Fei, Yan Hanbing. Multimodal-Data Enabling Teacher’s Profile: From Stick Figure to Holographic Portrait[J]. Open Education Research, 2021, 27(2): 80–89.
[29] Yu Xin, Zhou Lingyuan, Wang Qiuxian, et al. Research on the Theory of Digital Portrait in University from the Perspective of Digital Space[J]. Library, 2020(5): 69–73.
[30] Meng Yan, Qi Linshan. Study on the Improvement of University Performance Appraisal Process Based on Teacher Portrait[J]. Research and Exploration in Laboratory, 2022, 41(9): 258–263.
[31] Zhang Yongqiang. Exploration of Teacher Growth Profile Construction in the Era of Big Data[J]. Heilongjiang Archives, 2022(6): 164–166.
[32] Zhu Yanni. TEACHER PROFILE RESEARCH FORM THE PERSPECTIVE OF UNIVERSITY TEACHERS’PROFESSIONAL DEVELOPMENT [D]. Zhejiang Normal University, 2021.
[33] Zhou Y. Development and Training Strategies of College Teachers Based on Data Mining Technology[J]. Mobile Information Systems, Hindawi, 2023, 2023: e7103391.