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Original Research Article

Necessity and Factors Affecting the Development of Digital Management Capacity for Principals of High Schools in the Mekong Delta

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Abstract: In the context of widespread digital transformation in education, the digital management capacity of high school principals has become a key factor to ensure effective leadership, improve educational quality and adapt to innovation requirements. This article focuses on analyzing the needs and factors affecting the development of digital management capacity for high school principals in the Mekong Delta region, a region with diverse economic, social and technological infrastructure conditions. Based on a mixed research method, including a survey of 115 principals, vice principals, professional team leaders, and in-depth interviews with 12 managers, the article identifies necessary groups of competencies, such as educational data management, digital platform deployment in teaching and learning, information security, and digital transformation leadership. The research results show that five factors have a significant impact on the capacity development process, including: policy clarity, quality of technology infrastructure, innovation orientation in leadership, professional development opportunities, and coordination between schools and local authorities. From there, the article proposes policy and practical recommendations to build a roadmap for developing digital management capacity for principals, contributing to promoting educational innovation in the digital age in Vietnam.

Keywords: Necessity and Factors, Developing Digital Management Capacity, High School Principals, Mekong Delta.

1. INTRODUCTION

The strong development of digital technology in the 21st century is comprehensively changing the way the global education system is organized, managed and operated. In that context, digital transformation in education is not simply the application of information technology to teaching and learning, but also the process of restructuring the management model, operating and developing the capacity of the teaching staff towards innovation, creativity and adaptation. In Vietnam, especially after the profound impact of the COVID-19 pandemic, digital transformation has been identified as an inevitable and urgent trend. Decision No. 131/QD-TTg dated January 25, 2022 approving the National Digital Transformation Program to 2025, with a vision to 2030 in the education sector, emphasized the role of the education management team, especially principals, in leading the transformation and innovation process.

In this context, digital management capacity becomes a strategic requirement for the team of principals, who play a key role in designing visions, implementing innovation policies, allocating resources and creating momentum for change in schools. Digital management capacity does not stop at using information technology proficiently, but also includes comprehensive capacities such as: systems thinking, data-based decision making, digital knowledge management, information security, digital communication and leadership capacity in the digital technology environment. High school principals, as managers and pedagogical leaders, need to be fully equipped with these capacities to be able to effectively perform their roles in the new context.

However, in practice in Vietnam, especially in the Mekong Delta region, developing digital management capacity for high school principals is facing many challenges. This region, with 13 provinces, is a unique geographical area with diverse socio-economic conditions, technical infrastructure conditions and technology application levels among localities.

The differences in the level of access to technology, quality of human resources and policy orientation in each locality create gaps in the digital capacity of the education management team. Many principals are not yet equipped with formal knowledge of digital management, lack specialized training programs suitable for regional practices, and lack support from the policy system and technical infrastructure.

Worldwide, many studies have affirmed the central role of principals in school digital transformation (Anderson & Dexter, 2020; Hallinger & Wang, 2021). Capabilities such as analyzing learning data, designing technology development strategies, organizing digital learning for teachers, and leading innovation teams are core indicators for assessing digital management capacity. In countries such as Singapore, Korea, and Finland, this competency is integrated into the national competency framework for principals and is periodically assessed. However, in Vietnam, current principal competency frameworks such as Circular No. 14/2018/TT-BGDDT still do not fully reflect the requirements of digital transformation, especially in areas with difficult socio-economic conditions such as the Mekong Delta.

From that reality, it is urgent to study the actual needs and factors affecting the development of digital governance capacity for principals of high schools in the Mekong Delta. Correctly identifying training needs, accurately assessing the level of readiness, and analyzing influencing factors (such as policies, infrastructure, organizational culture, professional support, etc.) will create a scientific premise for proposing solutions to develop digital governance capacity systematically and following the local context.

With that goal, this article is conducted to clarify three basic issues: (i) What is the current need for developing digital governance capacity of high school principals in the Mekong Delta region? (ii) What factors are affecting the process of developing this capacity? (iii) How can we build a suitable and feasible roadmap to improve digital governance capacity for principals in this region?

To answer the above questions, the research team used a mixed-methods approach, combining a quantitative survey of 115 principals and vice principals in the Mekong Delta provinces with in-depth interviews with 12 educational managers with experience in implementing digital transformation at the grassroots level. Quantitative analysis aimed to identify priority needs and the level of influence of influencing factors, while qualitative analysis helped clarify the contexts, barriers and implementation practices at the grassroots level. The research results will contribute to building a theoretical and practical basis for developing digital management capacity for principals, a capacity considered a pillar of educational innovation in the digital age. At the same time, the article also provides policy recommendations and proposes models to support training and capacity development based on the characteristics of the Mekong Delta region, to contribute to realizing the goal of digital transformation in the education sector according to the strategic orientation of the Government and the Ministry of Education and Training for the period 2021-2030.

2. LITERATURE REVIEW

2.1. International Studies on Digital Governance Capacity of Principals

In the context of globalization and rapid digital transformation, digital governance capacity is increasingly recognized as a crucial factor in modernizing school management. In the world, many research works have emphasized the importance of this capacity for the leadership role of principals in orienting, organizing and implementing technology-based educational strategies (Dexter, 2011; Anderson & Dexter, 2020; Schrum & Levin, 2015).

According to Dexter (2011), digital management competencies include aspects such as the ability to use information and communication technology (ICT), make data-based decisions, design digital learning environments, and organize teaching staff in a technological context. Research by Schrum and Levin (2015) also shows that principals with high digital leadership competencies are often able to create a culture of innovation in schools, thereby promoting more effective digital transformation. At the policy level, many countries have integrated digital competencies into the principal competency framework. In Finland, the principal competency development program for the period 2016–2025 (Finnish National Agency for Education, 2017) requires principals to be proficient in exploiting student data, using digital tools in management, and developing teachers' professional skills. In Singapore, the “ICT-Enabled Leadership” model has been implemented as a core criterion for evaluating and training principals since 2018, emphasizing the use of big data, AI technology and blended learning models in educational administration (Tan & Goh, 2020).

Similarly, studies in the United States (Anderson & Dexter, 2020) also show that schools with principals who have a deep understanding of technology often achieve higher results in implementing digital learning programs and achieve high levels of satisfaction from teachers and students. Leadership through technology, e-leadership, is becoming an essential component in the modern educational context.

However, studies also point out common challenges in developing digital governance capacity, including: gaps between policy and practice, lack of appropriate training programs, and differences in technological capacity between

regions and management subjects (OECD, 2021; UNESCO, 2022). This is especially true in developing countries where technological infrastructure and organizational culture are still limited.

2.2. Domestic Studies Related to Digital Governance Capacity

In Vietnam, digital governance capacity has only been discussed more since 2020, associated with the trend of digital transformation of education launched by the Ministry of Education and Training. Some initial studies have mentioned digital capacity in education management, mainly in terms of applying information technology in school management and professional development (Hung, 2021; Hoa, 2022; Duchiep, *et al*., 2022).

According to Nguyen Van Hung (2021), the digital management capacity of principals is an integration of technology skills, data analysis capacity and digital communication capacity. A survey of 150 principals in the Northern provinces shows that most principals still tend to have basic IT application skills, while complex capacities such as data-based decision making or designing digital learning ecosystems are still weak.

Tran Thi Hoa (2022) approaches from the perspective of developing the teaching staff, arguing that the digital transformation leadership capacity of principals is a key factor in motivating teachers to innovate teaching methods. However, this study mainly focuses on schools in urban areas, not fully reflecting the diverse regional context.

Another approach is demonstrated through the research of the group of authors Tran Minh Duc and Le Thi Mai (2023), which built a digital management capacity framework consisting of 5 groups: (1) awareness of digital transformation, (2) capacity for digital planning, (3) infrastructure and data management, (4) digital learning management, and (5) team development in the digital environment. This capacity framework was tested in a number of high schools in Ho Chi Minh City and gave positive results. However, when applied to areas with difficult conditions such as the Mekong Delta, this framework needs to be adjusted to suit the economic, social and technical infrastructure conditions on site.

In addition, a number of thematic reports of the Ministry of Education and Training, especially the summary reports of the Digital Transformation program for the period 2021-2023, have pointed out clear differences in the digital management capacity of principals between regions. The provinces in the Mekong Delta are considered to be areas that lack specialized training programs, do not have a strong digital transformation support ecosystem, and have little coordination between schools and local technology agencies (Ministry of Education and Training, 2023).

2.3. Research Gaps and Approaches of the Article

From the above overview, some gaps in current research can be identified:

There is a lack of in-depth research on the practical needs of principals in developing digital governance capacity in specific local contexts, especially in the Mekong Delta region, where the economy is agricultural, digital infrastructure is limited and technology levels are uneven.

No research has used mixed methods to simultaneously survey quantitative needs and explore qualitative depth about factors affecting the development of principals' digital governance capacity.

The current framework for principals' digital governance capacity in Vietnam is still at a general level, not standardized and tested enough in difficult regional conditions.

Therefore, this paper aims to fill that gap by:

i. Surveying the practical needs and readiness of high school principals in the Mekong Delta in developing digital governance capacity;
ii. Analyzing the factors affecting this process in a systematic way;
iii. Proposing policy orientations and models to support the development of digital governance capacity suitable to regional characteristics.

3. RESEARCH METHODS

3.1. Research Design

The article uses a mixed-methods research method, combining quantitative and qualitative research to gain a comprehensive and in-depth view of the current situation, needs and factors affecting the development of digital governance capacity for the team of principals of high schools (high schools) in the Mekong Delta. The research design is implemented in the following order: quantitative survey first to identify general trends and models, then qualitative research to clarify the causes, context and depth of the quantitative results.

3.2. Quantitative Research Method

Objective:

Analyze the current status of digital management capacity, the level of training needs, and factors affecting the development of digital management capacity of principals and vice principals of high schools in the research area.

Subjects and Sample:

The survey was conducted with 115 principals and vice principals at high schools in 03 provinces and cities in the Mekong Delta region (including Vinh Long province, Can Tho city, Dong Thap province). The sample selection was conducted using the conditional convenience sampling method, ensuring representation of different types of schools (public, semi-public, urban and rural schools).

Survey Tool:

The survey tool is a structured questionnaire, including 5 main groups of questions: Personal information and work position; Self-assessment level of digital management capacity according to capacity groups (data management, digital transformation leadership, digital platform management, etc.); Level of awareness of the importance of digital governance; Need for training, fostering and support for digital governance capacity development; Factors affecting capacity development (policies, technology infrastructure, professional environment, local support, etc.). The questionnaire was designed on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). Before the official survey, the questionnaire was piloted on 15 people to preliminarily test its reliability and clarity.

Data Analysis:

Collected data were processed using SPSS 26.0 software. The analysis methods include: Descriptive statistics (to describe the level of capacity and needs); Cronbach's Alpha reliability analysis for groups of indicators; Exploratory factor analysis (EFA) to determine the latent structure of capacity groups; Multivariate linear regression analysis to determine factors that have a significant impact on the digital management capacity of principals.

3.3. Qualitative Research Methods

Objective:

To clarify the factors affecting the development of digital management capacity from a practical perspective; to exploit the experiences, perceptions and recommendations of educational managers in the specific conditions of the Mekong Delta region.

Interview Subjects:

Conducted 12 in-depth interviews with local educational managers, including: 04 officials from the Department of Education and Training (in charge of high school and information technology); 04 principals with experience in implementing digital transformation at schools; 02 officers from the Provincial Information Technology Center; 02 experts in training educational management staff, coded from CBQL1 to CBQL12. The selection of participants was carried out using the purposeful sampling method, ensuring that the selected people had practical experience and in-depth information on the field of digital management in education.

Data collection and processing techniques: Interviews were conducted according to semi-structured interview guidelines, focusing on the following topics: Assessment of principals' readiness in digital management; Obstacles and challenges in capacity development; the role of local authorities, the Department of Education and Training and schools in supporting digital capacity; Suggestions on appropriate capacity development models. Interviews were recorded (with consent), then transcribed, coded by theme and processed using NVivo 12 software. Content analysis was conducted using thematic analysis to draw out meaningful patterns, concepts and relationships.

4. RESEARCH RESULTS

4.1. Needs for Developing Digital Management Capacity of High School Principals

The survey results shown in Table 1 below show that groups of digital management capacity are being assessed by the principals and vice principals as having high development needs, with an average score of 3.69 to 4.18 on a 5-point Likert scale.

Table 1: Survey results on the need for developing digital management capacity of high school principals in the Mekong Delta region

Order	Survey content	1	2	3	4	5	XTB
1	Ability to use data to make management decisions	2	6	25	43	39	3.97
2	Ability to deploy digital learning platforms	0	2	20	48	45	4.18
3	Understanding of educational digital transformation policies	1	4	28	41	41	4.02
4	Leadership skills in the digital environment	1	5	30	45	34	3.92
5	Ability to ensure information security and data confidentiality	4	10	32	41	28	3.69
6	Ability to organize and train staff through digital platforms	3	7	25	47	33	3.87
7	Ability to develop a school-wide digital transformation plan	0	3	18	55	39	4.13

The survey results in Table 1 show that the capacity to deploy digital learning platforms is rated highest (average score = 4.18). This clearly reflects the practical needs of high schools today in applying technology to teaching and learning after the COVID-19 pandemic. Next are the capacity to understand digital transformation policies in education (4.02) and the capacity to use data for decision making (3.97). These are strategic management capacities that help principals organize effective operations in a digital education environment. Other capacities, such as leadership in a digital environment (3.92) and organizing training through digital platforms (3.85), also show a relatively high level of interest.

Comments and assessments on "The need to develop digital management capacity of high school principals", according to CBQL4, "Current principals still rely mainly on intuition when making management decisions. The application of digital data, such as academic performance, attendance, and parent surveys has not been systematically implemented. Therefore, they really need to be trained in data mining skills for management." This is proof that the ability to analyze and use data is not only technical but also a necessary management mindset in the modern educational environment.

CBQL9 Said:

"We have deployed an LMS (learning management system) but the principal did not fully understand the functions, leading to not fully exploiting the features. If you do not understand the digital platform, you cannot lead the implementation team." This comment shows that the role of leading digital transformation requires the principal to not only manage but also be a "technology companion" with teachers.

4.2. Factors Influencing the Development of Digital Governance Capacity

Based on linear regression analysis and qualitative assessment, five key factors were identified as having a significant impact:

Table 2: Factors influencing the development of digital governance capacity

Order	Factors	Consensus ratio 4-5	TB
1	Clarity of departmental/industry policies	76.5%	4.02
2	Technology infrastructure and network connectivity at school	73.0%	3.95
3	Digital learning environment for teachers	71.3%	3.89
4	Opportunities to participate in digital professional development	69.5%	3.84
5	Cooperation between schools and local authorities	66.1%	3.78

The survey results shown in the table show that there are five main factors influencing the development of digital management capacity of the principals at high schools (high schools) in the Mekong Delta region. The high consensus rate (levels 4 and 5 on the Likert scale) along with the average score above 3.7 shows that the school management team's awareness and assessment of the importance of these factors are quite clear.

First, "Clarity of department/sector-level policies" is the factor with the highest level of influence with a consensus rate of 76.5% and an average score of 4.02. This reflects the actual need for clear direction from local and central education management levels. In the context that many principals have not had full access to guiding documents on digital transformation, the lack of consistency in implementation or the lack of specific guidance from the Department of Education makes it difficult to establish a digital transformation strategy at school.

Second, "Technology infrastructure and network connection at school" is also a factor with great influence (73.0% consensus; average score 3.95). This is especially meaningful for schools in rural areas, where equipment, transmission lines and digital learning conditions are limited. A principal, even with good awareness and full training, will still face obstacles if the school lacks servers, weak networks or lacks technical support personnel.

Third, "Teachers' digital learning environment" has a score of 3.89, showing that the interaction between teachers' and principals' digital capabilities is very large. If the teaching staff is not ready to adopt technology or lacks basic digital skills, it will be difficult for the principal to play the role of digital transformation leader. Therefore, the principal's capacity depends not only on themselves but also on the readiness of the school staff.

Fourth, "Opportunities to participate in digital professional training" was assessed with an average score of 3.84. This result reflects the fact that principals still lack the opportunity to access specialized training programs on digital management. Current training courses are mostly scattered, formal, or do not focus on technology management skills - a core component in digital transformation.

Finally, "Cooperation between schools and local authorities" with the lowest average score (3.78) but still achieved a high consensus rate (66.1%) shows that the role of local support is still unclear. Developing digital capacity

cannot be the sole responsibility of the education sector but requires coordination from departments, branches of technology, finance, information and communication, etc. The lack of multi-sectoral linkage will slow down the development process or fall into formality.

Overall, this survey shows that to develop digital management capacity effectively and sustainably, there needs to be a synchronous combination of policies, infrastructure conditions, pedagogical environment, training programs and institutional coordination. These factors not only create conditions for principals to access and apply digital technology, but also form an environment for practice and capacity development in actual school management.

Commenting on "Factors affecting the development of digital management capacity" according to CBQL1, "Digital transformation cannot be just a general directive from the top down. There needs to be clear policies and specific instructions from the Department of Education and Training for principals to feel secure in implementing." Thus, orientation policy is a prerequisite for creating changes in administrative behavior.

CBQL7 emphasized: "Many schools in remote areas still lack computers and have weak networks. There are schools where principals want to implement online learning, but the equipment does not allow it. There is a need to synchronize infrastructure and training." This comment shows that the technology infrastructure factor is an essential material condition, directly affecting the implementation capacity of the principal.

4.3. Directions for Building a Roadmap to Improve Digital Management Capacity

From the survey results and qualitative analysis, the research team proposed a roadmap to develop digital management capacity in 3 stages:

Table 3: Directions for building a roadmap to improve digital management capacity

Order	Phase	Objectives	Main content	Unit in charge of the proposal
1	Cognitive consolidation (0–6 months)	Improve understanding of digital governance policies and roles	Policy training, experience sharing workshops	Department of Education and Training in coordination with pedagogical universities
2	Intensive training (6–18 months)	Develop skills in data governance, digital learning system management, and information security	Modular courses (face-to-face and online) combined with mentoring	Ministry of Education and Training places orders for specialized training
3	Support for practical implementation (18–36 months)	Apply to digital transformation plans at schools	Designing "School Digital Transformation Projects" by local groups	Local authorities and Department of Education and Training provide financial support and supervision

The table presents a roadmap for developing digital governance capacity for high school principals in the Mekong Delta in three successive phases: strengthening awareness, intensive training, and supporting practical implementation. Each phase clearly identifies its objectives, key content, and implementing unit, demonstrating a systematic and feasible approach that is appropriate to the specific context of the region.

Phase 1:

Strengthening awareness (0–6 months): The goal of this phase is to improve the understanding of the team of principals about the role and policies of digital transformation in education. This is a strategic first step, helping principals correctly approach the views and policies of the State and the Ministry of Education and Training on the role of digital governance in modern school management. Implementation content includes policy training and organizing workshops to share practical experiences between schools. This activity not only helps to identify the importance of digital capacity but also creates initial consensus in the local education system. The leading role belongs to the Department of Education and Training, in coordination with pedagogical universities - units with sufficient professional capacity and experience in training management staff.

Phase 2:

Intensive training (6-18 months): This is the key phase in the roadmap, aiming to train practical digital management skills such as: data management, operating online learning systems, ensuring information security and deploying digital tools in school management. The highlight in this phase is the flexible and in-depth training organization, combining online and direct training modules and mentoring and accompanying consulting. This approach is suitable for

the reality of schools, helping principals learn according to their needs and receive support in the process of transforming knowledge into practice. The lead unit in this phase is identified as the Ministry of Education and Training, through the mechanism of "ordering" training programs from prestigious schools and specialized institutes.

Phase 3:

Support for practical implementation (18–36 months): The goal of the final phase is to apply the trained capacity to actual school management, through the implementation of "school-level digital transformation projects" jointly developed and implemented by groups of principals at the local level. This is a step from learning to action, contributing to turning training content into measurable changes at schools. The participation of local authorities and the Department of Education and Training in the role of funding, monitoring and technical support is a key condition to ensure success. This phase is also an opportunity to re-evaluate the effectiveness of the program, adjust training content and spread good models in the region.

Overall, this three-phase roadmap shows a systematic and practical approach, ensuring that the development of digital management capacity does not stop at awareness or skills, but is practiced and institutionalized in each school. At the same time, the clear division of roles between the Ministry, Department, local authorities and training institutions will create an ecosystem to support educational management capacity in the digital age, contributing significantly to the process of educational innovation in the Mekong Delta region.

Assessing the above issues, according to CBQL12, it is proposed: "It is necessary to build a regional group learning model, where principals can exchange and learn from each other, avoiding a single and passive individual approach." Thus, learning, support between principals and support by school clusters are effective approaches in the context of limited resources and experts.

5. DISCUSSION

The research results have provided a fairly comprehensive picture of the needs and factors affecting the development of digital management capacity of the team of principals of high schools (high schools) in the Mekong Delta region. From the perspective of analysis and comparison with domestic and foreign studies, it is possible to draw some important conclusions that are valuable in both theory and practice.

First, in terms of needs, the survey results show that the team of principals in this region clearly shows the urgent awareness of developing digital management capacity. Competencies such as implementing digital learning platforms, making data-based decisions, understanding digital transformation policies, leading teams in the digital environment and organizing online training activities are all assessed at a level from good to very high (average scores from 3.69 to 4.18). This reflects a positive shift in the management thinking of principals, from traditional management to a digital approach. Compared to studies by Anderson & Dexter (2020) or Schrum & Levin (2015) in the United States, it can be seen that the need to develop digital capacity is a global trend, but in the context of Vietnam, especially the Mekong Delta region, this need is still limited by actual conditions and uneven support policies.

Second, the study identified five key factors that have a clear impact on the development of principals' digital governance capacity: (i) clarity of departmental/industry-level policies; (ii) school-based technology infrastructure; (iii) teacher readiness; (iv) digital professional development opportunities; and (v) collaboration with local authorities. These factors are not only consistent with local survey practices but also similar to previous research findings by OECD (2021) and UNESCO (2022), which emphasize the central role of policies, technical conditions, and organizational culture in the digital transformation of education. However, it is worth noting that the role of local authorities and cross-sectoral support in the Mekong Delta region has not yet been demonstrated. Although it is considered an influential factor, the lowest average score (3.78) shows that this coordination is still formal, lacking depth and has not created a real companionship mechanism between schools and the community.

Third, the three-phase roadmap model proposed by the study, including the phase of strengthening awareness, intensive training and practical implementation support, is a systematic approach, consistent with the model of leadership capacity development in the digital environment applied in advanced countries. Designing a roadmap over time, with clear goals and leading units, allows educational institutions to plan specific actions, avoiding the situation of scattered and ineffective training (Van, 2022). At the same time, this approach emphasizes learning through practice, with the principal at the center of the transformation process, not just a passive recipient of instructions (Thuyhang, 2020). This approach is also similar to the "Distributed Leadership" model, which is being effectively implemented in Singapore, where digital leadership capacity is developed through collaborative learning, mentoring and school projects.

Fourth, when compared with domestic studies, it can be seen that the results of this topic have expanded and deepened previous findings. While some studies such as Nguyen Van Hung (2021) or Tran Thi Hoa (2022) only stopped

at describing capacity or proposing a theoretical framework, this study has gone a step further by clearly analyzing practical needs, measuring with specific survey tools and integrating qualitative comments from experienced education managers. This is a remarkable strength in terms of methodology, and at the same time contributes to overcoming the research gap on digital governance in the local educational context.

Finally, the research results also show that developing digital management capacity cannot be separated from the national digital transformation strategy for education. If only focusing on technical training for principals without support mechanisms from local institutions, policies and resources, training programs will hardly bring sustainable impacts. Therefore, developing digital management capacity should be considered a mandatory component in the strategy to improve the quality of education management teams in provinces and cities in the region, especially in the period 2025–2030, when digital transformation of education enters the acceleration and expansion phase.

6. CONCLUSION

The research has shown that in the context of widespread digital transformation of education in Vietnam, especially in the Mekong Delta region, where there are many inequalities in infrastructure and educational conditions, developing digital management capacity for high school principals is a strategic requirement. The survey results show that the need to develop capacities such as using data in management, implementing digital learning systems, understanding policies and information security is very high, reflecting the proactive approach to digital transformation of the school management team. The study also identified five factors that mainly influence the development of this capacity, including: policy clarity, technology infrastructure, pedagogical environment, professional development opportunities, and support from local authorities. On that basis, the authors propose a three-phase roadmap to develop digital management capacity in a systematic, sustainable and practical manner. The most important conclusion is that developing digital management capacity should be considered a pillar in the education modernization strategy, and must be integrated into human resource management policies, principal training, as well as in investment in local education development in the digital age.

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