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Paths and challenges of teachers' role transformation in the artificial intelligence era

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Abstract. In the era of artificial intelligence, teachers' role transformation is a core issue in teachers' professional development under the background of educational digitalization, which is directly related to the quality of education and teachers' own practical adaptation. Currently, teachers' roles are shifting from mere knowledge transmitters to learning guides and technological collaborative constructors. Meanwhile, teachers are confronted with multiple challenges such as insufficient technical integration capabilities, vague role cognition, and lagging external support systems. To address these issues, at the individual level, teachers should enhance their digital skills and ethical awareness to improve their transformation competence; at the teaching practice level, efforts should be made to integrate technology empowerment with emotional education to construct a new teaching model; at the external support level, it is necessary to improve the training system and evaluation mechanism, and optimize the institutional environment for transformation. These measures aim to help teachers adapt to the new requirements of intelligent education and provide practical references for the digital transformation of education.

Keywords: artificial intelligence, teachers' role transformation, paths and challenges

1. Introduction

The report to the 20th National Congress of the Communist Party of China clearly states that "education, science and technology, and talents are the foundational and strategic supports for building a modern socialist country in all respects. We will strengthen the development of teachers' ethics and conduct, cultivate a high-quality teaching workforce, and promote a social atmosphere of respecting teachers and valuing education. We will advance the digitalization of education and build a learning society and a major learning country where lifelong learning is accessible to all" [1]. Meanwhile, the educational industry standard *Teachers' Digital Literacy* issued by the Ministry of Education defines a framework of teachers' digital literacy covering five dimensions: digital awareness, digital technology knowledge and skills, digital application, digital social responsibility, and professional development, providing fundamental guidelines and action directions for the digital transformation, upgrading, and professional development of the teaching workforce in the new era [2]. As the core subject of educational practice, teachers' literacy and capabilities directly affect the quality and direction of talent training. The shift from the traditional "knowledge transmitter" to the "learning guide" has become an inevitable trend of teachers' role transformation in the artificial intelligence era. To find their own

position in the new human-machine collaborative teaching model, teachers must realize the deep integration of technology empowerment and the essence of education. However, in reality, many teachers not only face internal dilemmas such as insufficient technical integration capabilities and vague role cognition but also are constrained by external factors including imperfect support systems and lagging evaluation mechanisms. These problems not only hinder teachers' professional growth but also affect the overall process of educational digitalization transformation. Currently, academic research on teachers' role transformation in the artificial intelligence era has yielded numerous achievements, but most focus on single-dimensional characteristic descriptions or partial countermeasures, lacking a systematic discussion from "role deconstruction—role remodeling—implementation paths—multi-dimensional challenges". Therefore, starting from the dual impacts of artificial intelligence on teachers' roles, this study systematically sorts out the core paths and multi-dimensional challenges of teachers' role transformation, aiming to provide theoretical references and practical ideas for constructing a collaborative support system and promoting high-quality educational development.

2. Deconstruction and remodeling of teachers' roles in the context of artificial intelligence

2.1. Deconstruction of traditional teachers' roles: dissolution of knowledge authority and reconstruction of teachers' functions

With the rapid social development and the vigorous advancement of artificial intelligence technology, profound changes have taken place in the field of education, and the knowledge authority of traditional teachers' roles has gradually been dissolved. Artificial intelligence technology, especially large language models like ChatGPT, has fundamentally shaken the "knowledge authority". Artificial intelligence surpasses humans in knowledge reserve, memory accuracy, and retrieval speed, enabling students to access massive amounts of information anytime and anywhere through intelligent tools. In educational applications, artificial intelligence is no longer merely an auxiliary tool but an "intelligent teacher" with analytical and comprehension capabilities. Teaching practice has also shifted from teacher-centered instruction to a dual-subject model of "human-machine collaboration", and the teacher-student relationship has evolved from the traditional "human-human" dialogue to a new type of "human-machine-human" interaction mediated by machines. Artificial intelligence has not only innovated teaching tools but also reshaped the teacher-student relationship and knowledge dissemination system: teachers have transformed from "knowledge monopolists" to "learning guides", and students have shifted from "passive recipients" to "active explorers". With the help of artificial intelligence and online platforms, students can access high-quality cross-regional resources, breaking the temporal and spatial limitations of teaching, weakening teachers' discourse power, and even presenting characteristics of "post-figurative culture" in some emerging fields, where the phenomenon of students "surpassing their teachers" has become increasingly prominent. Relying on its powerful knowledge processing capabilities, artificial intelligence has demonstrated significant advantages in performing procedural tasks, grading assignments, etc., making teachers' traditional knowledge transmission functions gradually decline. In addition, the dissolution of teachers' authority is also the result of the combined effect of drastic changes in the external environment and slow adaptation of teachers themselves: objectively, technology integration has reshaped the teaching form, knowledge iteration has accelerated, and educational goals have shifted to innovative talent training, shaking the foundation on which teachers establish their authority relying on inherent knowledge; subjectively, some teachers have fallen into role confusion, insufficient technical

capabilities, and transformation inertia, gradually losing their discourse power in intelligent classrooms, which further accelerates the loss of authority.

Faced with the impact of artificial intelligence, teachers' roles are undergoing a profound reconstruction from "knowledge authority" and "teaching dominator" to "guide for teachers and students to learn together". This transformation is not a weakening of functions but a sublimation of value. In the future, teachers should base themselves on their moral cultivation, fulfill the mission of fostering morality and cultivating people, help students establish a moral judgment system based on core human values through words and deeds, inspiration and guidance, promote the organic integration of human wisdom and artificial intelligence, thereby better enlightening students' innovative and critical thinking and stimulating their inherent potential. Teachers should adhere to the dominant position of education, make technology serve people rather than define them, guide the "efficient" instrumental rationality with the "educational" value rationality, take the initiative to control technology, and guard against its "reversing the roles" in the teaching process. At the same time, in the era of artificial intelligence, teachers must realize a change in thinking: from passive technology users to active learners, flexibly applying artificial intelligence in combination with teaching experience to make it a capable "assistant" in teaching work, and setting an example to guide students to rationally use intelligent technology and become students' "digital role models". In short, in the era of artificial intelligence, teachers are no longer mere knowledge transmitters but guides of human-machine collaboration, designers of innovative learning, and companions on students' growth paths. As Professor Ye Lan advocated, "If we fail to understand teachers and change teachers, all educational transformative reforms will be empty talk". Therefore, only by reconstructing teachers' roles from the perspective of social roles can we truly change teachers and clarify the direction of teachers' role transformation [3].

2.2. Remodeling of new teachers' roles: shift from knowledge transmitters to learning guides

In traditional education, teachers are entrusted with the mission of imparting knowledge to students; while in the era of artificial intelligence, teachers' responsibilities are far more than that. They are more oriented towards becoming guides for students' learning, guiding them to explore actively, stimulating their learning interest, cultivating their innovative and critical thinking, and improving their problem-solving abilities [4]. In the past, teaching was mostly curriculum-centered, and students, as passive knowledge recipients, their initiative was often restrained by preset teaching content and rules; today, the educational concept has gradually shifted to student-centered, truly making students the main body of learning. This transformation has made teachers no longer the sole authority of knowledge, but through interaction and communication with students, they achieve mutual learning between teaching and learning, guide students to learn how to learn, discover and flexibly apply knowledge, and truly achieve "teaching based on learning" [5], thereby promoting students' personalized learning and all-round development. In addition, teachers should not only be passive users of artificial intelligence technology but also "co-constructors" of its educational applications. This means that teachers need to actively participate in the educationalization of technology, which is specifically reflected in two aspects: first, teachers are "rational shapers" of the educational application of artificial intelligence—when artificial intelligence enters the classroom, teachers determine its usage scenarios, methods, and degrees based on their own teaching experience and educational concepts, essentially defining the educational value of technology; second, teachers can "reconstruct themselves" under the influence of artificial intelligence—intelligent technology puts forward new requirements for teachers' original knowledge and ability structure, from basic operations to data interpretation and teaching decision-making, all requiring teachers to continuously learn and dynamically adjust [3]. In short, in the era of artificial intelligence, teachers' roles are

increasingly clear: they are both "companions" who keep pace with the times and grow together with students, and "navigators" who guide students to master technology and explore the future.

2.3. Role integration under human-machine collaboration: collaborative symbiosis of technology empowerment and the core of education

In the era of artificial intelligence, education is developing towards the integration of human-machine collaboration. In this context, relying on its accuracy and efficiency, artificial intelligence helps teachers efficiently complete repetitive work such as assigning and grading assignments, daily administrative tasks, basic Q&A, and tutoring in teaching, effectively reducing teachers' workload and enabling them to devote more energy to students and teaching themselves, which is the unique feature of artificial intelligence technology. The essence of education is "fostering people" rather than mere knowledge transmission. The humanistic traits possessed by teachers, such as reflective ability, intuitive insight, and empathy, are unique advantages that artificial intelligence cannot replicate. This enables teachers to go beyond the single category of "imparting knowledge" and truly assume the fundamental mission of "fostering people". To achieve this goal, future education should move towards the direction of "human-machine collaborative symbiosis, each leveraging their strengths". Although artificial intelligence can improve the efficiency of knowledge transmission, excessive pursuit of technical efficiency may trap education in a single and empty predicament. Teachers, influencing lives with their own lives, cultivate students' correct values, critical thinking, and healthy spiritual qualities through slow-paced teacher-student interaction, which precisely makes up for the deficiencies of artificial intelligence in humanistic care and value guidance. Therefore, the application of artificial intelligence technology must serve the fundamental educational goal of "cultivating complete people". At the same time, the intervention of intelligent technology has transformed teacher-student emotional communication from direct dialogue to indirect "human-machine-human" interaction, which is prone to emotional alienation. Teachers need to take the initiative to give play to the advantages of emotional interaction, maintain an intimate teacher-student relationship centered on understanding and care, and prevent education from deviating from the essence of "fostering people" due to excessive reliance on technology [6]. With the evolution of teaching facilities and teacher-student relationships, teachers' teaching behaviors and professional characteristics have been further reshaped: the focus of teaching design has shifted from "knowledge transmission" to "learning process design", and teachers need to consider how to use artificial intelligence to support personalized learning, promote in-depth thinking, and avoid potential risks; the focus of classroom management has shifted from maintaining discipline to using intelligent technology to create immersive learning environments that accurately match students' needs; teaching evaluation needs to break through the data limitations provided by artificial intelligence, and combine technical analysis conclusions to make comprehensive value judgments on the teaching process and effects. In summary, education in the era of artificial intelligence is not about replacing teachers with machines, but through human-machine collaboration, promoting teachers' role transformation into learning designers, growth guides, and value judges, thereby promoting the development of education to a higher level [7].

3. Core paths of teachers' role transformation in the artificial intelligence era

3.1. Individual literacy upgrade: dual improvement of digital skills and ethical awareness

In the era swept by the wave of artificial intelligence, teachers are still the core of educational practice. As the main undertakers of school educational practice, teachers must not only shoulder the bounden duty of

fostering morality and cultivating people but also continuously iterate themselves to keep up with the times. For a long time, society has not only endowed teachers with ideal roles metaphorically such as "gardeners" and "engineers", which are deified, but also put forward ideal standards of omniscience and omnipotence. However, the gradual penetration of artificial intelligence technology into the field of education has broken traditional perceptions: students can obtain knowledge more conveniently, and teachers' knowledge authority has been weakened; comprehensive technical monitoring has also broken the information blind spot of teachers' images, making it difficult for them to maintain a "perfect persona" [8]. Faced with this transformation, teachers need to face the impact of artificial intelligence technology with an open and inclusive attitude, abandon idealized role cognition, and avoid falling into the misunderstanding of "technology fear and dependence". Teachers should take the initiative to become leaders of artificial intelligence technology and systematically construct artificial intelligence technology competence covering awareness, knowledge, skills, and ethics. Specifically, they should deeply understand the core concepts and data processing principles of artificial intelligence technology, be good at using technology to analyze students' learning situations, formulate personalized teaching plans, and at the same time have the ability to evaluate, integrate, and screen educational resources [9]. In addition, teachers should actively carry out interdisciplinary learning and strengthen exchanges and cooperation with experts in the field of artificial intelligence; as a key platform for teachers' growth, universities should also build a sound support system to help teachers realize role transformation and concept renewal through professional training [10]. We must clearly recognize that although "AI + education" can promote the refinement of teaching management and the personalization of learning processes, it essentially relies on computer programming and big data processing, lacking the unique social emotions and creative thinking abilities of humans, and cannot replace teachers' fundamental mission of fostering morality and cultivating people. Only when teachers complete a systematic transformation in educational concepts, technical literacy, and teaching practice, complement each other's advantages with artificial intelligence, and focus on cultivating students' creativity, critical thinking, and other abilities, can they highlight the core value of fostering people in the new ecology of human-machine collaborative education and guide students to achieve personalized and all-round development.

3.2. Teaching practice reform: in-depth integration of personalized teaching and emotional education

Under the background of artificial intelligence promoting profound educational reforms, teachers' roles urgently need systematic reconstruction: from the traditional "knowledge authority" to "co-learning guide", taking the initiative to build a student-centered learning community; from "passive adapter" to "self-improver", improving professional literacy through continuous learning and collaboration; from "technology user" to "human-machine collaborator", actively promoting the deep integration of intelligent technology and teaching practice; from "resource consumer" to "resource integrator", promoting the interdisciplinary integration and sharing of teaching content with a "big resource concept" [3]. What is particularly important is that teachers should uphold the educational essence of fostering students' all-round development and attach great importance to the dialogue and emotional connection between teachers and students. Professor Ye Lan pointed out that although technology can replace some labor, the teacher-student relationship should be an "I-Thou" relationship based on sincere dialogue. Academician Chu Junhao also emphasized that human spiritual emotions cannot be replaced by machines, and teachers must focus on emotional education and pay attention to the spiritual growth of students [11]. If teaching lacks emotional interaction and only stays at the level of knowledge transmission, teachers will be hard-pressed to compete with artificial intelligence in terms of efficiency. Only by touching students' hearts in teaching can we realize education with warmth, which is

exactly the irreplaceable core value of teachers. Therefore, education in the future should move towards a model of "human-machine collaborative symbiosis". While completing their role transformation, teachers must give full play to the unique emotional advantages of human beings, form a complementary relationship with artificial intelligence, and jointly build a new educational ecosystem oriented towards the future and characterized by collaborative education.

3.3. Optimization of support system: collaborative adaptation of training empowerment and evaluation mechanism

Teachers' role transformation depends not only on their own willingness but also is deeply affected by factors such as the school environment, job responsibilities, and cultural atmosphere. To effectively respond to the trend of educational digitalization, schools must build a comprehensive support system to systematically improve teachers' digital literacy, educational concepts, interaction models, and professional development levels. Specifically: first, schools should actively promote the construction of digital culture, improve infrastructure such as digital platforms, high-quality resource libraries, and safety protection, establish standardized data management and technical operation systems, and provide environmental and institutional guarantees for teachers' role transformation [12]. Second, targeted school-based training and research activities should be carried out. Through various forms such as simulated teaching, thematic lectures, and action learning, help teachers master core capabilities such as information retrieval, data security, and educational technology integration, and deepen their understanding of role transformation. In teaching practice, teachers should be supported to transform from knowledge transmitters to learning guides, focusing on interdisciplinary integration and blended teaching, using data analysis to implement personalized teaching, and building an open and shared digital resource library [13]. In addition, schools should encourage teachers to strengthen interaction, communication, and collaborative inquiry between teachers and students, and among teachers through digital platforms, and improve the quality of interaction and teaching effects through online discussions, virtual cooperation, and other methods. Finally, schools should optimize the management mechanism, adhere to the people-oriented concept, improve the incentive mechanism for digital teaching and the lifelong learning system, incorporate digital teaching practice into assessment and evaluation, effectively reduce teachers' burden, and build a healthy teaching ecology that supports teachers' continuous growth and prevents role marginalization.

4. Multi-dimensional challenges in the process of teachers' role transformation in the artificial intelligence era

4.1. Individual capacity challenges: insufficient technical integration literacy and role adaptation dilemmas

Technology Integration was initially proposed by Marco Iansiti, referring to the process by which enterprises select suitable technologies for new products, and is regarded as a more efficient method to adapt to complex needs. With the deep integration of artificial intelligence and the field of education, this concept has gradually extended to higher education. In 2006, American scholars Punya Mishra and Matthew Koehler proposed the "Technological Pedagogical Content Knowledge (TPACK) Model", which mainly consists of three core components: content knowledge, technological knowledge, pedagogical knowledge, and four composite elements formed by their intersection [10]. In the new educational field of "softened boundaries" constructed by intelligent technology, teachers are facing severe challenges to their individual capabilities, which are

concentrated in the structural lack of technical integration literacy and the resulting role adaptation difficulties. This challenge is not a lack of a single skill but is reflected in three key aspects: knowledge reserve, teaching practice, and professional judgment. In terms of knowledge structure, teachers are trapped in the "professionalism paradox"—the more deeply they engage in their professional fields, the more likely they are to be trapped in "knowledge silos", and the more obvious their shortcomings in interdisciplinary knowledge such as education, cognitive psychology, and artificial intelligence become. In teaching practice, insufficient literacy is manifested as the "dual disadvantage of human capital": teachers are not only difficult to compete with artificial intelligence in accuracy and efficiency but also have not formed high-order teaching capabilities adapted to the human-machine collaborative environment, such as designing data-driven interaction processes and creating intelligent integrated learning scenarios, leading to the dilemma of "not being proficient in traditional models and not being able to use new models". In terms of professional decision-making, it is manifested as "failure of decision-making capital": in the field of intelligent education, teachers need to transform from knowledge transmitters to learning guides who are data-based and pay attention to students' spiritual and personality differences. However, the lack of digital literacy makes it difficult for them to interpret the cognitive and emotional states behind the data, unable to implement effective personalized teaching and independent decision-making, and thus the core value of their roles is questioned [9]. In summary, the lack of technical integration literacy not only hinders the transformation of teachers from "role cognition" to "role realization" but also shakes their professional foundation in the intelligent era, constituting the most fundamental individual capacity challenge in the process of role adaptation.

4.2. Cognitive concept challenges: vague role orientation and constraints of traditional teaching inertia

Under the background of the deep integration of artificial intelligence and education, teachers' roles are facing a profound crisis of subjectivity. From the perspective of social role theory, teachers are difficult to establish a clear value orientation in the integrated ecology of "teacher-technology-education", and the construction of self-roles has structural imbalance. When instrumental rationality continues to squeeze the living space of value rationality, teachers are prone to deviate from the essence of education and student care, fall into a technical execution cycle of pursuing efficiency, leading to role identity deviation and "losing direction" in the technology-driven transformation [3]. From the perspective of philosophy of technology, some teachers have developed cognitive dependence on artificial intelligence tools, regarding them as completely replaceable teaching subjects, transferring classroom initiative, and making themselves increasingly "transparent" in the educational field; at the same time, under the dominance of technology's "enframing", teachers' teaching judgments are infiltrated by algorithmic logic, and their professional sensitivity and autonomy are continuously weakened, eventually alienating from the subject of the educational process into a "standing reserve" of technical rationality and losing teaching leadership [14]. From a practical perspective, this cognitive and subjective dilemma is exacerbated by deep-seated "role inertia". Although technological iteration continues to promote teachers' transformation into multiple roles such as knowledge extractors, learning designers, and digital literacy trainers, many teachers are still constrained by traditional teaching habits and role stereotypes and hold a conservative attitude towards educational reforms. They are accustomed to playing the role of knowledge transmitters in a stable structure, lacking the motivation to break through existing cognitive and behavioral models, leading to a serious disconnect between teaching practice and the "student-centered, human-machine collaborative" concept advocated by digital education. The sense of meaning loss at the cognitive level, the dissolution of subjectivity at the existential level, and the role inertia at the behavioral level are intertwined and reinforced, jointly forming a deep obstacle to teachers' professional

development in the artificial intelligence era. This multiple dilemma not only affects teachers' individual professional identity and career development but also profoundly reveals the systematic importance of reconstructing teachers' value rationality, professional autonomy, and role initiative while technology empowers education.

4.3. External environment challenges: lagging support mechanisms and mismatched evaluation systems

In the era of artificial intelligence, teachers' role transformation is constrained by multiple factors in the external environment and support systems. Although the digital transformation of education has expanded the teaching boundaries, the increase in the uncertainty of the teaching field and the diversification of teaching tasks have also plunged teachers into role adaptation dilemmas. The root cause lies in the imperfect support system: the ethical norms for new teachers' roles have not yet been improved, and there are gaps in data management systems; society's research on the cognitive and behavioral models of teachers' role transformation is insufficient, and training mostly focuses on operational skills while ignoring role education and practical situational training. In addition, the educational needs of the artificial intelligence era are seriously disconnected from the current teacher evaluation system, forming a structural contradiction—promotion and scientific research output are still the main evaluation indicators, and there is an obvious tendency of "valuing scientific research over teaching". However, the intelligent era requires teachers to invest a lot of time in reconstructing their knowledge systems and exploring new teaching models. This contradiction, combined with the dual pressures of life and family responsibilities, further weakens teachers' motivation for transformation. More importantly, in the face of the new requirements of the intelligent era for teachers as curriculum designers, technical ethics guides, guardians of student development, and other multiple roles, the existing evaluation framework lacks clear standard definitions and vague role boundaries, which not only increases teachers' psychological burden but also hinders their professional identity and value realization. In short, the dilemmas of teachers' role transformation stem not only from the limitations of individual adaptability but also from the structural lag of evaluation mechanisms, institutional norms, and professional support systems. Providing institutional guarantees and systematic support for teachers' professional development in the digital intelligent era has become an important issue that urgently needs to be addressed.

5. Conclusion

Under the background of the deep integration of artificial intelligence and education, teachers' role transformation has become an inevitable trend. This transformation not only faces practical challenges such as technological adaptation, role reconstruction, and lagging evaluation mechanisms but also contains important opportunities for professional growth and educational innovation. Future education will form a normal working state of collaborative symbiosis between teachers and artificial intelligence, which requires teachers to not only maintain an open learning attitude and actively master intelligent technology but also adhere to the original aspiration of education and highlight the temperature of fostering people. Successful role transformation not only requires teachers to achieve breakthroughs at the cognitive, literacy, and practical levels but also requires institutions to build scientific evaluation systems and professional support mechanisms, as well as society to form a rational technical cognition and a sound collaborative ecology. Only through the joint efforts of multiple parties can we promote teachers to complete the magnificent transformation from knowledge transmitters to learning guides, technical collaborators, and growth guardians

in the artificial intelligence era, and ultimately realize the organic integration of technology and education at a higher dimension.

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