CHAPTER I

INTRODUCTION

This chapter presents the background of the study, the problem statement, the research questions, the objectives of the study, the scope of the study, the significance of the study, and the novelty of the study, as well as a definition of the important terminology involved in this study, including the definitions of the main conceptual and operational variables involved in this study.

1.1 Research Background

This section aims to provide an overview of the national policy orientation for educational digital transformation, the theoretical framework and current state of research on educational digital transformation, the current status of digital transformation in basic education, and the gaps between the ideal and reality of digital transformation. This will fully elucidate the background of this study and demonstrate its necessity and value. The digital transformation of education is both a response to the demands of the times and the implementation of policy. On the one hand, the rapid development of information technology and policy calls for the integration of technology and education to enhance educational quality and scale up the cultivation of new-era talent. On the other hand, the implementation of digital education transformation has yielded unsatisfactory results and low success rates. In this context, identifying effective methodologies for digital transformation implementation indeed holds both contemporary necessity and significance.

The digital transformation of education is the result of the demands of the times and the implementation of policies(Ministry of Education of the People's Republic of China, 2018; OECD, 2021). On the one hand, the rapid development of digital technologies such as LLM, AI, IoT, and cloud computing has propelled the field of

education into the digital age, these technologies are increasingly integrated into educational systems worldwide, driving profound changes in teaching and learning methods（OECD, 2021；UNESCO, 2019）. For instance, AI is being used to personalize learning experiences, while cloud computing enables access to vast educational resources online. As an important strategy for improving the quality of education globally and promoting the sustainable development of education, the digitization of education has become a major trend in the future transformation of education.

On the other hand, from a policy perspective, the concept of 'high-quality education' has been gradually clarified and widely emphasized in China's education policy in recent years, and has become the State's strategic goal and strategic plan for the reform and development of the education system(Central Committee of the Communist Party of China & State Council, 2025; Yu et al., 2025). The specific timeline of its introduction and development can be traced as follows: At the Fifth Plenary Session of the 19th CPC Central Committee (Central Committee of the Communist Party of China, 2020), the Central Committee of the Communist Party of China (CPC) for the first time explicitly put forward the policy orientation and key requirements of 'building a high-quality education system', which marks that a high-quality education system has become one of the core objectives of the country's education development. In the 14th Five-Year Plan (Central Committee of the Communist Party of China, 2021), the importance of building a high-quality education system was further emphasised, proposing the comprehensive implementation of the Party's education policy, adhering to the principle of establishing a moral character, optimising the structure of education, and fostering socialist builders and successors who are all-rounded in terms of morality, intelligence, physical fitness and aesthetics,

and in 2024, the government's work report explicitly proposed that the Government would Strengthen the construction of a high-quality education system, fully implement the Party's education policy, and insist on high-quality development as the lifeline of education at all levels and in all categories. 2025, the CPC Central Committee and the State Council issued the Outline of the Plan for the Construction of a Stronger Education Nation (from 2024 to 2035), which explicitly proposed accelerating the construction of a high-quality education system, and promoting the transformation of education from scale expansion to high-quality development.

The core objective of a high-quality education system is to provide solid support for high-quality human resources and innovative intellectual support for the modernization of the country by optimizing the structure of education, upgrading the quality of education and promoting equity in education(CPC Central Committee & State Council, 2026). In recent years, with the continuous promotion of national policies, high-quality education system has become the core direction of education development.

How to optimize the education structure, improve the efficiency and quality of education, cultivate innovative talents that meet the needs of future development, and achieve the construction of a high-quality education system? With the rapid development of new-generation information technology such as 5G, LLM, AI, Cloud computing and so on, the digital transformation of education has undoubtedly become a powerful tool and a necessary path for educational change. SAGE Journals (2025) points out that digital transformation not only changes business models, but also has far-reaching impacts on society and the education system, especially in improving the quality of education. Zhu (2022) then argues that the digital transformation of education is a necessary way for education to respond to the changing times and realities. This is because without the support of modern information technology, it is difficult for

education to achieve large-scale equity, personalization and high efficiency, openness and sharing of high-quality resources, and it is impossible to achieve truly high quality in education. At the same time, the mastery and use of digital technology is also a demand for professionalism that must be met in order to train future talents. For example, the European Union attaches great importance to the digitization of education. As early as 2006, it identified digital competence as one of the key competencies for lifelong learning, and has since formulated digital competence frameworks for different target groups.

For the digital transformation of education, China has also issued a series of policy documents to explain the value and significance of the digital transformation of education for the construction of a high-quality education system, and at the same time vigorously promotes the digital transformation of education. The Ministry of Education issued the Education Informatization 2.0 Action Plan in 2018, emphasizing the important role of digital technology in improving the quality of education and promoting educational equity. It is considered that education informatization is an endogenous variable of systemic change in education, it supports and leads the development of education modernization, and promotes the updating of education concepts and model change and system reconstruction, which is an effective way to accelerate the realization of education modernization(The Ministry of Education, 2018). The Opinions on Deepening the Reform of Education Teaching and Learning and Comprehensively Improving the Quality of Compulsory Education (CPC Central Committee & State Council, 2019) clearly put forward the need to optimize the teaching methods and approaches, focus on the integration and application of traditional and modern technological means, accurately analyse the situation of students, and attach importance to differentiated teaching and individualized instruction. 2021 is the first

year of China's digital transformation of education, in July, the Ministry of Education and six other departments issued the ‘Guiding Opinions on Promoting the Construction of New Educational Infrastructure and Building a High-Quality Educational Support System’, which emphasized that promotion of digital transformation, intelligent upgrading, integration and innovation in education, and support for the high-quality development of education (the Ministry of Education ,2021); in August, the Ministry of Education approved that Shanghai should take on responsibility for the pilot project of the digital transformation of education in the whole country. In October 2022, the report of the 20th Party Congress explicitly proposed that promoting the digitization of education, building a learning society and a learning country with lifelong learning for all people. In May 2023, when presiding over the Fifth Collective Learning Session of the Political Bureau of the CPC Central Committee, President Xi Jinping emphasized that the digitization of education is an important breakthrough for China to open up a new track and shape a new advantage in education development.

The above policies and important discussions have profoundly revealed the important role of education digitisation and pointed out the direction and path for high-quality development of education.

This series of national policies clearly demonstrates China's commitment to integrating digital transformation into its national development strategy. The country believes that this transformation is both inevitable and essential for optimizing the education system, improving quality, and promoting equity(Wang, 2025; CPC Central Committee & State Council, 2025). To this end, China has introduced a series of guidelines and action plans. In response to the call of the times and strong policy guidance, the academic community has also invested unprecedented enthusiasm in this area.

Academics have also conducted research and reached conclusions on the advantages and shortcomings of education models such as ‘integration of information technology and education’ and ‘Internet + education’, as well as on the value and significance of the digital transformation of education for the development of education. Zhu et al. (2023) believe that the core of the digital transformation of education is to build a future education ecosystem with the integration of digital technology, to promote the systematic reconstruction and cultural innovation of all elements, businesses, fields and processes, and to accelerate the achievement of balanced, personalized, lifelong, flexible and open education; and Li (2023) proposes that in order to achieve high-quality development of basic education, digitization is used as a new tool, digitalisation is the main theme of the future classroom. Cui (2020) advocates that new teaching in the digital era should enhance the technological content of teaching tools and learning environments as a whole, increase the interactivity, collaboration and exploratory nature of learning, and retain massive amounts of process data; “differentiated learning” should be implemented as far as possible, and “learning gaps” should be addressed through the implementation of “differentiated learning”, so as to upgrade personalized teaching and cultivate the core qualities required for each student to adapt to the development of society. To sum up, the digital transformation of education is a basic need and a key path to building a high-quality education system, and a high-quality digital education system is also an important element in the construction of a high-quality education system.

From a practical point of view, in today's general environment of digital intelligence, and the attention paid at the national and regional levels, the view of giving full play to the irreplaceable nature of digital transformation of traditional education, opening up a new track of educational development and shaping a new advantage of

educational development has gradually become a consensus (Yuan, 2023), and the in-depth fusion of digital technology and educational elements has become the choice of more and more primary and secondary schools.

The fundamental purpose of educational digital transformation is to serve people, and talent cultivation is the starting point and direction of educational digital transformation practice. To achieve the development of core competencies for students towards the future, it is necessary to reshape the capabilities, structure, and culture of educational organizations, and create a digital education ecosystem that integrates digital technology (Zhu et al., 2022).

According to the latest study by the Institute of Comparative Education of the Chinese Academy of Educational Sciences and the Future Education Committee of the Chinese Society for Educational Development Strategies(2024), the comprehensive index of digital transformation of China's primary and secondary education is 0.45, of which the degree of digital transformation of the core elements mainly consists of the degree of digital transformation of teaching and learning, the degree of digital transformation of evaluation and the degree of digital transformation of management, with indexes of 0.20, 0.34 and 0.25 respectively, the digital transformation of China's elementary schools is at the early stage .Problems such as lack of preparation for transformation strategy, mismatch of technical facilities, unready digital capacity, unscientific construction mode, unremarkable construction effect, and low starting point for teaching and learning creation are prevalent (Zhang et al., 2023).

There are still many urgent problems to be solved in the continuous promotion of digital transformation in fundamental education. For example, there is a lack of communication between digital learning environments, resulting in application silos, system silos, and data silos; Artificial intelligence technology has not yet matured to

the extent that it can deeply intervene in the process and essence of learning. The core scenario teaching mode is single, and the teaching process is simply overlaid with digital tools rather than effectively integrated; The learning device system is incompatible, lacking highly integrated technical systems and standardized device standards and communication interface parameters; It is difficult to grasp the degree of investment and sustainability of technology in education; schools in different regions have uneven resource investment, deep digital divide, and system differences (Xiao & An, 2023). Among the numerous challenges faced by the digital transformation of education, the ability barriers of educational subjects and the identification barriers of educational innovation are particularly prominent. The ability obstacle of educational subjects refers to the insufficient information technology ability and literacy of teachers and students, and difficulties in skill operation (Jun & Xiu, 2023). The study by Li et al. (2022) indicates that the digital teaching ability of teachers needs to be improved, and the implementation of digital teaching practices is facing challenges. Meanwhile, according to the research of Hu et al. (2022), in the absence of digital thinking and data analysis abilities, behavioural data of teachers and students has not been comprehensively collected and applied.

Summarising the conclusions of existing studies, we can clearly know that there are obvious deficiencies in the digital competence and educational innovation literacy of educational subjects, the organic integration of digital tools and the teaching process, and the governance and application management of educational data, etc., and that the road to digital transformation of education has a long way to go, and that a set of effective operational system frameworks and a successful implementation path are of great significance for the digital transformation of educational institutions at all levels. A framework of a proven and operational system and a successful implementation path

are of great significance for the digital transformation of educational institutions at all levels. Existing research focuses on assessment models of digital transformation status, but there are no research results that build a methodology or framework oriented towards successful implementation of digital transformation from the perspective of implementation guidelines. This study attempts to fill this research gap by examining the key factors of success and building a successful implementation path.

Existing studies have conducted theoretical studies or empirical studies on the concept of digital transformation, connotation, elements of digital transformation influence, dilemmas, digital transformation maturity assessment, digital transformation success model, etc. These studies are the solid theoretical foundation of this study, which can provide a theoretical basis for us to find out and optimise the key success factors of digital education transformation. Meanwhile, in digital transformation, the acceptance of the product/technology used by the subject of the product/technology applied, as well as the ease of use of the product/technology, directly affects the effectiveness of the digital transformation, and is an important influencing factor for the success of the digital transformation, therefore, this study will also make full reference to the Technology Acceptance Model (TAM), in order to ensure that the digital transformation can be successfully implemented on the level of the product/technology. In addition, from the perspective of students, who are one of the most important subjects, the construction of personalised and interactive digital learning scenarios is also one of the most important factors to ensure the successful implementation of digital transformation, and this study will also fully refer to the Constructivist Learning Theory (CLT) to emphasise how digital technology can promote personalised learning and knowledge construction.

1.2 Problem Identification

Driven by the global wave of digital transformation in education, digital technology has been widely regarded as a strategic tool for improving educational quality and promoting equitable development. However, despite China's sustained policy efforts to advance the ‘educational informatisation’ and ‘educational digitalisation’ strategies, and significant progress in infrastructure and resource development, the practical outcomes of digital transformation in basic education remain problematic.These issues indicate that the digital transformation of education is not merely a matter of improving and applying technology, but involves complex changes in the education system, governance structure, teaching culture, and implementation pathways (Fullan, 2020; OECD, 2021). Therefore, to achieve the ‘successful implementation’ of digital transformation in basic education, it is imperative to address several key issues at both the practical and theoretical levels.

Disconnection between Policy and Practice

China's digital education strategy is characterised by sound top-level design and clear policy objectives. Since the introduction of the ‘Ten-Year Plan for the Development of Education Informatisation (2011–2020)’, followed by the ‘Education Informatisation 2.0 Action Plan’ (Ministry of Education, 2018) and the ‘Digital Education Strategy Action Plan’ (Ministry of Education, 2022), the central government has continuously emphasised the promotion of educational reform through informatisation and digitalisation.However, from a practical perspective, there is a significant disconnect between policy direction and actual implementation at the school level (Zhang Jianhua, 2021). On the one hand, policy documents emphasise ‘technology-enabled education,’ but in practice, many schools' understanding and

implementation remain stuck at the stage of ‘hardware construction’ and ‘platform launch.’ On the other hand, policy objectives are typically macro-oriented and general in nature. Without a specific action framework, schools often struggle to translate policy objectives into actionable plans. This ‘disconnect between top-down design and grassroots implementation’ has significantly undermined the effectiveness of policy implementation.

Research Orientation Biases and Shortcomings

Existing research on promoting the digital transformation of education also has certain biases and shortcomings. First, many studies focus on the technical conditions or external environment of digital transformation, such as infrastructure, information platform construction, and network environment optimisation (Chen Li, 2021), but pay little attention to key tasks, governance models, and operational paths in the transformation implementation process. Second, some academic findings tend to approach the issue from an evaluation perspective, constructing diverse ‘maturity models’ or ‘effectiveness evaluation systems’ (Kampylis et al., 2019; Xu, 2024). While these studies provide references for measuring transformation outcomes, they lack in-depth exploration of the critical question of ‘how to implement.’ Third, some studies exhibit a ‘fragmented’ characteristic, often focusing on single elements such as teacher capacity building, learner autonomy, or technology adoption willingness, while neglecting the systemic interactions and overall framework among these elements (Ertmer & Ottenbreit-Leftwich, 2010).Therefore, at the theoretical level, research on the digital transformation of education tends to emphasize evaluation over implementation and lacks operational, logically closed implementation studies.

Practical Challenges at the School Level

At the school level, the challenges of the digital transformation of education are more specific and direct. First, urban-rural and regional disparities have led to uneven digital infrastructure, with some rural schools struggling to meet even basic network access and hardware requirements (Liu, 2020). Second, teachers' digital literacy and instructional design capabilities are insufficient, leading to digital technologies remaining largely at the ‘tool-based’ level rather than truly transforming learning methods and teaching approaches (Zhang, 2021). Third, school governance mechanisms and cultural transformation lag behind, lacking cross-departmental collaboration and continuous improvement mechanisms, resulting in digital projects often being short-lived ‘campaigns’ without sustainable mechanisms (Yu , 2023). More critically, many schools lack scientific, systematic, and effective implementation methods and action plans when advancing digital transformation. This results in many schools' digital transformation practices being superficial, with ‘high input but low output,’ and even ‘failed transformation’ due to unclear direction and chaotic processes.

For example, research has found that some regions have rapidly built smart classrooms and education cloud platforms within a short timeframe. However, due to teachers' inability to effectively utilise these technologies and the absence of follow-up management and support mechanisms, these hardware facilities quickly became ‘idle assets’ and failed to have a substantial impact on teaching and learning (Wang, 2023). This phenomenon highlights the severe consequences of lacking actionable pathways and further illustrates that technical conditions and policy drivers alone are insufficient.

The Gap Between Theory and Practice

A review of international experiences and domestic practices reveals a significant gap between theoretical research and practical needs. Internationally, frameworks such as the EU SELFIE tool, the UK Digital Maturity Model, and the US K-12 DTRMA

have accumulated relatively mature experience in the division of transformation stages and effectiveness evaluation (Jisc, 2019; CoSN, 2020), these models are primarily aimed at macro-level education systems and lack specific guidance on implementation pathways at the primary and secondary school level. Domestic research has made some progress in education informatisation strategies and maturity models (Xu, 2024), but it still overemphasises condition preparation and lacks detailed implementation tasks.

As such, neither international experience nor domestic research has yet provided a comprehensive and operational framework to address the core question of how primary and secondary schools can scientifically and effectively advance digital transformation. This research gap is precisely the entry point and value of this study.

Raising the Core Question

Based on the above analysis, it is clear that the key obstacles to promoting the digital transformation of basic education in China are not only insufficient hardware, resources, or teacher qualifications, but also the lack of a scientific and systematic implementation path and action framework. Such a framework should be able to integrate key success factors (such as teacher capabilities, school governance, resource security, and cultural atmosphere) and embed them into the division of the entire transformation process, thereby providing schools with clear task-oriented and action-oriented guidelines.

In other words, the core issue addressed by this study is: How to construct a digital transformation implementation framework for primary and secondary schools in China based on systematicity and operability, in order to enhance the success rate and effectiveness of the transformation.

1.3 Research Scope and Limitations

To maintain the focus of the research and the usability of the outputs, this study establishes the following boundaries.

1. The research focuses on the school system of basic education (primary and junior high schools) in mainland China; senior high schools, vocational education, and higher education are not within the scope of this study. The questionnaire survey targets teachers, administrators, and IT staff, as the study focuses on school-level organizational and process factors; students are not direct respondents.

2. The core deliverables are an implementation framework/action guide, including the identification and validation of key success factors, the theoretical basis for dividing the implementation phases, a phase-task-responsibility-output-indicator matrix, and supporting tools. The study does not conduct randomized controlled trail or complex longitudinal effectiveness tracking.

3. A mixed-method approach is adopted, combining literature review, questionnaires and statistical analysis, case consistency testing, and Delphi expert assessment. Due to time constraints and accessibility limitations, questionnaires and interviews may introduce subjective biases, and the number and types of cases may affect the generalizability of conclusions.

4. The framework is based on the principle of "minimum viable unit + contextualized supplements" to provide customizable pathways for different school contexts; it does not advocate a "one-size-fits-all" approach across regions or school types.

5. Some key data (e.g., long-term academic growth, behavioral changes, and non-cognitive ability changes) are difficult to obtain comprehensively within the research timeline. Therefore, the study emphasizes process calibration and the sufficiency of evidence from interim outputs.

1.4 Statement of Research Questions

The root cause of the aforementioned issues lies in the fact that the digital transformation of Fundamental education in China is still in its nascent stage. In practice, the key stakeholders lack sufficient experience; theoretically, the digital transformation of basic education schools lacks guiding, systematic, and comprehensive action frameworks to serve as a roadmap. Consequently, school digital transformation has largely been a passive, fragmented, and disorderly process driven by policy mandates, resulting in suboptimal outcomes. Therefore, it is hoped that this study will develop an implementation methodology and pathway for digital transformation in basic education based on the Key Success Factors (KSFs) that influence the successful implementation of digital transformation in school education. To achieve this objective, this study focuses on the main thread of "identification-verification-construction-evaluation" and proposes the following research questions:

1. Based on the integration of relevant theories and domestic and international practical evidence, what are the key success factors that have a decisive impact on the "successful implementation" of digital transformation in Chinese primary and secondary schools?

2. In the context of basic education in China, how are the role pathways and relative importance of the factors identified manifested in the successful implementation of digital transformation in basic education?

3. How to construct the correct path for the digital transformation of basic education?

4. How effective is the constructed implementation framework for the digital transformation of basic education?

1.5 Research Objectives

In line with the research questions, this study establishes the following objectives:

1. To identify the key success factors for the digital transformation of basic education, and define them in terms of behavior using language applicable to school implementation.

2. To develop measurement tools, form a questionnaire and indicator system that includes reliability and validity tests, and obtain statistical evidence and management explanations for key factors.

3. To propose a clear phase division and calibration mechanism, construct a phase-task-responsibility-output-indicator matrix, and provide comprehensive template tools (task lists, milestones, progress boards, self-assessment forms, etc.).

4. To evaluate the effectiveness of the constructed implementation framework for the digital transformation of basic education.

1.6 Significance of the Study

This study is based on the key success factors of digital transformation in basic education and project process management theory to construct a method/pathway framework for the successful implementation of digital transformation in basic education. The framework combines theory and practical operability, filling a gap in existing research and providing important theoretical and practical significance.

1.6.1 Theoretical Significance

1. Expanding the Research Perspective on Digital Transformation in Education

Existing research in the field of digital transformation in education has mostly focused on policy, technology, or teaching reforms, paying attention to the introduction of digital technologies, the improvement of teachers' information technology

capabilities, or changes in learning methods (Fullan, 2020; OECD, 2021). However, there is a relative lack of systematic research on how to ensure the successful implementation of transformation at the practical level.This study addresses this research gap by constructing an implementation framework for the digital transformation of basic education, providing a new academic perspective on the "implementation process" of digital transformation.

2. Enriching the Application of KSFs theory in the field of education

Key success factors (KSFs) theory is widely used in business management and information system implementation research, but has not been systematically applied in the field of digital transformation in education (Rockart, 1979;Bullen & Rockart, 1981). This study introduces the PPTE (People–Process–Technology–Ecosystem) theoretical framework and combines empirical analysis to validate its applicability in the context of basic education, thereby expanding the interdisciplinary applicability of KSF theory and providing a new path for the theoretical construction of educational digital transformation.

3. Proposing a Stage-based Theoretical Framework Tailored to Basic Education

Although theoretical frameworks for stage-based analysis have been proposed in fields such as project management (PMBOK, 2021), organizational change (Kotter, 1996), and educational informatization (UNESCO, 2019; Ministry of Education, 2018), these theories often suffer from being too macro-level or generalized when applied to basic education.This study combines international and domestic maturity models with the actual situation of China's basic education to propose a stage division model of "assessment and preparation—planning and design—implementation and promotion—assessment and optimization." This model inherits the internationally accepted logical

framework while innovating in localization, thereby forming a new explanatory power for the stage division of educational digital transformation at the theoretical level.

4. Constructing a Theoretical and Practical Implementation Framework

The major theoretical contribution of this study lies in proposing a systematic framework consisting of five inter-related elements: “stage—task—responsibility—output—indicator.” This framework addresses the theoretical question of “how transformation can be successfully implemented.” It further integrates key success factors with an indicator system for transformation effectiveness, forming a conceptually closed loop with coherent theoretical logical chains. Moving beyond the fragmented “conditions-process-outcome” perspective dominating prior studies, this framework offers a more holistic theoretical model for research on educational digital transformation.

Practical Significance

1. Providing Operational Implementation Guidelines for Basic Education Schools

Currently, basic education schools in China are generally facing problems such as unclear paths and tasks in the process of promoting digital transformation, which has led to blindness and inefficiency in the practice of some schools. The implementation framework proposed in this study clarifies the core tasks, division of responsibilities, and expected results at different stages, providing a directly referenceable action guide for the digital transformation of schools, which can effectively improve the standardization and success rate of implementation.

2. Providing Scientific Basis for Education Administrators and Decision-makers

Education administrative departments and local education bureaus need scientific reference standards and implementation paths when formulating and evaluating digital

transformation policies. The framework and indicator system proposed in this study can serve as tools for management departments in resource allocation, progress management, and effectiveness evaluation, thereby improving the targeting and effectiveness of policies.

3. Promoting the Development of Teachers' and Students' Capabilities

By emphasizing teacher professional development, student learning outcomes, and educational equity, the framework proposed in this study can provide structured support for teacher training and personalized learning for students, helping schools achieve dual improvements in teaching quality and learning outcomes in a digital environment.

4. Promoting Educational Equity and the Sharing of High-quality /Resources

The framework design emphasizes educational equity and resource efficiency, striving to narrow the gaps between urban and rural areas, regions, and schools through digital means.The application of the framework can promote the equitable distribution of high-quality digital educational resources, thereby promoting educational equity and improving the overall level of education in society.

5. Providing Reference and Inspiration for Future Educational Transformation

The implementation framework proposed in this study is not only applicable to the current digital transformation of basic education but also provides inspiration for the further transformation of education in the future driven by new technologies such as artificial intelligence, big data, and the metaverse. It has strong forward-looking and expandability.

In summary, this study not only provides a new theoretical framework for the digital transformation of education but also offers practical action pathways for schools and policymakers. Its academic value and practical significance complement each other, providing strong support for the development of digital transformation in basic

education in China and globally.

1.7 Definition of Key Terms

This section defines the key terms used in this study in two parts: conceptual definitions, which clarify the theoretical connotations of each term based on existing literature and policy documents, and operational definitions, which specify how each term is identified, measured, or applied in the present research.

1.7.1 Conceptual Definitions

This subsection clarifies the theoretical connotations of the core terms that appear in the title and research questions of this study. These definitions are drawn from established academic literature and policy documents and serve as the conceptual foundation for the research framework and logical reasoning of this dissertation.

1. Education

"Basic education" generally refers to compulsory education and its extension, covering the initial education and development of children and adolescents (UNESCO, 2015). In the Chinese context, basic education mainly includes preschool education, primary education, and junior high school education , which are core components of the nine-year compulsory education system (Ministry of Education, 2019). It plays a critical role in fostering students' core competencies, character development, and introductory digital literacy.

2. Digital Transformation

Digital transformation refers to the use of digital technologies to profoundly change the way organizations operate, their cultural structures, and their service models, thereby creating new value and improving efficiency (Vial, 2019). In the field of education, digital transformation is defined as the systematic restructuring of

educational concepts, teaching models, management mechanisms, and resource supply methods through the use of digital technologies to achieve the goal of educational modernization (OECD, 2021; Ministry of Education, 2022). It is characterized by systematic, complex, and goal-oriented features, involving not only hardware and resource construction but also the overall transformation of teacher capabilities, teaching methods, school governance, and the educational ecosystem.

3. Implementation Framework

An implementation framework refers to a systematic structure for dividing a complex process into stages, designing tasks, allocating responsibilities, and setting expected outcomes based on certain theoretical and practical foundations (Pettigrew, 1987). In information and digitalization research, implementation frameworks are widely used in IT governance, project management, and organizational change processes to ensure that the transformation process has a clear path and is operational (PMBOK, 2021). In this study, it specifically refers to the "Implementation Framework for the Digital Transformation of Basic Education," which consists of five elements: stages, tasks, responsibilities, outputs, and indicators.

4. Key Success Factors (KSFs)

The theory of critical success factors was first proposed by Rockart (1979) and refers to a few key areas that organizations must pay special attention to and ensure success in order to achieve their strategic goals. Bullen and Rockart (1981) further defined them as "several key elements that ensure the success of an enterprise." In the context of educational digitization, critical success factors refer to the core conditions and enabling factors that influence the success or failure of school digital transformation, such as teacher capabilities, technological infrastructure, governance models, and school culture (He & Li, 2020).

5. PPTE Model (People–Process–Technology–Ecosystem Model)

The PPTE model is an extended framework based on the PPT (People–Process–Technology) model commonly used in information systems, education, and organizational change, combined with the educational context. Its core idea is that the success of educational digital transformation depends not only on "people" (teachers, students, managers), "process" (optimization of teaching and management processes), and "technology" (digital tools and infrastructure), but also on the combined effects of "Ecosystem" (policy environment, cultural atmosphere, and external support) (Zhang & Li, 2022). In this study, PPTE serves as both the theoretical basis for analyzing key success factors and an important logical support for the implementation framework design.

6. Stage Division

Stage division refers to the decomposition of the transformation process into several logically interconnected stages, each with clear tasks, objectives, and key results (Kotter, 1996; PMBOK, 2021). In the field of educational digitization, stage division typically includes three major categories: preparation, implementation, and optimization (UNESCO, 2019). Based on a summary of international and domestic maturity models and project management theories, this study divides the digitization transformation of basic education into four stages: "assessment and preparation—planning and design—implementation and promotion—assessment and optimization," emphasizing the completeness and operability of the causal chain.

7. Digital Education Ecosystem

The digital education ecosystem refers to a dynamic interactive system formed by policies, schools, teachers, students, technology providers, and social forces in the context of digitalization (Zhao, 2021). At the basic education level, the digital education

ecosystem is not only manifested in the support of the technological environment but also includes the cultural atmosphere, governance models, home-school collaboration, and the sharing of regional educational resources. The introduction of the “Ecosystem” factor in the implementation framework design of this study is based on the systematic and holistic nature of educational digital transformation.

8. Case Consistency Assessment

Case consistency assessment is a method used to validate the applicability of a theoretical framework or model. It involves comparing and analyzing multiple practical cases to verify whether the constructed theoretical framework can effectively explain practical phenomena and guide action (Ragin, 1987). In this study, case consistency assessment is used to validate the applicability and effectiveness of the constructed implementation framework.

9. Participants in the Digital Transformation Implementation of Basic Education

Participants in education are “all individuals and groups involved in the educational process who contribute to and are affected by educational outcomes” (UNESCO, 2019). This includes groups directly involved in educational activities, such as students and teachers, as well as those who influence education indirectly through policy, funding, and technical support, such as parents, education administrators, policymakers, technology developers, and community members. Stakeholders within educational organizations are the actual implementers of teaching and learning and its digitization, as well as the “last mile” of digital transformation, and therefore constitute one of the most important dimensions determining the success of digital transformation (Zhu, 2022).

1.7.2 Operational Definitions

This subsection specifies how the core terms in this study are operationalized for the purposes of research design, data collection, and analysis. These operational definitions are consistent with the research questions (RQ1–RQ4) and the methodological design presented in Chapter III. They define the boundaries, measurement approaches, and analytical treatment of each term without pre-empting the specific findings reported in Chapter IV.

1. Basic Education

In this study, basic education is operationalized as primary education and junior high school education in mainland China. Preschool education, senior high school education, vocational education, and higher education are explicitly excluded from the scope of this study. This operational boundary is consistent with the research scope defined in Section 1.3 and determines the sampling frame of the questionnaire survey and case studies.

2. Digital Transformation

In this study, digital transformation is operationalized as the process of innovation and change in educational concepts, teaching models, teaching content, learning environments, and management systems of basic education schools, supported by digital technologies. It is measured through the four dimensions of the PPTE framework (People, Process, Technology, and Ecosystem) and the transformation outcome dimensions (Student Learning Outcomes, Teacher Professional Development, Educational Equity and Sustainability, and Educational Management Efficiency and Operations).

3. Implementation Framewor

In this study, the implementation framework is operationalized as a phased, task-oriented, and accountability-based structure that translates validated key success factors

into actionable tasks across different stages of the transformation process. The framework specifies, for each stage, the key tasks, responsible parties, expected deliverables, and success indicators. It is constructed through the factor-to-task translation method and validated through multi-case pattern-matching analysis. The detailed content of the framework is presented in Chapter IV.

4. Key Success Factors (KSFs)

In this study, KSFs are operationalized as the core conditions and enabling factors that influence the success or failure of digital transformation in basic education, identified through a systematic literature review (SLR) and two rounds of Delphi expert consultation, and subsequently validated through confirmatory factor analysis (CFA) and structural equation modeling (SEM). The KSFs are organized within the four dimensions of the PPTE framework and measured through Likert-scale items with demonstrated reliability and validity. The specific number, structure, and measurement properties of the KSFs are reported in Chapter IV.

5. PPTE Model

In this study, the PPTE model is operationalized as a second-order structural model in which the validated first-order key success factors are aggregated into four higher-order latent dimensions: Ecosystem, People, Process, and Technology. The model is tested using structural equation modeling (SEM) and chain mediation analysis to examine the synergistic pathways among the four dimensions and their collective impact on the overall effectiveness of digital transformation. The detailed model specification and results are presented in Chapter IV.

6. Stage Division

In this study, stage division is operationalized as a four-stage framework comprising Assessment and Preparation, Planning and Design, Implementation and

Promotion, and Evaluation and Optimization. Each stage is defined by its phase positioning, key KSFs, key tasks, responsible parties, deliverables, and success indicators. Stage transition conditions are specified as reference standards for schools to conduct self-assessment and determine whether they meet the criteria for advancing to the next stage. The detailed operational definitions of each stage are presented in Chapter IV.

7. Digital Education Ecosystem

In this study, the digital education ecosystem is operationalized as the Ecosystem dimension of the PPTE model, which encompasses the external institutional, resource, social, and collaborative environment that supports school digital transformation. It is measured through Likert-scale items and analyzed as both a direct predictor of transformation outcomes and an indirect driver through the chain mediation pathway. The specific components and measurement items of this dimension are detailed in Chapter III and Chapter IV.

8. Case Consistency Assessment

In this study, case consistency assessment is operationalized as a multi-case pattern-matching analysis following Yin's (2018) approach. Representative schools from different regions were selected as cases. The framework's tasks were translated into verifiable analytical items and coded using a four-point rating scale. Inter-coder reliability was assessed to ensure coding consistency. A matching rate of ≥70% is adopted as the heuristic threshold for judging the framework's explanatory applicability. The detailed case selection criteria, coding procedures, and matching results are presented in Chapter III and Chapter IV.

9. Participants in the Digital Transformation Implementation of Basic Education

In this study, participants are operationalized as frontline teachers, middle managers, IT managers, and school-level leaders (principals/vice principals) from basic education schools in mainland China. The questionnaire survey sample comprises these four groups of school stakeholders. For the case study phase, participants include principals or vice principals in charge of digital transformation, IT directors, and teacher representatives from the selected case schools. The specific demographic characteristics and sampling procedures are reported in Chapter III and Chapter IV.

1.8 Research Novelty

This study makes the following innovative contributions and unique contributions in the process of constructing the "Implementation Framework for the Digital Transformation of Basic Education in China":

1. Innovative Research Perspective: Introduction and Extension of the PPTE Integrated Framework

Existing research on the digital transformation of education has mostly focused on technological factors or teaching processes, emphasizing the construction of information infrastructure or classroom teaching applications (He & Li, 2020; OECD, 2021).Some scholars have adopted the PPTE (People–Process–Technology) model to analyze the process of educational digital transformation, but often overlook the institutional and ecological environment in which educational transformation occurs (Zhang & Li, 2022). Building on this, this study proposes and adopts the PPTE (People–Process–Technology–Ecosystem) model, which incorporates "Ecosystem" as a core dimension, emphasizing that school digital transformation not only depends on teachers, students, processes, and technology, but is also profoundly influenced by policy support, cultural atmosphere, social collaboration, and governance structures. This expanded

framework provides a more systematic and adaptable analytical tool for research on digital transformation in education.

2. Uniqueness of the Research Object: Focusing on the Basic Education Context

Existing maturity models at the international and domestic levels (such as the EU SELFIE tool, the UK Jisc model, the US K-12 DTRMA model, and Huawei's education digital maturity model) are mostly aimed at macro-level education systems or higher education stages, with few focusing on the basic education context of primary and secondary schools (Kampylis et al., 2019; CoSN, 2020; Xu Qiuxuan, 2024). However, as the starting point of the education system, basic education plays an irreplaceable role in cultivating students' digital literacy and achieving educational equity. Through empirical surveys and case analyses, this study addresses the actual issues in China's basic education stage (such as urban-rural disparities, insufficient teacher capabilities, and unbalanced resource allocation) to construct a more adaptable implementation framework, filling the research gap in this area.

3. Innovation in the Research Approach: a five-Element Matrix of Stages, Tasks, Responsibilities, Outputs, and Indicators

Most studies on the digital transformation of education have remained at the level of strategic planning or maturity level descriptions, lacking operability and executability (OECD, 2021; Ministry of Education, 2022). The implementation framework proposed in this study innovatively combines the five-element matrix of “stage-task-responsibility-output-indicator,” clearly defining the stage divisions of the entire digital transformation process while specifying concrete tasks, responsible parties, expected outcomes, and measurement indicators for each stage. This “strategy-to-execution” end-to-end design is grounded in academic theory while providing

schools and education administrative departments with directly actionable guidelines, thereby enhancing the framework's practical value.

4. Innovation in research methods: introduction of case consistency assessment

In educational digitalization research, framework construction studies often struggle to validate their effectiveness, leading to a disconnect between theory and practice (Fullan, 2020).This study, while constructing an implementation framework, designed and introduced the Case Consistency Assessment method. By comparing and analyzing transformation cases from different regions and different types of schools, the applicability and universality of the framework were tested. The application of this methodology provides an innovative empirical testing path for research on educational digital transformation.

5. Dual Innovation in Academic and Policy Value

This study not only promotes the deepening of research on digital transformation in education through theoretical integration and framework construction, but also provides practical action guidelines for stakeholders such as primary and secondary schools, education administrative departments, and enterprises. This research model, which closely integrates theory and practice, helps to bridge the gap between educational research and policy-making, thereby enhancing the social value and application value of research results.

In summary, the novelty of this study is mainly reflected in the following three aspects:

Theoretically, the PPTE extended model was proposed and applied, enriching the theoretical framework of research on digital transformation in education.

In terms of research objects, the study focused on basic education in China, filling a gap in previous research.

In terms of methods and practice, an operational five-factor matrix was constructed, and its effectiveness was ensured through case consistency assessment.

These innovations not only expand the academic boundaries of digital transformation research but also provide scientific basis and methodological support for the digital transformation practice of China's basic education.

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