

Research on the improvement of clinical teachers' digital literacy under the background of digital medical education

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Abstract: The key to the digital transformation of clinical education is the improvement of the digital quality of clinical teachers. At present, clinical teachers are in the initial stage of digital literacy, and there are many problems. This study explores the overall strategy, application scenario and evaluation feedback of clinical teachers' digital literacy, puts forward feasible strategies, and focuses on solving the problems of clinical teachers' digital literacy. The integration of digital intelligent technology into the whole process and whole link of clinical education management and teaching is aimed at effectively improving the digital literacy of clinical teachers and accelerating the pace of digital transformation of medical education.

Keywords: Digital transformation of education, Digital literacy, Medical education

1. Introduction

At present, digital technologies such as big data, artificial intelligence and cloud computing are developing rapidly and gradually empowering education, becoming a new trend in the development of education [1]. The Overall Layout Plan for the Construction of Digital China clearly states the goal of "vigorously implementing the national education digitalization strategic action and improving the national education intelligent education platform" [2]. The education industry standard "Teachers' Digital Literacy" was released, which puts forward new requirements for the digital literacy that future teachers should have from five first-level dimensions (digital awareness, digital technology knowledge and skills, digital application, digital social responsibility and professional development) [3]. The "2024 World Digital Education Conference" with the theme of "Digital Education: Application, sharing and Innovation" was held in Shanghai. The conference mainly focused on the discussion of teachers' digital literacy and competency improvement, the digitalization of education governance and digital education governance [4]. Clinical teaching, as an important part of clinician training, is also changing. The scope of medical students' access to learning resources is becoming global, which puts forward higher requirements for clinical teachers' main role, teaching ability, technology integration, application ability, and resource analysis ability. Clinical teachers not only need to have rich clinical knowledge and teaching skills, but also face new challenges such as teaching reconstruction, teaching function transformation, teaching content update, digital technology application and digital technology integration [5]. Based on the core demands of education transformation under the digital background, this study explores the overall strategy, application scenarios and evaluation feedback of clinical teachers' digital literacy.

2. The background of improving clinical teachers' digital literacy under the digital background of medical education

The key to the digital transformation of education is the improvement of teachers' digital quality. The European Union and the United States have systematically expounded the connotation of digital literacy, and made a lot of explorations in the research and implementation of digital literacy. The released digital literacy framework has become an important reference for the standards of digital

literacy in various countries. The Digital Competence Framework for Citizens is one of the most influential digital literacy frameworks in the world. Since its release in 2013, it has been updated several times. Based on this, in 2017, the European Framework for the Digital Competence of Educators was released. Many countries have directly adopted or developed teachers' digital literacy frameworks in line with their national conditions. As one of the countries with the richest educational policies and practices, the United States has issued several national educational technology plans and several versions of teacher educational technology standards [6]. In 2021, the Teacher Digital Learning Guide and the School Leader Digital Learning Guide were released. Provide important guidance strategies for teachers and school leaders to better adapt to the digital trend. In November 2022, the Ministry of Education of China released Teachers' Digital Literacy, which provides an important basis for the training and evaluation of Chinese teachers' digital literacy. According to this standard, teachers' digital literacy system of different educational subjects has evolved. At present, there are few studies on the digital literacy training of teachers in clinical teaching. This study hopes to provide support for the improvement of digital literacy and skills of clinical education practitioners, and provide reference for the in-depth development of domestic research in this field.

3. The overall strategy for improving clinical teachers' digital literacy under the background of digital medical education

The digital transformation of medical education should focus on training a large number of clinical teachers with digital literacy, strengthen the construction of clinical teachers, and integrate digital intelligent technology into the whole process and whole link of clinical education, teaching and management. The use of digital technology to promote the construction of clinical teachers is not only an important measure to promote the high-quality development of clinical teachers, but also an important way to train and improve the digital literacy of clinical teachers [7]. Guided by the actual needs of the education digital transformation strategy, policy documents as macro guidance, guided by the standard framework of "teachers' digital literacy", based on digital application scenarios, digital intelligence evaluation-feedback and improvement as the main body, the precise training mode of digital literacy for clinical teachers is comprehensively linked. In the 2024 press conference of the Ministry of Education, it was emphasized that the development of digital education and the promotion of digital teaching were the trend of The Times, the needs of development, and the direction of reform. Teacher Digital Literacy clearly defines teacher literacy [8], that is, "the consciousness, ability and responsibility of teachers to properly use digital technology to obtain, process, use, manage and evaluate digital information and resources, find, analyze and solve educational problems, and optimize, innovate and transform educational activities. Leading the direction of teacher digital quality training and evaluation in our country. The application of intelligent technology to create a new type of digital clinical teachers' study and practice environment, the development and integration of high-quality and diverse training courses [9], and the implementation of generative teaching practice are the basis for improving digital literacy. Artificial intelligence, data mining, multimodal learning and other digital technologies are used to optimize the evaluation mode, generate feedback information [10], guide clinical teachers to analyze the results and self-reflect, realize the continuous improvement of clinical teachers' digital literacy, and promote the construction of high-quality clinical teachers in the digital era.

4. Application scenarios of improving clinical teachers' digital literacy under the background of digital medical education

There are a wide range of application scenarios for improving clinical teachers' digital literacy under the background of digital medical education, including the establishment of digital literacy curriculum system for clinical teachers, the reform and innovation of digital training courses, the application of digital teaching platforms and tools, and the realization of digital generative teaching practice. These application scenarios not only help to improve the digital teaching ability of clinical teachers, but also help to improve the digital teaching ability of clinical teachers. It can also promote the modernization and high-quality development of medical education.

4.1 To establish a digital literacy curriculum system for clinical teachers and reform and innovate digital training courses

Under the background of digital transformation of education, clinical teaching should adopt a

top-down hierarchical structure design method, on the basis of theoretical guidance, emphasize practice, and build a training curriculum system to meet the differentiated needs of teachers in different departments and ensure the realization of the ultimate goal. It can be divided into three categories: general courses, integrated courses and extended courses. Based on the framework of teachers' digital literacy, the universal digital literacy curriculum includes five dimensions: digital awareness, digital knowledge and skills, digital application, digital social responsibility and digital professional development. Integrated curriculum is the integration of digital literacy related subjects and content into the original systematic teacher education curriculum. The extended courses can be set according to the needs of teachers in different majors and departments, and can also add information literacy, intelligence literacy, evaluation literacy and other related courses. The training of clinical teachers' digital quality requires the cooperation of education experts, first-line clinical teachers, artificial intelligence enterprises and other subjects. Education experts have a better understanding of cutting-edge educational theories and policies, can effectively guide and improve the teaching methods and skills of clinical teachers, and develop new teacher training resources. The first-line clinical teachers have rich clinical knowledge and teaching practice experience, and can use the teachers' excellent teaching plans, classrooms, and experiences as practical resources. Artificial intelligence enterprise is the technical guarantee of digitalization and the platform for carrying out digital teaching. Give play to the power of multi-agent collaborative innovation, build and develop a diversified, systematic and high-quality digital training curriculum for clinical teachers.

4.2 The application of digital teaching platform and tools to achieve digital generative teaching practice

With the accelerated innovation and application of digital technology, human teachers and AI teacher assistants will cooperate through dialogue to carry out curriculum design, resource production, teaching assistance, outcome evaluation and other human-computer collaborative teaching activities will become the basic characteristics of digital education. The teaching design resource library of each clinical science university unit is established, and the large model's understanding ability, reasoning ability and content generation ability are used to train and generate the large unit teaching design assistant based on the large model, which can generate more comprehensive teaching plans for large units, innovative teaching design schemes, and generate teaching courseware and mind maps that fit the situation^[11]. In the process of dialogue and generation, the digital teaching design ability of clinical teachers was improved. The huge knowledge map of artificial intelligence can be used to inspire dialogues and open questions and answers, so as to improve teachers' personalized, intelligent and flexible ability to teach students in accordance with their aptitude^[12]. In the whole process of teaching, digital tools are used to collect and analyze teaching data, and the results of data analysis are used to feedback the whole teaching, continuously improve, and make teaching activities that are more in line with teaching rules and more suitable for the development needs of students^[13]. Human teachers should be clear about the dominant position in the human-computer collaboration, establish the awareness of keeping pace with The Times, lifelong learning and sustainable development, grasp the initiative and creativity in the cultivation of students' emotions, the guiding role of ethics and values, and the training of thinking, so as to adapt to the needs of digital transformation education practice and the changes of future digital development.

5. Evaluation and feedback on the improvement of clinical teachers' digital literacy under the background of digital medical education

The implementation of teaching evaluation can effectively improve the quality of teaching, and the diversified evaluation mechanism driven by big data is more conducive to the perfection and improvement of the digital literacy curriculum system. However, there is a lack of effective, scientific and comprehensive evaluation methods, and evaluation tools and methods are still in the exploration stage. To explore the ways of digital portrait, large model and micro-authentication to drive the evaluation of digital teachers' digital quality.

5.1 Real-time evaluation based on digital portrait

In the field of education, digital portraits can provide personalized learning resources and teaching support for students and teachers. By collecting and analyzing students' learning behavior and performance data, students' learning portraits can be generated to provide accurate teaching suggestions

for teachers^[14]. At the same time, digital portraits can also be used for teachers' comprehensive evaluation and career development planning. Digital portrait adopts multi-terminal data acquisition technology to collect relevant raw data from multi-terminal applications and teaching scenes, and form a basic database after data cleaning and naturalization. The man-machine collaboration was used to screen and optimize the data, and the data indicators were repeatedly trained until the index interpretation reached the standard. The optimized indicators were imported into the data standard library. The pre-processed data were modeled and analyzed according to the calculation rules of the portrait, and the quantitative standard values of each sub-dimension were obtained. The reinforcement learning algorithm was used to construct the calculation relationship between dimensions at all levels and comprehensive scores, and the evaluation model was constructed by adjusting the indicators and their related weights. Through the visualization platform, the evaluation model and standard structure were configured to output the digital literacy portrait for individual clinical teachers, and the evaluation model and results were visually presented. Based on teachers' digital literacy portraits, the system can recommend required training resources and digital teaching cases for teachers to improve teachers' self-accurate assessment and development^[15]. Based on the evaluation results, targeted and hierarchical ability improvement training was organized and carried out.

5.2 Stage evaluation based on the large model

The large model integrates a large amount of medical knowledge and skills, simulates the clinical environment, and provides an efficient, interactive and personalized learning platform for medical students. At the same time, the large model can also analyze the teaching methods and teaching effects of teachers to provide support for teaching improvement^[16]. The big model evaluates the effectiveness of teaching methods and the advantages and disadvantages of teaching effects by collecting and analyzing various data of teachers' teaching behavior, students' learning performance and teaching process^[17]. Teachers' teaching data were collected, including teaching plans, teaching plans, teaching videos, and classroom interaction records. These data are the basis for the analysis of teaching methods. The collected data needs to be cleaned, collated, and analyzed. The big model will use natural language processing, data mining and other technical means to extract useful information to provide support for subsequent analysis, and will conduct in-depth analysis of teachers' teaching methods according to the processed data. At the same time, attention will be paid to whether the teaching methods of the teachers meet the learning needs of the students and whether they can stimulate the learning interest and enthusiasm of the students. A series of tasks and problems for the improvement of digital literacy ability are set up through scenario hypothesis, human-computer dialogue, etc., and teachers' background knowledge, views, event cognition, and attitude tendency are analyzed to diagnose the real performance of teachers in various aspects of digital literacy^[18].

5.3 Comprehensive evaluation based on micro-authentication

Micro-credentials is a kind of opportunity for adults to prove formal and informal learning outcomes, and it is an assessment process to prove that specific skills or specific achievements of learners meet the corresponding quality standards^[19]. Micro-certification of clinical teachers can evaluate the digital literacy ability of teachers by recording and collecting the evidence of practical behavior or results such as teaching design, courseware, teaching results, and students' competency generated in the process of teaching and training. To construct digital literacy micro-certification for clinical teachers, it is necessary to define and explain the framework of digital literacy ability, and clarify the standard knowledge and skills to be achieved. Practical courses or results can be used as evidence items for teachers' digital literacy certification. Teachers submit corresponding task evidence through the micro-certification system, and the micro-certification system evaluates and attests teachers' digital literacy ability according to the corresponding ability certification scoring guidelines, and provides diagnostic feedback and suggestions^[20]. It can promote teachers to constantly understand themselves, develop themselves and improve themselves in the process of certification, and realize the comprehensive evaluation of literacy.

6. Conclusion

The improvement of clinical teachers' digital literacy is an important part of the construction of clinical teachers in the transformation of medical digital education, and it is also a key way to promote and implement the transformation of digital education. This study puts forward theoretical insights for

digital literacy of clinical teachers from three aspects: overall strategy, application scenario and evaluation feedback. The improvement of clinical teachers' digital literacy in the context of digital education is a long-term and complex process, which requires the joint efforts and support of education departments, schools, clinical teachers and social enterprises [21]. Through strengthening training and learning, practice and application, communication and cooperation, and formulating specific measures, the digital literacy and ability level of clinical teachers will be continuously improved, so as to contribute to the modernization and high-quality development of medical education.

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