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The Realistic Challenges and Road Choices of Primary and Secondary School Teachers in the Era of Artificial Intelligence: From the Perspective of Embodied Cognition Theory

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Abstract: The rapid development of artificial intelligence technology is triggering profound changes in the field of basic education, presenting new challenges to primary and secondary school teachers. Embodied cognition theory offers a fresh perspective on understanding these changes. This study, based on the tripartite view of embodied cognition theory—body-environment-cognition—systematically explores the teaching practice challenges faced by primary and secondary school teachers in the age of AI: the challenge between holistic development and teachers overemphasis on knowledge transmission, and the challenge between the intelligence of teaching tools and teachers weak technical skills. Corresponding strategies are proposed to address these challenges, such as shifting from disembodied educational concepts to a holistic educational philosophy that integrates body and mind, focusing on immersive embodied learning environments, continuously enhancing information literacy, and clarifying the educational value of intelligent technologies. The aim is to provide theoretical foundations and practical guidance for primary and secondary school teachers to navigate educational transformations in the intelligent era, promoting an organic unity of technology empowerment and educational authenticity, and driving high-quality development in basic education

1. Introduction

In the process of deep integration between artificial intelligence technology and education, the educational ecosystem and environment have undergone tremendous changes. From traditional teaching aids like blackboards and projectors to the iterative upgrades of intelligent interactive teaching systems, from a single reliance on teachers to innovative practices of "human-machine dual-teacher" collaborative teaching models, this technology-driven educational transformation has put forward systematic requirements for the professional capabilities of teachers in the basic education stage. Against this backdrop, the Ministry of Education issued the "New Era Basic Education Teacher Strengthening Plan" in 2022, emphasizing the need to further advance pilot measures for AI-assisted teacher team building, exploring new approaches and models for applying AI in teacher management optimization and teacher education reform[1].From the perspective of

technology empowerment, artificial intelligence, with its massive data storage capabilities and efficient computational processing performance, can effectively support teachers in making data-driven teaching decisions, replacing them in routine knowledge transmission tasks. However, it is important to note that many primary and secondary school teachers face new practical challenges during the integration of technology.

2. Realistic challenges faced by primary and secondary school teachers in the context of intelligent era

The deep integration of embodied cognition theory and intelligent technology promotes the profound transformation of educational ecology. The embodiment of technology not only drives the updating of teaching concepts but also prompts the restructuring of educational subjects and the transformation of cognitive methods. In this context, primary and secondary school teachers, as the core force in teaching, are facing multiple challenges.

2.1. Physical absence: the conflict between students development demands and teachers knowledge transmission orientation

Modern education, influenced by ideas such as technological rationality and instrumental rationality, places greater emphasis on teaching objectives at the knowledge and skill levels. Many teachers prioritize helping students master basic professional knowledge and proficient professional skills when conducting instruction and evaluation. In instructional design, they often focus solely on knowledge-based goals. Teachers teach "for the sake of knowledge," while students learn "for the sake of knowledge." Teachers play the role of knowledge carriers in the teaching process, while students act as recipients of knowledge. This teaching approach simplifies diverse and interactive classroom instruction into procedural knowledge acquisition and intellectual training. Under the pressure of exam-oriented education, the emphasis on intelligence over morality becomes more common, but it cannot be considered comprehensive development. Overemphasis on knowledge transmission by teachers, focusing only on students cognitive development and neglecting physical, aesthetic, and labor aspects, can lead to a distorted developmental state. Relying solely on knowledge transmission is insufficient for cultivating the essential character traits and critical abilities required for lifelong development and social progress, making it difficult to adapt to the demands of the times.

2.2. Environmental fission: the opposition between multiple learning fields and traditional teaching mode

Traditional teaching models refer to a method where teachers systematically impart knowledge from textbooks and lecture notes to students through lectures in a fixed educational setting (primarily classrooms). This model emphasizes centralized knowledge delivery and standardized assessment methods. Under this teaching model, the entire learning process is entirely teacher-led, with teachers at the center of the classroom and serving as the primary source of knowledge for students. With the rapid development of intelligent technologies and the increasing personalization of learners needs, learning environments have become more diverse, digitalized, personalized, and collaborative. The intelligent, multifaceted learning environment has addressed the issue of single, monolithic learning settings, creating a borderless learning space that transcends time and space limitations, thus expanding the scope of learning. Learning spaces have expanded from the traditional, fixed school setting to various ubiquitous spaces such as communities and homes. Learners can now immerse themselves in learning anytime and anywhere using digital devices, and

even experience more realistic and natural learning environments through wearable technology and digital personal assistants. At the same time, the diversified learning environment places greater emphasis on individuality, autonomy, and innovation, as well as the cultivation of lifelong learning skills. This makes it difficult for traditional teaching models to meet the needs of diverse learning environments, not only affecting teaching. It can even reduce students interest and participation in learning.

2.3. Technical gap: the imbalance between intelligent teaching tools and teachers technical adaptability

In the era of intelligent education, the use of smart teaching tools has become an important means to improve teaching quality and optimize teaching efficiency. Especially with the addition of educational robots, intelligent guidance systems, and adaptive learning systems, a new form of "dual-teacher" classroom instruction has emerged, which is a highly integrated blend of human wisdom and artificial intelligence. This places higher demands on teachers intelligent education capabilities. Teachers need to possess the necessary competencies to effectively utilize smart technologies in their teaching. However, the overall level of teachers intelligent literacy in China remains relatively weak[2].On the one hand, intelligent teaching tools are characterized by their high complexity and the ongoing need for continuous updates, which requires teachers to constantly learn new technologies to adapt to the needs of these tools; on the other hand, some teachers, due to their weak intelligence literacy, find it difficult to properly handle their relationship with intelligent teaching tools, leading either to completely rely on these tools, acting as "hands-off managers," or to avoid using them altogether, viewing them as a "burden."

3. The internal mechanism of teaching transformation of primary and secondary school teachers under the theory of embodied cognition

Embodied cognition theory holds that cognitive activities are generated in the process of interaction with body experience, environment and social and cultural structure.

3.1. Focus on physical experience to provide direction for teaching shaping of primary and secondary school teachers

The core point of embodied cognition theory is to emphasize the basic role of body in the cognitive process, and cognition is embodied. Body perception and body attributes will affect the formation and development of cognition, and the process of individual cognition is provided by body perception and physical properties of body[3].The characteristics of the bodys physiological structure and the way it moves determine, to some extent, how an individual perceives the world. Conceptual metaphor theory holds that complex abstract concepts can only be understood by establishing a connection with the bodys existing experience through metaphor[4]. The learning process of students is not only a simple "stimulus—response" process, but also a whole-body participation process and an active construction process. In this process, knowledge is formed through the physical properties of the body and the special channel of the perception—movement system. Teachers must recognize that bodily perception is the foundation of student learning, and physical experience is an essential element in the learning process. In educational activities, only when knowledge resonates with students bodily experiences can they internalize it, truly achieving "internalization of mind and externalization of action."

3.2. Pay attention to environmental functions to provide guidance for primary and secondary school teachers teaching shaping

Cognition is the result of the interaction between internal physiological mechanisms and external environmental factors. Humans create their environment, and in turn, the environment shapes them. Under the perspective of embodied cognition theory, learning environments exhibit characteristics of complexity and dynamism. Complexity refers to the fact that learning environments consist of multiple complex elements, and the relationships between these elements are intricate. Dynamism indicates that learning environments are not static systems; the various elements within them are in a state of dynamic change, evolving with the learning process and technological advancements. This environment can be a real on-site setting created by teachers or a virtual one generated through intelligent technologies. The development of various intelligent technologies has provided learners with more authentic learning environments, allowing them to transcend the limitations of time and space, experiencing the charm of knowledge right in the classroom. Knowledge is internalized through the interaction between the body and specific environments. If teaching focuses solely on knowledge itself without considering the learning environment, it will be difficult to achieve ideal educational outcomes.

3.3. Seize the "bridge" of technology to provide opportunities for primary and secondary school teachers to shape teaching

Technology and the body interact and are inseparable. Technology serves as the medium for human interaction with the world, while the body acts as the intermediary and foundation for this interaction. As early as the 20th century, Merleau-Ponty used womens feathered headdresses and blind peoples canes to illustrate how technology extends the human body. Idem, on the other hand, used glasses to explain the embodied relationship between the human body, cognition, and technology. Embodied cognition theory involves three key elements: cognition, environment, and body. The introduction of intelligent technologies, represented by artificial intelligence, not only serves as a critical bridge connecting internal cognition, external environment, and human bodily activities but also makes technology itself an indispensable part of human cognitive activities, achieving a high degree of integration between humans and technology, as well as between environment and cognition. In the process of human adaptation to and transformation of the environment, technology has gradually shown a trend towards embodiment, blending with the self, highlighting its unique value as an extension of human physiological functions[4].Together, they shape students cognitive experience and lifestyle.

4. The path of teaching in primary and secondary schools in the era of artificial intelligence returns

To break through the teaching dilemma of primary and secondary school teachers, we need to return to the reconstruction of the meaning of teaching itself.

4.1. Promote the reconstruction of ideas: realize the transformation from "disembodiment" to "body and mind integration"

Disengagement education emphasizes the cognitive process while neglecting physical participation, treating the body as a "carrier" or "container" of education. It views learning as a mental activity that does not involve the body, leading to the phenomenon of "learning above the neck" in educational practice. Teachers must first shift their mindset from disengagement education

to an integrated approach that combines mind and body. The body is closely linked to the cognitive process and directly influences the internalization and understanding of knowledge. Ignoring bodily sensory experiences and relying solely on input-based knowledge transmission will make it difficult to effectively help students grasp and internalize what they learn. Secondly, teachers should create teaching methods that allow students to acquire knowledge through physical engagement. Learning is a process of active construction, where knowledge acquisition involves continuous reconfiguration through interactions with the environment, others, and oneself. By designing experiential and practical teaching methods based on the content, teachers can integrate students visual and auditory channels with their bodily experiences, helping them deepen their understanding of knowledge through mind-body interaction. Finally, teachers can combine the content they teach with students experiences. Learning occurs in specific environments, not just abstract classroom settings. When the content taught is too abstract or far removed from students real-life experiences, it often becomes difficult for them to understand The true meaning of "knowledge". At this time, teachers need to simplify "knowledge" and combine it with students existing physical experience.

4.2. Design embodied context: create a multimodal immersive embodied learning environment

Embodied learning environment is an environment that integrates real environment and digital virtual environment supported by embodied technology and based on embodied cognition theory. This learning environment dynamically learns knowledge and improves ability through the interaction, observation and experience between body and various elements in the environment[5].Teachers should closely monitor students physical and mental experiences, designing learning environments that align with the cognitive and emotional needs of students based on the characteristics of subject knowledge and the developmental requirements of students during knowledge instruction or teaching activities. Additionally, teachers should focus on how to leverage various elements in embodied environments to enhance the depth and breadth of student learning. When the created environment struggles to resonate with students, teachers can use modern tools such as intelligent technologies to extend students sensory experiences. They can also employ virtual reality and other technical means to construct realistic scenarios, including real-world embodiment, sensory embodiment, and offline embodiment, enabling students to actively build bridges of knowledge across multiple dimensions and levels, achieving deep and immersive learning.

4.3. Strengthen technical guidance: expand the teaching practice path of teachers information literacy

The deep integration of artificial intelligence technology with education is gradually shaping the core form of future educational development. The value of intelligent technology in teaching not only lies in reducing teachers workload and optimizing management processes but, more crucially, in supporting personalized learning, enhancing motivation, and generating learning feedback. Teachers, as the core regulators of intelligent technology in the teaching process, must possess good technical awareness and information literacy to truly realize the transformation of technological educational value. This requires dual changes in teachers mindset and attitude. On one hand, teachers need to shift their biases or overestimations towards intelligent technology, viewing it correctly and reasonably. On the other hand, in practical teaching, teachers should actively combine information tools and equipment based on the characteristics of the subject matter they teach, truly applying intelligent technology in teaching, strengthening the use of information tools, neither relying solely on nor abandoning intelligent technology, finding the right balance in its application, and continuously improving their theoretical knowledge and practical skills in using intelligent

technology.

5. Conclusion

The era of artificial intelligence has brought new opportunities and challenges to teaching in primary and secondary schools. Embodied cognition theory emphasizes that the acquisition and understanding of knowledge are rooted in bodily experiences and interactions with the environment, providing profound insights for teachers 'practices. In future development, teachers should actively embrace AI technology, building a "human-machine collaboration" model in teaching to enhance students' learning outcomes. At the same time, teachers should adhere to a people-oriented approach, respecting students' subjectivity and diversity, focusing on cultivating their comprehensive qualities, and achieving mutual improvement in both teaching and learning.

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