Research on the Operation Mechanism and Optimization Paths of Smart Education Public Services from the Perspective of New-Quality Productive Forces

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Abstract： New-quality productive forces, featuring technological innovation as the leading driver and high-quality development as the core, offer a new perspective and core guideline for the upgrading of smart education public services. Based on the theoretical core of new-quality productive forces, this paper interprets the operation mechanism of smart education public services, analyzes the practical dilemmas in current operations, and proposes targeted optimization paths. It aims to help smart education public services adapt to the development requirements of new-quality productive forces, thereby supporting the high-quality development of education and the cultivation of innovative talents.

Keywords： new-quality productive forces; smart education; public services; operation mechanism; optimization paths
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Accelerating the development of new-quality productive forces is a core strategy for advancing high-quality development. Its inherent requirement of being oriented towards technological innovation provides a clear direction for the digital transformation of education. As the core carrier of educational digitalization, smart education public services assume key functions including resource integration, precise service provision, and fairness guarantee, directly affecting education's supporting effectiveness for new-quality productive forces. However, problems such as insufficient technological empowerment and imperfect coordination mechanisms still exist, making it difficult to meet the needs of cultivating innovative talents. Therefore, clarifying its operation mechanism and exploring optimization paths from the perspective of new-quality productive forces is of great practical necessity.

1 Theoretical Analysis

1.1 Core Connotation of New-Quality Productive Forces

New-quality productive forces are the core driving force for high-quality development. Their essence lies in breaking away from traditional development paths through factor innovation and structural transformation, with the core hallmark being the systematic improvement of total factor productivity. As a composite concept, it can be deconstructed from two key dimensions: factor composition and value orientation.

In terms of factor composition, new-quality productive forces manifest as a qualitative leap in key production factors. Led by technological innovation, data is elevated to a core driving element. Traditional factors such as labor, capital, and land achieve efficiency multiplication through in-depth integration with digital technologies and intelligent tools. Laborers have transformed into innovative talents with higher-order thinking and digital literacy; means of labor have evolved into new infrastructure such as intelligent algorithms and digital platforms; and objects of labor have expanded from physical entities to data, knowledge, and virtual scenarios. This profound innovation at the factor level lays the foundation for the "qualitative change" in productivity.

In terms of value orientation, new-quality productive forces unswervingly focus on high-quality development. They pursue the "efficiency" and "connotation" of development rather than mere "speed" and "scale." Their development logic emphasizes achieving higher-quality, more efficient, fairer, more sustainable, and safer development through technological revolution and factor optimization, ultimately serving the all-round development of individuals and the overall progress of society.

1.2 Connotative Reconstruction of Smart Education Public Services

From the perspective of new-quality productive forces, the connotation of smart education public services needs to realize a paradigm shift from "technological instrumentalism" to "systematic reconstruction theory." It can be defined as a new form of modern educational public services that is ubiquitous, precise, collaborative, and sustainable. It takes cultivating innovative talents adaptable to future society as its fundamental purpose, regards data as a key strategic resource, and relies on the in-depth integration of technologies such as artificial intelligence with the educational ecosystem as the core driver. This new form is formed through the systematic reconstruction of service supply, governance, and evaluation models.

This definition involves four fundamental transformations: first, a goal shift—from ensuring "scale equity" of resources to promoting "high-quality innovation" that fosters learners' innovative potential, making education a talent incubator for new-quality productive forces; second, a driving force shift—from the superficial application of "technological superimposition" to the ecological driving force of in-depth and organic integration of "technology-education-humanities"; third, a model shift—from the standardized "unified supply" model to "precise services" and personalized provision based on learner profiles and intelligent algorithms; fourth, a system shift—from the "management closed-loop" system led by the government and schools to an "open and collaborative" network co-constructed, governed, and shared by multiple subjects, so as to promote the efficient flow and optimal allocation of educational factors.

2 Operation Mechanism of Smart Education Public Services from the Perspective of New-Quality Productive Forces

From the perspective of new-quality productive forces, the operation of smart education public services is a dynamic closed-loop system with technological innovation as the core engine, multi-subject collaborative linkage, and the realization of precise resource supply and continuous efficiency improvement. Its core mechanism can be summarized as the interconnected operation of four key links: "innovation-driven - multi-subject collaboration - precise supply - efficiency improvement."

2.1 Core Driver: Technological Innovation Empowers Factor Reconstruction

New production factors such as big data, artificial intelligence, and cloud computing are the core driving forces for the operation of smart education public services. Big data technology enables precise user demand profiling, dynamic monitoring, and prediction of service effects; artificial intelligence supports the development of applications such as personalized learning systems and intelligent teaching assistants, promoting the transformation of educational services from "standardized supply" to "personalized adaptation"; cloud computing helps build flexible and efficient service platforms, realizing the intensive management and cross-regional sharing of educational resources. These technologies complete the reconstruction and integration of traditional educational resources with new technological factors, laying the foundation for the high-quality operation of services.

2.2 Core Link: Precise Supply Adapting to Demands

Based on the demand insight capability empowered by technological innovation, a precise supply mechanism is established. Differentiated needs of different academic stages and groups are collected through multiple channels such as platform data monitoring, school feedback, and questionnaires. Big data analysis is used to classify and assess these needs, forming precise demand profiles. Relying on resource integration platforms and intelligent matching systems, personalized educational resources, teaching services, and training guidance are provided to different users. Service content and supply methods are continuously optimized based on user feedback and service effects, achieving dynamic adaptation between supply and demand.

2.3 Goal Orientation: Efficiency Improvement Supporting Development

The continuous improvement of operational efficiency is the core goal of smart education public services, ultimately focusing on two key tasks supporting the development of new-quality productive forces: first, improving the quality and fairness of education by narrowing regional and urban-rural educational gaps through the inclusive supply of high-quality resources; second, cultivating innovative talents by enhancing learners' innovative thinking and practical abilities through personalized and innovative educational services, thereby providing talent support for the development of new-quality productive forces. Meanwhile, through the dynamic monitoring and optimization of service efficiency, smart education public services themselves achieve high-quality and sustainable development.

3 Practical Dilemmas in the Operation of Smart Education Public Services from the Perspective of New-Quality Productive Forces

Against the background that new-quality productive forces require systematic and innovative reforms, the current operation of smart education public services still faces deep-seated contradictions, restricting its paradigm shift towards high-quality development. The main dilemmas are reflected in the following five aspects:

3.1 Superficial Technological Empowerment and Insufficient Innovation-Driving Role

Most current technological applications remain at the level of educational resource digitization and process onlineization, failing to further promote the structural transformation of teaching models and educational organizations. The application of key technologies such as artificial intelligence and big data in core links such as precise academic diagnosis, personalized learning path planning, and dynamic evaluation of educational quality is still weak. The integration of technology and education shows an obvious "instrumentalization" tendency, failing to effectively stimulate the innovation and reorganization of all educational factors, which limits the in-depth driving effect of science and technology on educational public services.

3.2 Unsmooth Collaborative Governance Mechanisms and Unformed Multi-Subject Co-Governance Pattern

Smart education public services involve multiple subjects, but an efficient and collaborative governance system has not yet been established. Although the government plays a prominent leading role, the participation of market mechanisms and social forces is insufficient, and there is a lack of effective cooperation and interest-sharing mechanisms among subjects such as enterprises, schools, teachers, and students. Vertical and horizontal divisions between departments and regions are obvious, leading to prominent problems such as data silos, inconsistent standards, and redundant construction. Resource allocation and business collaboration across levels and regions face obstacles. The true voices from the demand side are difficult to effectively feedback to the supply side, resulting in a deviation between service supply and actual needs.

3.3 Deviated Orientation of the Evaluation System and Imperfect Quality Measurement Standards

The existing evaluation system is difficult to reflect the development quality emphasized by new-quality productive forces. The evaluation content focuses on quantifiable indicators such as hardware facilities, resource quantity, and platform visit volume, while paying insufficient attention to qualitative outcomes such as service effectiveness, user satisfaction, improvement of teachers' and students' digital literacy, and cultivation of innovative literacy. The evaluation subjects are still mainly internal to the system, lacking third-party professional evaluation and social supervision, leading to limited credibility and improvement value of evaluation results, which are difficult to guide public services to return to the essence of educating people and innovation goals.

3.4 Insufficient Support of Key Factors and Weak Foundation for Sustainable Development

There are still shortcomings in the allocation of key factors such as talents, data, and funds. The shortage of interdisciplinary talents with both educational understanding and technical capabilities restricts the level of service design and iteration; the educational data asset management mechanism is imperfect, the data sharing, application, and security guarantee system is lacking, and the value of data has not been fully released; investment is mostly concentrated on initial construction, and there is a lack of long-term mechanisms to support continuous operation, content update, and system upgrading. As a result, some projects are difficult to maintain effective operation after completion.

4 Optimization Paths of Smart Education Public Services from the Perspective of New-Quality Productive Forces

4.1 Strengthen Technological Innovation Empowerment and Consolidate the Core Driving Foundation

Based on the core orientation of technological innovation in new-quality productive forces, construct a full-chain technological empowerment system of "R&D - application - iteration." Increase special R&D investment in key technologies such as big data and artificial intelligence in the field of education, establish interdisciplinary research projects, and promote in-depth cooperation between universities, research institutions, and technology enterprises. Focus on developing adaptive applications for core scenarios such as personalized learning push, innovative ability assessment, and intelligent teaching diagnosis. Strengthen the in-depth integration of technology with education and teaching, carry out special training on teachers' information technology application capabilities, build technology application exchange platforms, and guide teachers to integrate intelligent technology into the entire process of teaching design, classroom interaction, and after-class tutoring. Establish a diversified technological innovation incentive mechanism, stimulate the innovation vitality of technology enterprises and educational institutions through special subsidies, tax reductions and exemptions, and pilot demonstration projects, ensure the transformation of technological empowerment from "superficial application" to "in-depth empowerment," and improve the intelligence level of services.

4.2 Improve Multi-Subject Collaborative Mechanisms and Enhance Governance Efficiency

In line with the coordinated development requirements of new-quality productive forces, construct a multi-subject collaborative governance structure with clear powers and responsibilities and efficient linkage. Clarify the power and responsibility boundaries of the government, enterprises, schools, and society: the government focuses on top-level policy design, standard formulation, and supervision and accountability, and guides social capital to participate in service construction through government procurement of services and franchising; enterprises give play to their technological and market advantages to provide professional platform operation and maintenance and resource supply services; schools strengthen their main role in demand feedback and application practice. Build an online-offline integrated collaborative communication platform, establish regular demand docking meetings and collaborative workshops, and ensure that frontline teaching needs are accurately transmitted to the supply side. Improve the collaborative guarantee system, formulate unified service standards and data sharing specifications, establish interest-sharing and risk-sharing mechanisms, break down cross-regional and cross-departmental collaborative barriers, and enhance governance coordination efficiency.

4.3 Optimize the Resource Supply System to Adapt to Innovation Cultivation Needs

Guided by the high-quality development of new-quality productive forces, construct a resource supply system of "high-quality balance and precise adaptation." Optimize the resource structure, focus on the needs of innovative talent cultivation, and increase the development of interdisciplinary integration, project-based inquiry, and scientific research practice resources. Form a resource R&D team composed of university experts, frontline famous teachers, and enterprise technical backbones to improve the professionalism and innovation of resources. Promote the balanced allocation of resources, establish a targeted flow mechanism of high-quality resources to remote areas in the central and western regions and rural areas through policy inclination and financial support, and build remote resource sharing platforms using technologies such as AR to improve resource accessibility in underdeveloped areas. Establish a unified resource standardization system, standardize resource metadata, quality certification, and transmission formats, break down resource barriers between different regions and departments, realize efficient resource integration and reuse, and solve the problems of fragmentation and redundant construction.

4.4 Improve the Evaluation and Guarantee System and Consolidate the Foundation for Sustainable Development

Construct a comprehensive evaluation and guarantee system adapted to the requirements of new-quality productive forces. Establish a multi-dimensional evaluation index system that includes not only explicit indicators such as platform construction and resource quantity but also strengthens the quantitative evaluation of implicit indicators such as service quality, user satisfaction, innovative talent cultivation effectiveness, and technological empowerment efficiency. Innovate the evaluation mechanism by introducing independent third-party professional evaluation institutions, absorbing multiple subjects such as schools, teachers, and students to participate in the evaluation, and establishing an evaluation result disclosure and feedback rectification mechanism to improve the objectivity and credibility of the evaluation. Strengthen guarantee support: establish a long-term financial guarantee mechanism dominated by government investment and supplemented by social capital, focusing on supporting core technology R&D and service upgrading in underdeveloped areas; build a school-enterprise cooperation talent training platform to cultivate interdisciplinary talents with both educational literacy and technical capabilities; improve data security management systems and technical protection systems, standardize data collection, storage, and use, and ensure the sustainable and high-quality operation of services.

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