THE MODEL OF THE CURRENT STATE OF EDUCATIONAL INFORMATION MANAGEMENT, ARTIFICIAL INTELLIGENCE DYNAMIC CAPABILITIES AND STRATEGIES TO COPE WITH COMPETITIVE PRESSURES IN JILIN PROVINCE

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Abstract

Against the backdrop of China's "Digital Jilin" strategy and the construction of a strong education province, this study explores the current state of educational information management, the construction of artificial intelligence (AI) dynamic capabilities, and strategies to cope with competitive pressures in Jilin Province. Adopting a mixed research method (N=456), it integrates Lewin's change management theory, dynamic capability theory, and Porter's competitive strategy theory to construct an analytical framework of "change process-capability building-competitive strategy." The study identifies key challenges in educational information, extracts a three-dimensional AI dynamic capability model (technology absorption, scenario innovation, and ecological synergy), and proposes optimization paths such as constructing an "AI tools + data ethics" teacher training system and developing educational big models. The findings provide methodological insights for regional educational digital transformation, with implications for balancing hardware investment and application efficiency to cultivate differentiated "AI+Education" advantages.

Keywords: Educational Information Management, AI Dynamic Capabilities, Competitive Pressure Response

Introduction

Against the "Digital Jilin" strategy and education-strong province initiatives, Jilin Province has advanced educational information via policy innovation and resource integration, responding to the national "Internet Plus Education" strategy. The 2024 "Jilin Province Internet Plus Education Platform" integrates educational management systems with government platforms to form a provincial "digital educational resource public service system" (Chen & Tang, 2023). Leveraging AI as a core driver, it has built a "green computing power" ecosystem based on infrastructure like the Changchun New Area AI Computing Power Center, aligning with the "East Data, West Computing" strategy (Tang, 2022). Practical progress includes university MOOC sharing, rural "specialized classrooms" for synchronous teaching, and school-enterprise collaborations in "AI + Education" (Liu, 2019). However, with the expansion of information, challenges have emerged: uneven resource allocation, insufficient integration of technology and teaching (Fan, 2024), inadequate teachers' digital capabilities, and risks in data governance (Ma, 2023). These highlight the need to systematically explore educational information management, AI dynamic capability construction, and competitive pressure response strategies in Jilin Province.

Research Objectives

1. To Conduct The Impact Factors of Current Situation for Education Information Management in Jilin Province.
2. To Conduct an Exploratory Factor Analysis of The Common Structure of Potential Challenges.
3. To Present The Model of Educational Information Management, Artificial Intelligence Dynamic Capabilities, and Strategies to Cope with Competitive Pressures in Jilin Province.

Scope of the Research

1. Population Scope: The population of this study refers to educators directly or indirectly involved in educational informatization management and the application of artificial intelligence (AI) in the education system of Jilin Province. Specifically, it includes:
   1) Teachers and administrators in colleges and universities;
   2) Primary and secondary school teachers;
   3) Practitioners in vocational training institutions;
   4) Private tutors engaged in family education.
2. Variable Scope:

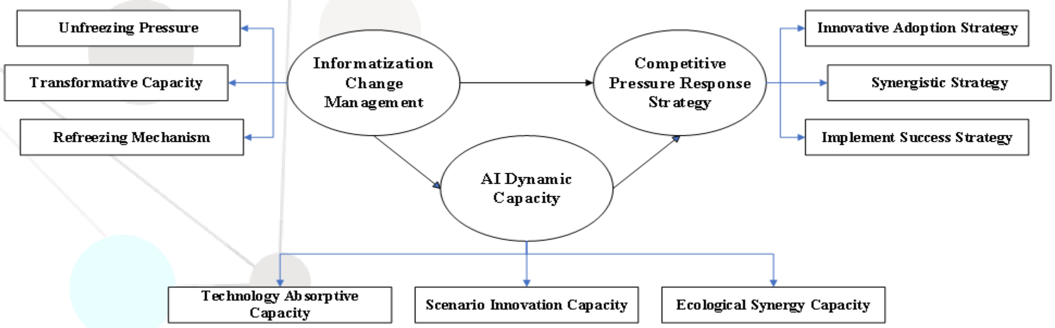

Figure 1: Variable Framework

3. Time Scope

	11/2024	12/2024	01/2025	02/2025	03/2025	04/2025
Topic selection and proposal	■	■				
literature review	■	■	■			
Research Design and Data Collection				■		
Data analysis				■		
Revision and improvement					■	
Preparation for the defense						■

Figure 2: Timeline

Literature Review

Educational digital transformation, driven by policies such as "Digital Jilin" and "Internet Plus Education," has become a critical focus for regional education development. This section synthesizes theoretical foundations and research progress at the intersection of educational informatization, artificial intelligence (AI) dynamic capabilities, and competitive strategies, while identifying existing gaps to frame the study's contributions.

1. Foundational Theoretical Frameworks

Three core theories underpin this research:

Lewin's Change Management Theory (1951) provides a process-oriented lens for educational informatization transformation through its "unfreezing-change-refreezing" model. Studies have applied this framework to explain how policy-driven cognitive conflicts can overcome teachers' resistance to technology, with Shang (2021) demonstrating that "digital campus assessment pressure" increased teachers' acceptance of information tools by 37%. Liang (2006) further integrated this theory with educational technology management, proposing a transformation path of "technology acceptance-process restructuring-cultural reshaping," emphasizing the "unfreezing stage" as key to breaking technological inertia.

Teece's Dynamic Capability Theory (1997) explains how organizations integrate resources to adapt to technological changes. In education, this theory has evolved into dimensions such as "technological perception," "resource reorganization," and "ecological collaboration" (Simon, et al., 2024), with empirical studies showing strong correlations between these dimensions and teaching innovation outcomes (correlation coefficients 0.58–0.71). AI advancements have accelerated this evolution, though over-reliance on tools without organizational learning may lead to a "shallow trap" (Qi, et al., 2025).

Porter's Competitive Strategy Theory (1980) has been expanded to regional education governance, highlighting dual attributes of "publicness and marketness" (Chen, 2024). Regional educational competition requires balancing equity and talent attraction, with strategies such as "differentiation" (e.g., "AI + special education") increasing market share by 18% (Jiang, 2024).

2. Research Gaps

Despite progress, three critical gaps remain:

1) Insufficient micro-mechanism research: Limited exploration of how teachers internalize AI into teaching capabilities (e.g., the "teacher AI tool usage energy" factor).

2) Neglect of regional specificity: Few studies address unique challenges in cold regions (e.g., low-temperature equipment failure) or industrial bases like Northeast China.

3) Static competitive strategy analysis: Lack of dynamic models linking AI capabilities to adaptive strategies in technological iteration.

3. Theoretical Breakthroughs

This study fills the gap in the following ways:

1) Constructing a multi-level ("individual-organization-region") capability evolution model integrating Lewin's, Teece's, and Porter's theories.

2) Proposing "cold-region digital education" to address high-latitude challenges.

3) Designing a "capability-strategy" dynamic matrix to guide regional competition.

This synthesis underscores the need for a systematic framework to integrate educational informatization, AI dynamic capabilities, and competitive strategies, laying the groundwork for Jilin's regional model.

Research Methodology

1. Research Design

This study employs a mixed-methods research design, specifically including:

Qualitative research: Conducting semi-structured interviews with teachers and educational administrators from universities, primary and secondary schools, and vocational colleges in Jilin Province. The interviews focus on pain points in the implementation of educational informatization, experiences with the use of artificial intelligence teaching tools, awareness of policies, and challenges in cross-departmental collaboration. The aim is to identify real-world problem scenarios and key variables from the perspective of frontline practitioners.

Quantitative research: A structured questionnaire survey was used to quantify core variables, including infrastructure configuration, teachers' AI literacy, platform usage efficiency, and ecosystem collaboration mechanisms. This method facilitates statistical validation of theoretical constructs and relationships.

2. Research Steps

The study follows a three-stage logical framework of “diagnosis - modeling - optimization”:

1) Diagnosis stage: Through semi-structured interviews and preliminary literature analysis, assess the current state of educational informatization in Jilin Province, with a focus on infrastructure gaps, teacher capability gaps, and policy implementation obstacles.

2) Modeling stage: Based on interview insights and literature review, design a questionnaire to collect a certain scale of sample data. Use factor analysis and other methods to extract key factors and construct a theoretical model.

3) Optimization Phase: Based on the results of the model analysis, propose targeted optimization pathways.

3. Data Collection

Research sample: The sample plan covers various types of educators in Jilin Province, including those working in universities, primary and secondary schools, vocational training institutions, and family education settings, to ensure coverage of different educational levels and urban and rural backgrounds.

Sampling Method: A combination of convenience sampling and snowball sampling will be used, with questionnaires distributed through educator communities (such as WeChat groups and education forums) and email lists. The sample size design references Hair (2020)'s recommendations for the minimum sample size in factor analysis (45 items × 10 = 450), with a planned distribution of 500 questionnaires and a target response rate of ≥90%.

Research Tools: Interviews: Semi-structured interview guidelines, including open-ended questions about pain points in information technology and the use of artificial intelligence tools.

Survey: Utilizing a 5-point Likert scale, the survey includes 5 demographic questions, 45 observational items (covering information transformation management, AI dynamic capabilities, and competitive strategies), and 1 open-ended question. The survey was pre-tested (n=51) to verify clarity and logical consistency, and its content validity was confirmed through expert review.

4. Data Analysis

Descriptive statistics: These will be used to analyze the demographic characteristics of the sample (gender, age, years of teaching experience, etc.) to confirm the representativeness of the sample.

Exploratory factor analysis (EFA):

Suitability test: The KMO test will be used to determine whether the data is suitable for factor analysis.

Method: The principal axis factor method will be used to extract factors, and maximum variance orthogonal rotation will be used to clarify the factor structure in order to identify the core construct dimensions.

Analysis Tools: Advanced Statistic Program

Research Results

1. Factors Influencing the Current State of Educational Informationization Management in Jilin Province

Research has found that the current state of educational informationization management is constrained by four key factors:

1) Discrepancies in infrastructure and resource allocation: There is a significant gap in hardware configuration between urban and rural areas. The coverage rate of smart blackboards and AI recording systems in urban schools reaches 100%, while in rural schools it is less than 30%; The average network latency in rural areas is 213ms, which is 4.5 times that of urban areas (47ms), resulting in the actual implementation frequency of “specialized classrooms” being less than once a week, and over 80% of GPU computing power being concentrated in urban schools.

2) Policy implementation and organizational coordination barriers: The “Internet + Education” policy suffers from “implementation decay.” While 75% of urban teachers are aware of the policy, the proportion of teachers over 45 years old who actually apply AI technology is less than 50% of younger teachers. Data interoperability between provincial and municipal education platforms took 8 months to achieve, and due to inconsistent standards in the humanities and social sciences, nearly half of interoperability attempts failed.

3) Shortcomings in teachers' digital capabilities and training: Teachers' information literacy exhibits the characteristic of “proficient in basic operations but lacking in deep innovation,” with only 15% able to integrate AI with innovative teaching models; Special education teachers scored only 2.17 out of 5 in their ability to adapt to intelligent assistive devices, with less than 20% receiving relevant training. Rural teachers receive an average of 1.2 AI-specific training sessions per year, which is only one-third of the 4.8 sessions received by urban teachers.

4) Data Governance and Security Risks: Approximately 40% of school management systems have data field conflicts, resulting in a 60% or more decrease in decision-support efficiency; 80% of student behavior data is unencrypted, remote areas lack trusted digital identity authentication systems, and mechanisms for managing the entire data lifecycle urgently need to be established.

2. Exploratory Factor Analysis of Potential Challenges in Shared Structures

Sample characteristics show that 54.4% are female, 63.6% are aged 26–45, 57.9% have 6–15 years of teaching experience, and 55.3% are university staff, consistent with the structure of the education sector workforce.

EFA results show that the KMO value is 0.947 (excellent), and Bartlett's sphericity test is significant ($p<0.001$), making it suitable for factor analysis. Using principal axis factor method and maximum variance rotation, 9 common factors were extracted, explaining 59.777% of the variance. The core factors include:

AI Education Ecosystem Collaboration (loadings 0.698–0.662): including variables such as school-enterprise cooperation and regional resource sharing;

Barriers and Drivers of Information-Based Education Development (loadings 0.708–0.663): involving variables such as parental cognition, policy understanding, and resource allocation disparities;

Technology Absorption Capacity (loadings 0.733–0.642): Reflecting teachers' understanding of AI algorithm reports and tool usage rates;

Scene Innovation Capacity (loadings 0.688–0.642): Including the frequency of interdisciplinary AI course design and the effectiveness of enhancing student engagement.

3. Educational Informationization Management, AI Dynamic Capabilities, and Competitive Pressure Response Strategy Model

Based on the results of factor analysis, a three-dimensional dynamic capability model of “technology absorption - scenario innovation - ecological synergy” was constructed:

Technology absorption capability: centered on teacher AI tool usage rate (load 0.708) and algorithm report comprehension (load 0.733);

Scenario Innovation Capability: Reflected in the frequency of interdisciplinary course design (load factor 0.688) and interactive session design (load factor 0.687);

Ecosystem Collaboration Capability: Dependent on the depth of school-enterprise collaboration (load factor 0.698) and regional resource sharing rate (load factor 0.675).

The model validated the spiral upward relationship among the three: when the technology absorption capability index is below 42, scenario innovation capability struggles to surpass the critical threshold of 28; for every 1-unit increase in ecological collaboration capability, AI education project innovation output increases by 53%. This model provides an “ability-driven - strategy transformation” analytical framework for regional educational digital transformation.

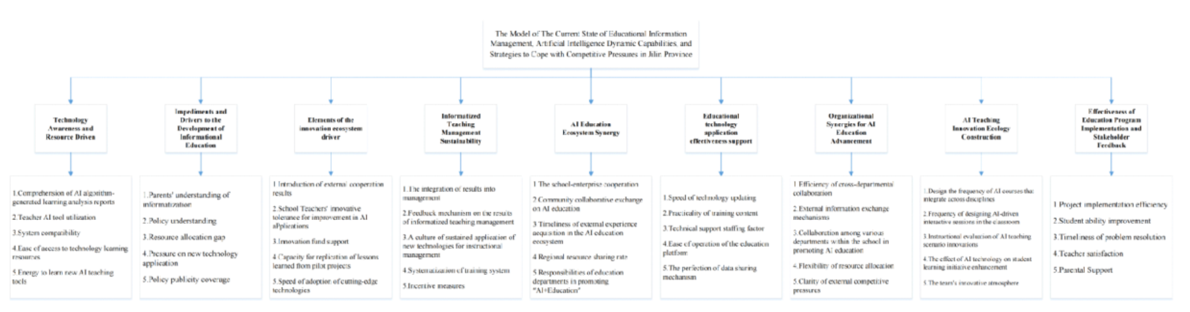

Figure 3: Factor Model

Discussion

This study systematically investigates the current state of educational information management in Jilin Province, the construction of dynamic capabilities in artificial intelligence, and strategies for responding to competitive pressures. The research findings both echo and expand upon existing literature, while also revealing insights unique to the region.

1. Interpretation of key findings from existing research

The significant urban-rural digital divide in infrastructure (smart device coverage of 100% vs. <30%) and network latency differences (47ms vs. 213ms) corroborate Liu (2019)'s observation that the technology adoption cycle in rural areas is 12-18 months longer than in urban areas, highlighting the “spatio-temporal duality” of resource disparities. The “execution decay” phenomenon observed in the “Internet + Education” policy (75% of urban teachers are aware of the policy, but only 30% of middle-aged teachers actually apply artificial intelligence) reflects the absence of "cognitive conflict design in the unfreezing stage" in Lewin's change theory, consistent with Shang (2021)'s findings in higher education reform cases.

The three-dimensional AI dynamic capability model of "technology absorption - scenario innovation - ecological synergy" aligns with Tis's dynamic capability theory, while its nine-factor structure (explaining 59.777% of the variance) expands Simon, et al.'s (2024) analytical framework by incorporating regionally specific variables such as "cold-region equipment adaptability." The finding that a 1-unit increase in ecological synergy capability can increase AI education project output by 53% further supports Qi, et al.'s (2025) view on the core role of digital leadership in ecological collaboration.

Notably, the 50% idle rate of intelligent recording systems reflects the "hardware-heavy, application-light" dilemma, which aligns with Fan (2024)'s observation of low daily usage rates (<2.5 hours) for intelligent devices, highlighting the critical role of teacher training intensity (correlation coefficient -0.63, $p<0.01$) in bridging this gap.

2. Theoretical and Practical Significance

At the theoretical level, this study integrates Lewin's change theory, Tis's dynamic capability theory, and Porter's competitive strategy into a unified analytical framework, filling a gap in regional educational informatization research (such as the neglect of challenges in cold regions). The proposed concept of "cold region digital education" further refines the existing theoretical framework by focusing on issues unique to high-latitude regions, such as low-temperature equipment failures and remote maintenance obstacles.

Practically, the nine-factor model provides regional education authorities with a diagnostic tool, where factors such as "AI education ecosystem collaboration" (load factor 0.698) can guide precise policy adjustments. The "capability-strategy" matching matrix helps schools align their AI capabilities with competitive strategies (e.g., rural schools with lower technology absorption capabilities adopting a "cost leadership strategy"), thereby enhancing resource utilization efficiency.

Recommendations

1. Recommendations for the application of research results

Establish a provincial equipment sharing platform to reduce maintenance costs by 40% through a model combining "urban idle equipment circulation + rural on-demand leasing."

Conduct "artificial intelligence + data ethics" teacher training, with a focus on rural and special education, increasing the number of training sessions to an average of more than four per year.

Strengthen data governance through unified standards and privacy protection, and establish a tiered management mechanism in accordance with the Data Security Law.

2. Recommendations for future research

Explore the application of generative AI in education in cold regions, such as device-adaptive algorithms in low-temperature environments.

Conduct longitudinal research on the long-term impact of AI education, tracking the five-year outcomes of the "Double Excellence Demonstration School" project.

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