Research on the Essence of Educational Informatization: A Pedagogical Perspective

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Abstract

As a product of the deep integration of information technology and education, educational informatization has become the core driving force for promoting educational reform and development. However, current research on educational informatization mostly focuses on the application of technology. While the exploration of its essence is still insufficient. This article starts from the perspective of education and deeply analyzes the core connotation of educational informatization, revealing its essential characteristics in dimensions such as educational goals, teaching processes, and teacher-student relationships; By analyzing the potential application of educational informatization in promoting personalized learning, promoting educational equity, and reconstructing educational evaluation, combined with the current practical challenges such as the disconnect between technology and educational concepts, insufficient teacher information literacy, and imbalanced regional development, this paper proposes development strategies led by educational theory, strengthening teacher construction, and building collaborative mechanisms, aiming to provide theoretical support and practical paths for the deep promotion of educational informatization.

Keywords

Education Informatization, Pedagogical Essence, Technology Integration, Personalized Learning, Education Equity

With the rapid development of digital technology, education informatization has moved from the stage of “tool application” to the new stage of “deep integration”. From blackboards to electronic whiteboards, from paper textbooks to digital resource libraries, from classroom lectures to blended learning, every iteration of technology is reshaping the shape of education. However, in this process, the tendency of “technology first” has gradually appeared: some schools blindly pursue the updating of hardware equipment but ignore the innovation of the teaching mode; the educational platform has become more complex, but fails to truly fit the learning rules of students. This phenomenon of “focusing on technology and neglecting education” highlights the need for pedagogical reflection on the nature of education informatization. The core proposition of pedagogy is “what kind of people to train” and “how to train people”. The essence of education informatization is not a simple superimposition of technology in the education scene, but a return to the true nature of education with the support of information technology — to promote the comprehensive development and personalized growth of human beings[1]. From Comenius's “pan-intellectual education” to Dewey's “do

middle school". From Tao Xing Zhi's "life education" to constructivism's "active learning", education theory has always been the "active learning". From Tao Xing Zhi's "life education" to constructivism's "active learning", pedagogical theories have always emphasized that education should respect people's cognitive laws and developmental needs[2]. The value of education informatization is being empowered by technology, so that these educational concepts can be more efficient and accurate landing.

At present, China's education informatization has entered the "2.0 era", and the "Education Informatization 2.0 Action Plan" clearly puts forward the goal of "supporting and leading the modernization of education with education informatization". In this context, clarifying the essence of education informatization from the perspective of pedagogy can not only provide guidance for the application of technology, but also prevent education from losing its original intention in the "wave of digitization". Therefore, this study focuses on the pedagogical nature of education informatization, which has both theoretical and practical significance.

The Core Connotation of Educational Informatization: Interpretation from the Perspective of Pedagogy

The essence of educational informatization needs to be examined within the framework of educational theory. Starting from the basic elements of education — educators, learners, educational content, and educational methods, its core connotation can be summarized into three levels: the integration of technological tools and educational essence, the digital reconstruction of the educational process, and the rational return of educational values[3].

The integration of technological tools and educational essence

The essence of information technology is "tools", but the essence of educational informatization is "tools serving education". From the perspective of education, the value of technology lies in supporting the achievement of educational goals, rather than replacing education itself. For example, multimedia technology can transform abstract physical formulas into dynamic simulation experiments, but its core value is to help students understand the essence of "scientific exploration", rather than simply presenting technical effects; Online learning platforms can break the limitations of time and space, but the ultimate goal is to enable students to construct knowledge systems more independently, in line with Rogers' "student-centered" educational philosophy . This integration is reflected in two dimensions: on the one hand, technology has expanded the possibilities of education — virtual reality (VR) technology allows history classrooms to "travel" to ancient battlefields, and students can understand the background of historical events through immersive experiences, which is difficult to achieve in traditional classrooms; On the other hand, educational philosophy constrains the application boundaries of technology — even if artificial intelligence can automatically correct homework, teachers' humanistic care and value guidance are still irreplaceable[4]. Because education is not only about knowledge transmission, but also about emotional cultivation and value shaping.

The digital reconstruction of the educational process

The educational process is an interactive

chain of "teaching" and "learning", and educational informatization has reconstructed every link of this chain through digital means. From the perspective of the "mutual growth of teaching and learning" theory in education, this reconstruction is reflected. In the fact that at the level of "learning", digital tools shift learning from "passive reception" to "active construction".

Students can form learning communities through online collaboration platforms, engage in discussions and division of labor exploration around problems, which is highly consistent with Piaget's "cognitive development stage theory" that "social interaction promotes cognitive enhancement". For example, when middle school students are learning programming, they not only master technical skills but also cultivate critical thinking and collaborative abilities by sharing code libraries to debug programs and provide improvement suggestions. At the level of "teaching", the role of teachers has shifted from "knowledge transmitters" to "learning guides".

With the help of learning analytics technology, teachers can grasp students' knowledge weaknesses in real time — when data shows that 80% of students are confused about the concept of "calculus limits", teachers can adjust their teaching pace and design targeted case studies instead of following pre-set lesson plans. This "learning determines teaching" model is precisely the practice of Dewey's "education is growth" theory in the digital age: education should follow the pace of students' development, rather than forcing them to adapt to a fixed teaching schedule[5].

The rational return of educational value

The ultimate value of education is to promote comprehensive human development, and one of the essences of educational informatization is to correct the utilitarian tendency of education through technology and return to this core value. For a long time, exam-oriented education has narrowed educational goals to "knowledge memory" and "skill training", and educational informatization has provided the possibility to break this limitation. For example, digital evaluation tools are no longer limited to "score quantification" but depict students' growth trajectories through multidimensional data: an evaluation report on "project-based learning" may include qualitative indicators such as students' ability to design programs, team contribution, problem-solving strategies, etc., which corresponds to the comprehensive goal of "from memory to creation" in Bloom's taxonomy of educational objectives. In addition, the popularization of online educational resources allows students to access a wider range of knowledge areas — rural students learn astronomy courses through the National Smart Education Platform for Primary and Secondary Schools, while urban students use intangible cultural heritage digital museums to learn about traditional handicrafts. This "personalized extended learning" reflects educational equity and comprehensive development.

The potential application of educational informatization in the field of education

From the perspective of educational theory, the potential application of educational informatization is not only reflected in the improvement of technical efficiency, but also in the breakthrough of core educational issues.

Its potential is mainly concentrated in the following four dimensions.

Promoting personalized learning and responding to the concept of "teaching students according to their aptitude" is the essence of traditional Chinese education thought, and the ideal state pursued by modern education. However, in traditional classrooms, teachers find it difficult to consider the individual differences of dozens of students, resulting in the dilemma of "excellent students not getting enough to eat raw food, and underachieving students not being able to keep up".

Educational informatization uses technological means to move "teaching according to students' aptitude" from concept to practice. Intelligent learning systems can construct "cognitive portraits" based on students' learning data: by analyzing the types of homework errors, students' logical thinking weaknesses can be identified; Evaluate students' learning perseverance by recording learning duration and frequency; By tracking points of interest (such as students who frequently click on programming courses being more sensitive to computer science), recommend matching extension resources. This personalized push is not simply about "content stuffing" but based on Vygotsky's "zone of proximal development" theory — the pushed learning content is always slightly higher than the student's current level, ensuring both challenge and avoiding frustration due to being too difficult.

For example, for a student with a weak foundation in mathematics, the system will first push "life oriented mathematical application problems" (such as shopping change calculation), and then gradually transition to abstract algebraic equations, keeping learning in a state of "jumping within reach".

Promoting educational equity and practicing the concept of "education without discrimination" is an educational ideal proposed by Confucius, which states that education should not be differentiated based on geography, wealth, or qualifications[6]. The important potential of educational informatization lies in narrowing the regional education gap and allowing high-quality resources to benefit more groups.

From a hardware perspective, the "Three Classrooms" (Delivery Classroom, Famous Teacher Classroom, and Famous School Online Classroom) use live streaming technology to enable students in remote areas to learn synchronously with teachers from prestigious cities. For example, the students in Naqu, Xizang, participated in the English classes of famous teachers in Shanghai through the courier class, not only getting access to standard pronunciation, but also getting targeted guidance through interactive questions, which was difficult to achieve in the past era of relying on "CD-ROM teaching".

From a software perspective, Open Educational Resources (OER) have broken the monopoly of knowledge — Tsinghua University's "School Online" has opened "Artificial Intelligence Fundamentals" courses for free to the society, allowing non elite students to access cutting-edge knowledge. This is the interpretation of "educational equity" in the digital age: equity is not only about "having access to education", but also about equal opportunities to "attend good schools".

Supporting lifelong learning and expanding the boundary of "education as life", Tao Xing Zhi proposed "life as education", believing that education should run through a person's entire life and cover

every scene of life. One of the potentials of educational informatization is to build a lifelong learning system that can be learned anytime and anywhere, allowing education to break through the limitations of school walls. The elderly can integrate into digital life and prevent cognitive decline by learning how to use smartphones through the "Silver Hair Digital Classroom"; Workplace professionals utilize micro course platforms to learn new skills in fragmented time - a marketing professional can complete online courses on "short video marketing" while commuting, which aligns with the characteristic of "learners with clear goal orientation" in adult education. In addition, the application of blockchain technology in education enables cross scenario recognition of learning outcomes[7] — a person's "emergency training" digital certificate obtained at a community college can be recognized in workplace recruitment, volunteer service, and other scenarios, providing technical support for "lifelong learning achievement certification" and expanding the scope of "education as life" to an unprecedented extent.

The current situation and challenges of educational informatization practice

Despite the significant potential of educational informatization, from an educational perspective, it still faces many challenges in practice, which are essentially conflicts and imbalances between the "technological logic" and the "educational logic".

The disconnect between technology application and educational philosophy

Currently, some schools' educational informatization construction has fallen into the misconception of "emphasizing hardware over concept": investing heavily in building smart classrooms but still using the traditional model of "teachers speak, students listen"; The introduction of an AI homework grading system has not changed the training method of "question sea tactics". This' traditional education packaged in technology 'violates the essence of educational informatization — technology should serve the innovation of educational concepts, rather than becoming a' decoration 'of traditional models. For example, the "VR History Classroom" in a certain middle school is equipped with advanced immersive devices, but the teaching process is still "teachers play VR content → students watch → memorize knowledge points", and students' experience is no different from "watching 3D movies", failing to fully utilize the educational value of VR technology in promoting active exploration. The root of these disconnects lies in the fact that school administrators and teachers' understanding of educational informatization remains at the level of "technological tools", lacking awareness of how technology can support teaching mode changes from the perspective of educational theory.

The mismatch between teachers' information literacy and digital teaching needs

Teachers are the core implementers of educational informatization, and their information literacy directly determines the effectiveness of technology applications. However, the information literacy of the current teacher group is difficult to meet the needs, mainly reflected in two aspects: one is the insufficient "technical ability". Although some teachers can use basic office software, they lack the ability to apply

advanced tools such as learning analysis and digital evaluation — When data shows that students are experiencing "learning fatigue", teachers cannot find the reason through data mining (is the content too difficult or the task monotonous?), resulting in technical tools becoming "data collectors" rather than "teaching decision assistants". The second is the lack of "educational wisdom". Even if they master the technical operation, some teachers find it difficult to integrate it with educational theory: a Chinese language teacher may use AI to generate multiple essay models, but they do not know how to guide students to analyze the writing logic of the models (such as "how to reflect character personalities through detailed descriptions"), resulting in the application of technology remaining at the level of "content generation" and failing to touch on the educational core of "thinking cultivation". This phenomenon of "having technology but no education" highlights the problem of the disconnect between "technical training" and "educational theory infiltration" in the cultivation of teachers' information literacy.

Unequal regional and group development hinders the goal of educational equity

Educational informatization should promote educational equity, but in practice it may exacerbate the "digital divide" and create new inequalities[8]. From a regional perspective, schools in developed eastern regions have begun to explore "AI personalized learning", while some schools in remote western regions still face difficulties such as "unstable networks" and "aging equipment", which directly lead to unequal access to educational resources due to hardware gaps. From a group perspective, "digital natives" (such as post-2000 students) can quickly adapt to new learning tools, while "digital immigrants" (such as elderly learners and left behind children in rural areas) face "use barriers" — a rural junior high school student may have difficulty operating a tablet computer in "online exams" due to unfamiliarity, which affects their grades[9]. This difference in "technological adaptability" makes educational informatization a new "filter" and violates the educational pursuit of "education without discrimination".

Data Ethics and Privacy Protection Risks

Educational informatization relies on the collection and analysis of a large amount of student data, but this data involves sensitive information such as students' learning behavior and psychological state. If not handled properly, it will violate students' privacy rights and even cause harm to their growth. For example, a certain learning platform shares students' "lack of concentration" data (such as the number of distractions in class) with parents, causing students to experience anxiety of being monitored, which violates the basic principle of "respecting students' personality" in education. In addition, the "bias" of data algorithms may exacerbate educational inequality: if AI recommendation systems push learning resources based on "historical grades", they may continue to push basic content to students with poor grades, forming a "low-level cycle", while students with excellent grades receive more advanced resources. This "Matthew effect" conflicts with the essential goal of "education should promote the development of every student".

Development Strategy of Educational

Informatization from the Perspective of Pedagogy

To address the challenges in the practice of educational informatization, it is necessary to return to the essence of education and construct a development path of "educational logic leading technology application".

Guided by educational theory, reconstruct the concept of information technology construction

The construction of educational informatization should establish the principle of "prioritizing education" and take educational concepts as the starting point and foothold for technological applications. Specifically, when schools formulate information technology plans, they need to organize teachers, educational experts, and technical personnel to participate together and demonstrate the necessity of technology application from the perspective of educational theory. For example, before introducing an "AI teaching assistant", it is necessary to clarify whether it conforms to the "constructivist learning theory". Whether it can promote students' active exploration? Will it weaken teacher-student interaction? Not just considering whether it can improve teaching efficiency. Teacher training should strengthen the integration of "education technology". The curriculum not only includes technical knowledge such as "intelligent platform operation" but also includes educational application modules such as "how to use learning analysis techniques to achieve personalized teaching" and "how to use digital tools to cultivate students' critical thinking". For example, through case studies, teachers can understand that the design of online discussion forums should follow the principle of "social constructivism" and include elements such as "open-ended questions" and "group peer evaluation" to avoid discussions becoming mere "watering".

Enhance teachers' information literacy and strengthen their ability to empower themselves with technology

Teachers are the core link between technology and education, and the improvement of their information literacy needs to shift from "technology use" to "educational innovation". Specific strategies include building a "tiered" training system: focusing on "matching digital tools with teaching processes" for novice teachers — how to use mind mapping software to organize the structure of Chinese language texts; Focusing on the design of teaching modes supported by technology for backbone teachers — how to use online collaboration platforms to carry out interdisciplinary project-based learning. This hierarchical training aligns with the "stage theory" of teacher professional development, avoiding a one size fit all ineffective training approach. Establish a "Teacher Informatization Practice Community": Through inter school cooperation, online communities, and other forms, teachers can share their educational experience in technology application[10]. For example, a teacher from a rural middle school can learn about the practice of "using short videos to promote students' expression ability" in urban schools through community learning, and adjust the plan based on local learning conditions — allowing students to shoot cultural short films of their hometown in dialects, which not only leverages technological advantages but also integrates local characteristics, achieving

the application of "technology localization".

Building a collaborative education mechanism to narrow the gap between regions and groups

To promote educational equity, it is necessary to establish a collaborative mechanism of "government leadership, school linkage, and social participation" to solve the problem of uneven education informatization: the government should increase its tilt towards information resources in rural and weak schools, not only investing in hardware equipment, but also ensuring "sustainable operation" — by purchasing services to equip remote schools with dedicated technical support personnel to avoid "equipment idle". At the same time, promote the localization and adaptation of high-quality digital resources, such as reconstructing the "physics experiment course" resources of urban prestigious schools with familiar "agricultural machinery" cases of rural students, to improve the applicability of resources. Give full play to the role of the "urban-rural matching support" mechanism and promote the balanced development of teachers' abilities through the "online teaching and research community". Urban teachers can share their experience of "technology integrated teaching" through live streaming, while rural teachers can provide feedback on the learning characteristics of local students, and both parties can jointly design a digital teaching plan that is suitable for the learning situation in both places. This interaction not only narrows the regional gap but also enriches the practical forms of educational informatization.

Improve ethical norms and safeguard systems to safeguard the humanistic essence of education

To prevent data ethics risks, it is necessary to establish an "educational ethics boundary for technology applications": formulate the "Guidelines for Educational Data Ethics", clarify the "minimum necessary principle" for data collection — only collect information related to teaching (such as knowledge mastery level), and prohibit the collection of irrelevant data such as "private social" and "family background"; The principle of informed consent for the use of data stipulates — students and parents have the right to know the purpose of the data and the right to refuse sharing. Establish an "algorithm review" mechanism and form a committee composed of education experts, ethics scholars, teachers, and parent representatives to regularly evaluate whether the recommendation logic and evaluation criteria of the AI system comply with the principles of educational equity. For example, reviewing the "learning resource recommendation algorithm" to ensure that it can provide "advancement opportunities" for students of different levels and avoid educational inequality caused by "algorithm bias".

Conclusion

The essence of educational informatization is to "rely on technology and return to the essence of education". With the empowerment of information technology, educational ideals such as "teaching according to aptitude", "education without discrimination", and "lifelong learning" can be more fully realized. From the perspective of pedagogy, the value of educational informatization does not lie in the progressiveness of technology, but in

whether it can serve the core goal of "human development".

At present, the challenge of the disconnect between technology and education in the practice of educational informatization reminds us that technology is the "means" rather than the "purpose" of educational reform. The future development needs to always be guided by educational theories, allowing technology applications to follow educational laws, meet students' growth needs, and find a balance between technological empowerment and humanistic care. Only in this way can educational informatization truly become the core driving force for promoting educational modernization, achieving a deep leap from "digital education" to "educational digitization". Not only a change in educational forms, but also a return and sublimation of educational essence.

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