

Research on the Path of Digital Transformation of Postgraduate Education in Chinese Universities under the Background of Digital Education Strategy

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Abstract

Digital transformation of education is an important strategic content of information construction in Chinese universities in recent years. Postgraduate education is characterized by many types of postgraduates, complex training links, long training process, and obvious individuation. Its information construction and digital transformation are the difficulties in the construction of smart campus in colleges and universities. This paper discusses the current situation and main problems of postgraduate education informatization in colleges and universities, and puts forward the key points and suggestions of digital transformation of postgraduate education in colleges and universities from the aspects of optimizing the information platform of postgraduate education management and service, driving the modernization and wisdom of postgraduate education with data, constructing the integrated platform of intelligent teaching, and continuously improving the digital literacy of teachers and students.

Keywords

Digital Transformation of Education, Postgraduate Education, Smart Campus, Colleges and Universities

1. Background of the Digital Transformation Strategy for Higher Education in China

Digital technology has accelerated the integration of all aspects of the economic and social fields, and has profoundly changed the way of human production, life and learning. There is an associated relationship between higher education and

social and economic development. The arrival of digital economy will inevitably promote the reform of higher education. Under the background of digitalization, the traditional educational concepts and models of higher education have been impacted, and diversification, personalization and modernization have become objective and universal needs. With the advancement of the digital economy, the digital transformation of education, as a historical process, has also become the only way for education reform.

The strategic action of education digitization is the focus of the Ministry of Education, and it is also the key content of current education reform and development, which has profound significance. Firstly, it conforms to the trend of digital development and helps to cultivate innovative talents with both knowledge and ability, so as to meet the needs of new economic forms and new social development. The second is to overcome the difficulties of education reform and development, promote the improvement of education quality with education equity, and realize the connotative development of education with high-quality education system. The third is to promote the comprehensive digital transformation and intelligent upgrading of the education industry under the guidance of the digital China and education power strategy.

2. Current Situation of Informatization of Postgraduate Education in Chinese Universities

With the development of information technology in universities for over 20 years, especially the promotion of digital campus construction, Chinese universities have basically realized the informatization of postgraduate education management. The concept of information service centered on teachers and students has been established, and the informatization of postgraduate education has gradually shifted from management to service.

In April 2023, the 2022-2023 Academic Conference on Informatization in Chinese Universities was held. The theme was “Digital Transformation of Education and New Technology Empowerment”. At the conference, many universities shared the achievements of information construction and the exploration and practice of digital transformation, representing the actual situation of most universities in China. In addition, the author deeply visited and investigated the current situation of postgraduate education informatization in several representative universities. In general, the informatization of postgraduate education in domestic universities presents the following characteristics.

1) Established postgraduate education management information system

Most colleges and universities have built the postgraduate education management information system as the main information platform for postgraduate management and service, covering core business function modules such as discipline and course management, student status management, student status management, training process management, daily affairs management, graduation defense management, degree application and award management, etc. As

far as possible, the information system is used to realize the fine management of the postgraduate education process, provide necessary information services for teachers and students, and promotes the implementation of relevant management systems with the application of information systems [1] [2] [3].

2) Possess online teaching ability and adapt to online teaching modes

The development of information technology has changed the teaching mode. During the three years of the COVID-19 epidemic, the live online teaching supported the suspension of classes without stopping learning, which made us deeply feel the reform and innovation of information technology for education and teaching. Some universities have created their own online teaching platforms. Some universities use universal online teaching cloud platforms or live teaching platforms such as Rain Classroom, DingTalk Classroom, Tencent Classroom, etc.

3) Explore the construction of smart classrooms and innovate smart teaching scenarios

With the advancement of digital campus to smart campus, some universities are gradually building smart classrooms, upgrading from traditional multimedia classrooms to smart classrooms, providing infrastructure support for multi form and intelligent education and teaching. Many smart classrooms in universities can carry out webcast and recording, supporting the online and offline mixed teaching mode [4].

3. Main Problems Existing in the Informatization of Postgraduate Education

The problems in the promotion of the informatization of postgraduate education in colleges and universities are also obvious.

Some training links have not been included in information management, and the business modules between the various departments within the graduate school lacks information linkage, and the integrated information management and service of the whole process of postgraduate training has not yet been realized. Mobile application support is not enough. The top-level design of the existing postgraduate education management information system is insufficient, and it cannot flexibly adapt to the changes in the training programs of various types of postgraduate training models. There is a lack of integrated consideration of the interaction with information systems of other business departments such as International Cooperation and Exchange Department, Finance Department, Security Department. Data mining and data analysis are not enough, and the value of data is not fully utilized. The degree of intelligence is not high, and the support for early warning and decision-making is insufficient. The function of the online teaching platform is still relatively single, the network teaching resources are relatively scattered, and the integration of new information technologies such as big data and artificial intelligence into the education and teaching process is still insufficient.

The report of the 20th National Congress of the Communist Party of China proposed to speed up the construction of digital China, accelerate the construction of a strong country in education, science and technology, and talents, promote the digitization of education, and build a learning society and a learning country for lifelong learning.

Generally speaking, the informatization level of postgraduate education is still far from the needs and expectations of teachers and students, and there is still a long way to go from the strategic goal of national education digitization.

4. Key Points of Digital Transformation of Postgraduate Education

4.1. Optimize and Improve the Information Platform of Postgraduate Education Management and Service

Continuously improve and optimize the existing postgraduate education information system, and form an integrated management and service information platform covering the whole process of before enrollment, during school, and after graduation, as shown in **Figure 1**. The pre-entry business mainly includes

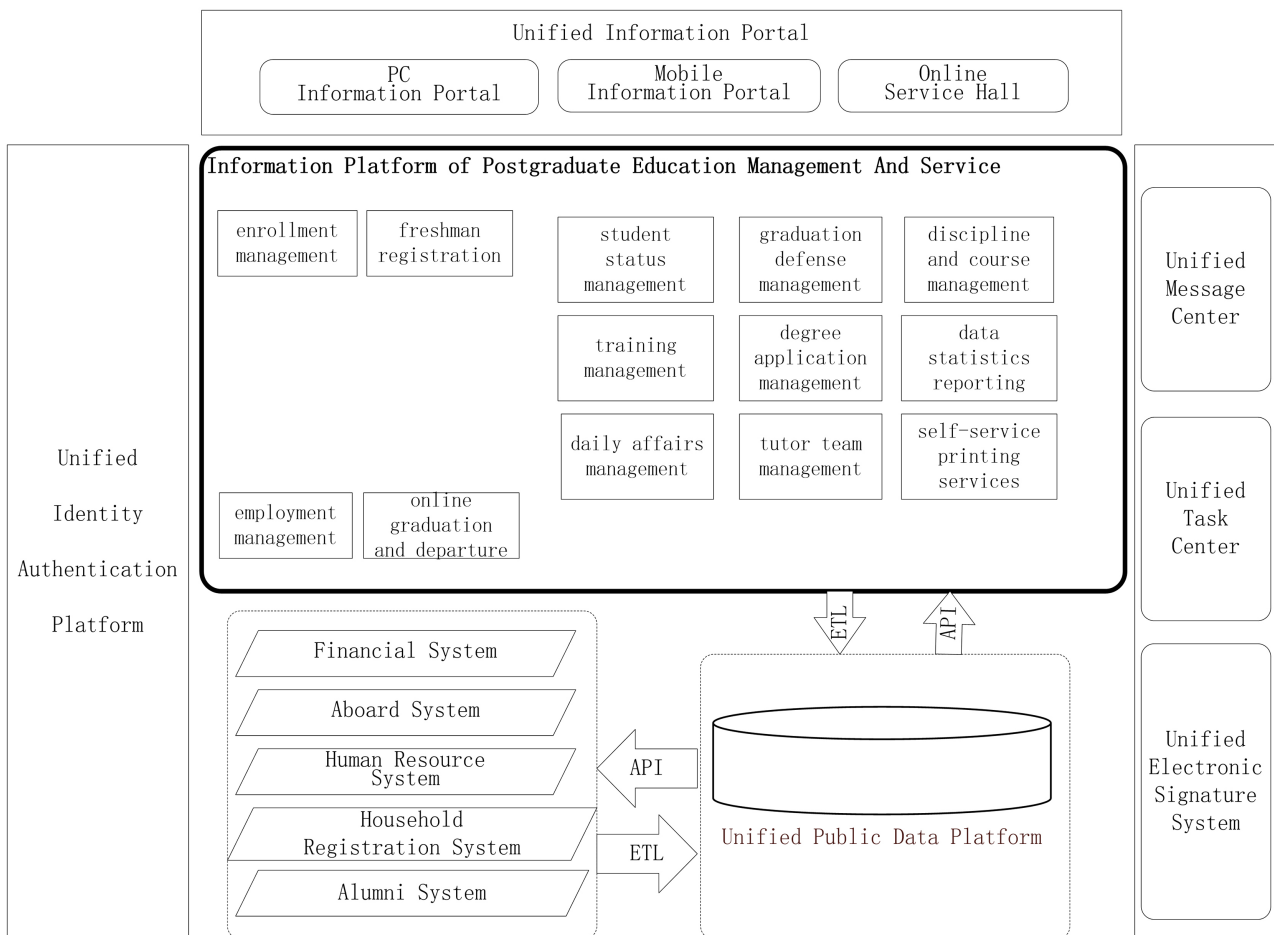


Figure 1. The integrated information platform of postgraduate education management and service.

enrollment management, freshman pre-registration and registration. The business during the school period mainly includes student status management, training management, daily affairs management, graduation defense management, degree application and award management, tutor team management, discipline and course management and data statistics reporting, self-service printing services, etc. The business related to graduation and employment mainly includes employment management services, online graduation and departure services.

4.1.1. Supplement the Information Gaps in the Management Process, Standardize the Management and Service Processes

Supplement the information gaps in the training process and training links, realize the information management and service of the whole process of postgraduate education, optimize and standardize the management service process, and improve the level of fine management. Through the accompanying data collection, the whole process business data of postgraduate education and training is accumulated, which provides basic data support for upper data mining, data analysis, monitoring and early warning, and prediction and decision-making.

We can focus on the following work: 1) Connect the enrollment management subsystem with the student status management subsystem, and the freshman information will be automatically transferred to the student status management subsystem through the enrollment management subsystem, and then synchronized to the unified public data platform. The freshmen information required by freshmen registration system, financial system, online service hall and other business systems is provided by the unified public data platform, abandoning the original way of providing freshmen information to other relevant business departments through excel lists. 2) Supplement the information management services of students' scientific research achievements, including academic papers, patents, software copyright, achievement awards and other information. When graduate students apply for graduation defense or degree application, the system automatically gives reminders and restrictions according to the requirements of graduation defense or degree application for scientific research results. 3) For the cultivation of professional master or doctor, increase the information management of application-oriented training links such as practice base, school-enterprise cooperation, and practical training. 4) Increase the information management service of tutor qualification identification and two-way selection between tutors and students.

4.1.2. Optimize the Technical Framework and Top-Level Design to Enhance Its Flexibility and Scalability to Meet the Needs of Postgraduate Education Reform and Business Changes

The reform of postgraduate education is advancing in depth, and the postgraduate education model needs to match the changes in the social market demand. In 2020, the Ministry of Education of the People's Republic of China issued the "Professional Degree Graduate Education Development Plan (2020-2025)",

pointing out that the development of professional postgraduate is an important way to actively serve the innovative construction of our country, and is the strategic focus of the reform and development of postgraduate education. By 2025, with the focus on major national strategies, key areas and major social needs, a number of professional master's and doctoral degree categories will be added, and the enrollment scale of professional master's degree postgraduate will be expanded to about two-thirds of the total enrollment scale of master's degree postgraduate, and the number of professional doctoral degree postgraduate will be greatly increased.

The reform and innovation of postgraduate education, especially the emergence of various types of professional postgraduates, puts forward new requirements and challenges for the information platform of postgraduate education management service. We need to optimize the top-level design and technical architecture of the information platform of postgraduate education management and service, enhance its flexibility and scalability, and support zero code or low code to quickly respond to the information needs of postgraduate education reform and business changes. We can pay attention to the following aspects: 1) The information items of the system page form can be flexibly edited; 2) The business functional process can be flexibly customized; 3) The training requirements for different postgraduate categories, such as academic reports, social practice, thesis proposal, and mid-term assessment, can be flexibly customized; 4) Meet the personalized elastic needs of multiple batches of graduation applications every year, and even apply for graduation at any time; 5) Quickly build new business function modules; 6) There is a flexible response mechanism for the integration of undergraduate and postgraduate training, the mutual selection of undergraduate and postgraduate courses, and the mutual selection of master and doctoral courses.

4.1.3. Enhance Collaboration and Coordinate the Integration and Interaction with the Public Information Platform and Other Information Systems

The information platform of postgraduate education management and service is not isolated. It is necessary to consider providing convenient information services for functional departments and teachers and students at the height of the digital construction of the entire smart campus, and to coordinate its integration, linkage and interaction with the public information platforms and other department information systems.

We can focus on the following work: 1) Connect with the unified identity authentication system and integrate it into the unified information portal platform, making it convenient for teachers and students to log in to the system. 2) Interact with the financial information system to push students' tuition, accommodation, scholarship, and scholarship payment information to the financial system through the unified data platform. Conversely, the financial information system pushes students' arrears information to the graduate education manage-

ment service information platform through the unified data platform. 3) Connect with the human resource information system, and the basic information of lecturers and tutors is synchronized with the human resource information system. 4) Connect with the alumni information system, and graduate information will be automatically transferred the alumni information system. 5) Connect with the household registration information system and the aboard management system, and automatically push postgraduate status change information to them, which is convenient for the relevant business departments to grasp the abnormal information of the students in time. 6) Integrate and utilize the common functions of the online service hall, such as questionnaire surveys, venue resource appointments, etc. 7) Integrated with the Unified Message Center and Unified Task Center, all reminder information and to-do tasks are pushed to the Unified Message Center and Unified Task Center, making it convenient for teachers and students to view and handle the reminder information and to-do tasks. 8) Integrate with the electronic signature system to output electronic credentials such as electronic transcripts.

4.1.4. Support Various Types of Data Reporting, Data Statistics and Printing

- 1) Support the output of various standardized statistical reports required by higher education departments, such as “Basic Statistical Report of Higher Education”: age statistics, student source statistics, student change statistics, political background statistics, etc.
- 2) Support the export of various reporting data required by higher education departments, such as freshman electronic registration reporting data.
- 3) Support all kinds of printing and self-service printing, such as enrollment registration card, certificate of enrollment, certificate of academic degree and so on.

4.2. Strengthen Data Mining and Analysis, Improve the Ability of Data-Assisted Decision-Making and Prediction, and Drive the Modernization and Intelligence of Education Governance with Data

In 2022, the Ministry of Education launched the National Education Digitalization Strategy Action, proposing to fully utilize the advantages of massive data, empower the modernization level of education governance system and governance capabilities with data.

On the one hand, the integrated information platform of postgraduate education management and service has accumulated a large amount of business data, such as course selection information, achievement information, scientific research and academic achievement information, etc. On the other hand, by using the existing infrastructure of digital campus and accelerating the construction of new infrastructure of digital education, we can obtain various data in the daily study and life of postgraduate, such as classroom performance, participation in

academic reports and community activities, late and absenteeism information, classroom self-study time, campus access records, dormitory access records, books borrowing, digital literature resource retrieval, online behavior and so on. Making full use of these data, we can make personal digital portraits of a student, fully display a student's comprehensive information, make diagnosis and early warning of a student's academic situation and comprehensive status, and predict a student's employment prospects. In addition to personal portraits, we can also make portraits of homogeneous and heterogeneous groups according to parameters such as specialty, college, training level, grade and student category, so as to help managers fully grasp the current situation and development trend of postgraduate training quality.

4.3. Build an Integrated Platform for Smart Teaching and Learning

Focusing on the whole teaching process of "pre-class", "in-class" and "after-class", combined with the needs of different time and different learning scenarios, innovative smart education teaching models are constructed to build an integrated platform for smart teaching, truly achieving "everyone can learn, everywhere can learn, and always can learn". The integrated platform of smart teaching mainly includes three parts: smart classroom, online teaching platform and digital resource platform, which are integrated deeply.

1) Smart classroom

To build a variety of types of smart classrooms suitable for different application scenarios, such as general teaching type, group discussion type, VR/AR type, etc., supporting wireless projection, classroom interaction, webcast and recording, remote synchronous classroom, intelligent recognition of blackboard text, speech recognition, intelligent checking on attendance, classroom learning data feedback (such as classroom attendance rate, course preview, homework completion rate, classroom activity), virtual simulation teaching, virtual simulation experiments and other intelligent teaching scenarios. At present, many colleges and universities in China have carried out in-depth exploration and practice on the construction and application of smart classrooms, and achieved good results [4] [5] [6].

2) Online teaching platform

Connected with the information platform for postgraduate education management and service, the information of students, teachers, courses and teaching classes in the information platform for postgraduate education management and service is automatically synchronized to the online teaching platform.

The integrated application of online teaching platform and smart classroom can carry out various online and offline mixed teaching. Before class, you can publish preview content and related notice announcements. It supports webcast and recording, classroom interaction, classroom discussion, in-class test, etc. After class, you can submit homework, course review, exchange questions and so

on. Furthermore, the teaching knowledge points of the course can be established into a multi-level topological relationship with micro-video, courseware and other digital resources through intelligent tags, forming a course knowledge map, which is convenient for students to learn in a targeted and personalized way [6].

3) Digital resource platform

Integrate internal and external teaching digital resources to build a unified digital resource platform. The first is to make full use of the National Smart Education Public Service Platform, the MOOC Platform of Chinese Universities. The second is to purchase and introduce high-quality professional courses and high-quality general education MOOCs at home and abroad, such as: Wisdom Tree, Superstar Erya, edX, Coursera. The third is to cultivate a normalized course recording ecosystem through smart classrooms and online teaching platforms, continuously generate and accumulate recorded course resources in the daily teaching process in the daily teaching process, and present them in categories through unified digital resource platform, open to all teachers and students. Furthermore, we can analyze the process learning data of students, and iteratively identify their learning difficulties and weaknesses through machine learning, thereby utilizing smart tags to recommend personalized learning resources for them.

4.4. Strengthen Training, Improve Teachers' Digital Literacy, and Cultivate a Good Digital Education and Teaching Ecology

Teachers and students' digital literacy and skills refer to the digital consciousness, ability and responsibility of teachers and students to properly use digital technology to acquire, process, use, manage and evaluate digital information and resources, discover, analyze and solve teaching and learning problems, and optimize, innovate and change education, teaching and learning activities in order to adapt to the learning, life and work in the digital age [7].

The cultivation of digital literacy is an integrated, long-term and continuous system engineering. At present, there are still some problems in the cultivation of digital literacy, such as insufficient attention, weak systematicity, difficulty in evaluating the effect and prominent lag [8].

The Ministry of Education issued and implemented the standard of "Digital Literacy for Teachers" On November 30, 2022, aiming to solidly promote the National Education Digitization Strategic Action and improve the education informatization standard system. This standard defines five dimensions of digital literacy for teachers, namely digital awareness, digital technology knowledge and skills, digital application, digital social responsibility, and professional development.

The digital literacy and skills of teachers and students are the core and key to the digital transformation of education. We should fully understand the impor-

tant role of digital literacy and skills in the development of teachers and students, and strive to improve their digital literacy.

The first is to focus on improving the digital leadership of education managers. It is not only necessary to strengthen the understanding of digital leadership from the theoretical level through systematic curriculum training, but also to cultivate the ability of education managers to coordinate and apply information technology to reshape teaching and management, and effectively guide schools to carry out organizational change and innovation from the practical level.

The second is to enhance the digital competence of teachers. First of all, increase the education digital thematic courses in the pre-service education stage. Secondly, make full use of the National Smart Education Public Service Platform, our smart classroom and online teaching platform, organize training and exchange activities in a hierarchical and classified way, and strengthen teachers' recognition of the practice of digital transformation of education. Finally, the digital competence is incorporated into teachers' professional assessment standards and incentive elements to stimulate teachers' endogenous motivation to apply information technologies to improve teaching practice.

The third is to cultivate students' digital literacy and digital ability. First of all, it is necessary to set up a series of digital and technological innovation projects to support students to actively develop digital ability and digital literacy in project practice activities. Secondly, a data-driven digital literacy evaluation system is established to promote the development of students' digital literacy [9].

5. Summary

The digital transformation of postgraduate education can promote the sharing and collaboration of educational resources, break the limitations of regions and disciplines, and make postgraduate education more popular and efficient. Students can learn anytime and anywhere through the network, mobile devices and other ways, without the limitation of time and space. Postgraduate digital education can stimulate students' interest in learning and innovative thinking, cultivate students' autonomous learning ability, practical ability and innovative ability through open and free learning environment, interactive teaching, virtual experiment and other teaching methods, so as to improve the quality of postgraduate education. Digital education can realize the personalization, differentiation and refinement of education through data analysis and intelligent evaluation, improve the efficiency and effect of education, and promote the process of education modernization.

Let us embrace the digital transformation of education and embrace the future of education.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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