

Digital Transformation of Curriculum Based on Tyler Rationale

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Abstract. With the increasing impact of digital technology on education, the digital transformation of education has become one of the most important changes in the field of education. Curriculum digital transformation is an important engine to lead and promote the digital transformation of education. At present, there are few theoretical and practical studies on curriculum digital transformation in academic circles, and the definition of curriculum digital transformation lacks a clear definition, and the research lacks a dialogue with educational theories and a theoretical framework. Curriculum digital transformation needs the help of digital technology and the guidance of pedagogy theory, which is the integration and innovation process of digital technology and curriculum theory. Based on this, this paper focuses on the four basic issues of Tyler Rationale to construct four dimensions of curriculum, namely curriculum objectives, curriculum content, curriculum implementation and curriculum evaluation, defines curriculum digital transformation by combining the four dimensions and relevant definitions of digital transformation, analyzes the factors that need to be considered in each dimension, and presents the activities that can be carried out in each dimension of digital transformation. It provides a research framework for curriculum digital transformation, and provides a reference for the integration and innovation of digital technology and curriculum.

Keywords: Curriculum digital transformation; Tyler Rationale; quadruple dimension; research framework.

1. Introduction

With the rapid development of big data, artificial intelligence, blockchain, cloud computing and other technologies, the impact of digital technology on education is increasing day by day, and many countries have taken digitalization as a strategic task for education development, releasing relevant plans, initiatives and actions. On 30 September 2020, the European Commission adopted the Action Plan for Digital Education (2021-2027). At the end of January 2023, France published the Digital Education Strategy 2023-2027. In 2022, China for the first time clarified the national education digitization strategic action, and proposed the "implementation of education digitization strategic action."

At the World Digital Education Conference in February 2023, the China National Academy of Educational Sciences (CNAES) released the China Smart Education Bluebook 2022 and the China Smart Education Development Index Report 2022, proposing to enter the digital era, promote the digital transformation of education, and explore smart education. At the same time, it is pointed out that, China's smart education is facing many practical problems and challenges such as "digital resources need to be enriched and optimized, and education and teaching integration and innovation need to be deepened".

Curriculum is the main carrier of education and teaching, which directly affects the quality of personnel training and accelerates the digital transformation of curriculum. It is the inevitable product of the digital transformation of education and the key element of the digital transformation of education. Curriculum digital transformation is the integration and innovation process of digital technology and curriculum theory, which needs the help of digital technology and the guidance of pedagogy theory. Based on Tyler Rationale and starting from four basic questions, this paper proposes four dimensions of curriculum, defines the definition of curriculum digital transformation, builds a research framework of curriculum digital transformation, and provides references for the study of curriculum digital transformation.

2. Definition of Curriculum Digital Transformation

At present, there is no unified definition of "curriculum digital transformation" in the academic circle, and very few scholars have clearly proposed and defined "curriculum digital transformation". This paper will combine Tyler's curriculum Rationale and the definition of digital transformation to define "curriculum digital transformation".

2.1 Four Basic Problems of Tyler Rationale

In *The Principles of Curriculum and Instruction*, Tyler reduced the principles of curriculum to four interlocking questions: "What educational purposes should the school seek to attain?" "What educational experiences can be provided that are likely to attain these purposes?" "How can these educational experiences be effectively organized?" "How can we determine whether these purposes are being attained?". Centering on these four questions, this paper constructs four dimensions of curriculum, namely "curriculum objectives", "curriculum content", "curriculum implementation" and "curriculum evaluation". The four dimensions run through the whole process of teachers' "teaching" and students' "learning".

2.2 Digital Transformation

Digital transformation is a prominent trend affecting all aspects of life in recent times. There are different definitions for the terminology "digital transformation." [1] For example, "the use of technology to radically improve performance or reach of enterprises" [2], "the use of new digital technologies, to enable major business improvements in operations and markets such as enhancing customer experience, streamlining operations or creating new business models." [3], "with digital technology, digital products and digital platform infrastructure as the starting point, and then triggered by individual, organization, industry and other levels of change, this process has different degrees of positive and negative impact on the organization" [4] or "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" [5]. In summary, in view of their different backgrounds and research emphases, the definition of different perspectives is given. But each definition reflects elements of digital technology, improvement, and transformation.

2.3 The Definition of Curriculum Digital Transformation

Based on the four dimensions of curriculum constructed above and the elements of digital technology, improvement and transformation reflected in various definitions of digital transformation, this paper proposes the following definitions of curriculum digital transformation. Curriculum digital transformation refers to the use of digital technology to achieve the transformation and upgrading of curriculum objectives, curriculum content, curriculum implementation, and curriculum evaluation, so as to achieve the deep integration of digital technology and curriculum, drive curriculum reform by digitization, comprehensively improve the integrity, systematization, and synergy of curriculum construction, and ultimately achieve more efficient, comprehensive, and personalized education purposes.

The above definition includes three elements: (1) digital technology, indicating the methods and technical means of transformation; (2) the scope of transformation, including curriculum objectives, curriculum content, curriculum implementation, curriculum evaluation, namely the four dimensions of curriculum, indicating the transformation object and content; (3) transformation results, the use of digital technology to achieve curriculum transformation and upgrading, drive curriculum change, improve curriculum construction, to achieve more efficient, more comprehensive, more personalized education purposes, indicating the purpose of transformation.

3. Construction of Curriculum Digital Transformation Research Framework Based on Tyler Rationale

At present, although many scholars have explored the difficulties, challenges and implementation paths in curriculum digital transformation from multiple perspectives, no systematic research framework has been formed. Why is the curriculum undergoing digital transformation, what is the scope of transformation, how to carry out the transformation, and what are the transformation methods? These issues urgently need to be clarified. In order to systematically answer the above questions, based on Tyler Rationale, this paper constructs a four-dimensional research framework for curriculum digital transformation, including curriculum objectives, curriculum content, curriculum implementation and curriculum evaluation, as shown in Figure 1.

The research framework is developed from four dimensions: curriculum objectives, curriculum content, curriculum implementation, and curriculum evaluation. Behind each dimension, there are two to four sub-dimensions, which explain the constituent elements of each dimension in detail. At the same time, the research framework also provides specific activities that can be carried out in the digital transformation, provides operational suggestions for the transformation of curriculum objectives, curriculum content, curriculum implementation and curriculum evaluation, and points out the direction for the integration and symbiosis of curriculum and digital technology.

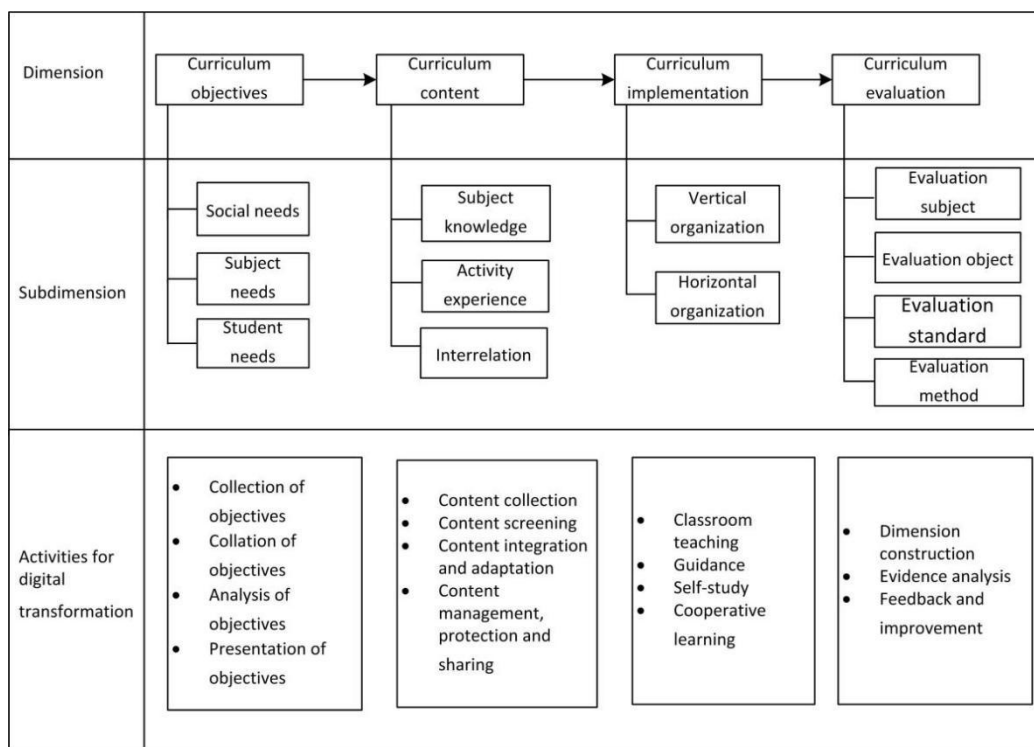


Fig1. Research framework of curriculum digital transformation based on Tyler Rationale

4. Analysis of the Research Framework

4.1 Analysis of Digital Transformation of Curriculum Objectives

4.1.1 Dimensions to be considered in curriculum objectives

Tyler's embrace of the student, subject matter, and society as three imperative sources for the curriculum[6], which providing a way to solve the problem of "What educational purposes should the school seek to attain?", which reflecting that the determination of curriculum objectives needs to consider the dimensions of student needs, social needs and subject needs.

Based on this, this paper puts forward that the dimensions to be considered in determining curriculum objectives include social needs, subject needs and student needs. The determination of curriculum objectives should start from the social needs, take the social needs as the basis, "draw" from the society; At the same time, it should reflect the characteristics of the subject and make corresponding changes to the curriculum objectives according to the current situation and development trend of the subject. It also needs to conform to students' psychological characteristics and cognitive laws, so as to promote students' more comprehensive and personalized development.

4.1.2 Digital transformation of curriculum objectives

From the three dimensions of social needs, subject needs and students needs, the scientific orientation of curriculum objectives. In the digital age, we can use digital technology to achieve the optimal combination of social development goals, subject development goals and students' personal goals. The activities that can be carried out in digital transformation include the collection of objectives, the collation of objectives, the analysis of objectives and the presentation of objectives. With the help of digital technologies such as the Internet of Things, image recognition and web crawler, the social goals, subject goals and students' personal goals corresponding to the curriculum are collected to form a target set. Through data cleaning, data integration, data transformation and other technologies, the collected data are cleaned, transformed and merged to realize the processing of the target set. Use statistical analysis and data mining techniques to find the relationship between the targets. Finally, the curriculum objective is presented by visualization technology, and the complex relationship between the objectives is expressed vividly. In essence, there is a symbiotic relationship between curriculum objectives and digital technology elements, and the digital transformation of curriculum objectives is a new ecological integration of curriculum objectives and digital development.

4.2 Analysis of Digital Transformation of Curriculum Content

4.2.1 Dimensions to be considered in curriculum content

So far, there are still different opinions on the question of "what is the content of the curriculum", which mainly include the theory of "subject knowledge" and the theory of "activity experience". The theory of "subject-knowledge" understands the essence of curriculum content as objective knowledge. In his rationale Tyler conceived of education as experience[6]. The theory of "subject knowledge" and the theory of "activity experience" both provide an answer to solve the problem of "What educational experiences can be provided that are likely to attain these purposes?". This paper believes that it is not accurate to simply equate curriculum content with subject knowledge or activity experience, which are only one of the elements. More importantly, it is necessary to treat curriculum content as a whole and pay attention to different elements and the correlation between them, it is necessary to pay attention to subject knowledge, activity experience and the interaction between them, to understand curriculum content from a structured perspective. Based on this, this paper puts forward that the dimensions to be considered in determining the curriculum content include subject knowledge, activity experience and interrelation.

From the three dimensions of subject knowledge, activity experience and interrelation, the curriculum content is understood from the perspective of structure, that is, the structure of curriculum content. At present, there are roughly three ways to structure curriculum content. The first is horizontal structure, the key lies in real activities, pointing to the process of problem solving; The second is vertical structure-bottom-up, the key lies in the existing knowledge and skills, the answer is "to enable students to learn this knowledge and skills, the premise is to master what knowledge and skills"; The third is vertical structure-top-down, the key lies in the basic concepts and Rationales of the discipline that have been learned, and then deduce the understanding of specific problems. The boundary between these three structures is not clear and opposite to each other, and in practical practice, they often show the combination of various organizational structures.

To return to the structured nature of curriculum content, it is necessary to regard curriculum content as a whole.

4.2.2 Digital transformation of curriculum content

Based on the holistic thinking of curriculum content, it starts from three dimensions: subject knowledge, activity experience and interrelation. This paper puts forward the activities that can be carried out in the digital transformation of curriculum content, including content collection, content screening, content integration and adaptation, content management, protection and sharing. Based on the clear curriculum objectives, the use of digital technology to collect the subject knowledge and activity experience involved in the curriculum; Statistical analysis and data mining are used to analyze the collected subject knowledge and activity experience, explore the relationship between them, and screen the curriculum content. After obtaining relevant permission, integrate the selected curriculum content and adjust the content appropriately according to the curriculum objectives; Manage and secure curriculum content and share it with digital platforms.

4.3 Analysis of Digital Transformation of Curriculum Implementation

4.3.1 Dimensions to be considered in curriculum implementation

"How can these educational experiences be effectively organized?" Tyler's answer is: "We can go from moment to moment, from field to field," that is, the vertical organization of the curriculum as well as the horizontal organization. Vertical organization, the curriculum content according to the logical sequence of discipline knowledge, vertical development sequence organization and implementation, emphasizing from the known to the unknown, from concrete to abstract. Horizontal organization, the curriculum content is organized and implemented according to horizontal relations, based on the problems that need to be explored in the psychological development stage of students and the society is most concerned about, and it is carried out one by one in accordance with the subject order. The two dimensions of vertical organization and horizontal organization are integrated to form a complete curriculum implementation system. Based on this, this paper proposes that the dimensions of curriculum implementation should be considered include vertical organization and horizontal organization.

4.3.2 Digital transformation of curriculum implementation

Based on the two dimensions of vertical organization and horizontal organization, combined with the evolution of curriculum content flow mode from traditional teacher-student "transfer" to "sharing" and "feed-back" in the digital era, and the characteristics of "everyone learns, everywhere learns, and always learns", this paper proposes the activities that can be carried out in the implementation of curriculum digital transformation. Namely classroom teaching, guidance, self-study, cooperative learning. In the digital age, curriculum implementation is no longer limited to classroom teaching, and the teaching space extends from the classroom to the extra-curricular space, which needs the guidance of teachers. In the digital age, students' learning is not limited to the classroom, and the learning space will extend to the extra-curricular space, which requires self-study and mutual cooperative learning.

In the four activities of classroom teaching, guidance, self-study and cooperative learning, classroom teaching is the key, and other activities are complementary. In the process of classroom teaching, it is organized and implemented according to the vertical or horizontal relationship according to the curriculum content, and implemented by using digital equipment and resources, using digital technology to record students' learning behavior in the classroom and provide timely help, and using digital technology to reasonably manage teaching and various interactive activities in the digital resource environment. In the extra-curricular space, digital technology is used to provide timely feedback on students' problems and questions in learning, and digital platforms are used to publish relevant digital resources before, during and after class, and digital technology is used to provide timely and effective guidance and help. While learning in class and receiving teachers' guidance and help after class, students can use digital equipment, resources and

technologies to carry out vertical or horizontal cooperative learning activities, thus strengthening their own cooperation ability and the ability to use digital technology. At the same time, digital equipment, resources and technology are used to carry out independent learning activities in vertical or horizontal relationships, use digital technology to plan the learning process, use digital technology to record the learning process and collect relevant information, improve themselves through planning, monitoring and reflection, and propose .

4.4 Analysis of Digital Transformation of Curriculum Evaluation

4.4.1 Dimensions to be considered in curriculum evaluation

Because of the different understanding of the curriculum itself and the Angle of looking at the problem, the definition of curriculum evaluation by scholars is different. The international development of educational evaluation is divided into the following four stages, namely the "measurement era" from the end of the 19th century to the 1930s, the "description era" from the 1930s to the 1950s, the "judgment era" from the late 1950s to the 1970s, and the "construction era" from the end of the 1980s. The four stages change from the evaluation that emphasizes objective tools, goal achievement degree and standard to the development evaluation that emphasizes negotiation and construction. Each stage evaluation has its advantages and disadvantages, we need to combine their advantages, comprehensive evaluation of the curriculum.

In answer to Tyler's question, "How can we determine whether these purposes are being attained?" At present, the academic circles have put forward "target model", "gap model", "CIPP evaluation model", "response model", "explanation model" and so on. In general, curriculum evaluation shows a diversified development trend, which is manifested in the diversification of evaluation subjects, objects, standards, methods and so on. Based on this, this paper puts forward the dimensions that need to be considered in curriculum evaluation, including evaluation subject, evaluation object, evaluation standard and evaluation method. Refer to Table 1 for details when constructing the four sub-dimensions. The comprehensive evaluation of the curriculum in four dimensions further answers the question "Who will evaluate? The teacher? The student Or others?" "Evaluate what ? Evaluate teacher? Evaluate student? Or something else?" "What is the evaluation based on? Is it goal achieved? Is it a value judgment?" "How to evaluate? Quantitative assessment? Qualitative assessment? A final review? Formative assessment?" .

Table 1. Construction of curriculum evaluation dimension

Dimension	Evaluation subject	Evaluation object	Evaluation standard	Evaluation method
Subdimension	(1)Teacher (2)Student (3)Other	(1)Teacher (2)Student (3)Curriculum (4)Other	(1)Goal achievement degree (2)Student achievement (3)Other	(1)Quantitative evaluation (2)Qualitative evaluation (3)Terminal evaluation (4)Formative evaluation (5)Other

4.4.2 Digital transformation of curriculum evaluation

From the four dimensions of evaluation subject, evaluation object, evaluation standard and evaluation method, combined with the characteristics of the digital age, the new direction of evaluation and technology integration is sought. This paper puts forward the activities that can be carried out in the digital transformation of curriculum evaluation, namely, dimension construction, evidence analysis, feedback and improvement. Dimension construction, the use of digital technology to carry out investigation and analysis, and finally determine the curriculum evaluation subject, evaluation object, evaluation standards and evaluation methods. Evidence analysis: Use digital

platforms to record and present all kinds of digital evidence, including students' learning process and learning results, use digital technology to analyze, excavate and judge all kinds of digital evidence, and consider curriculum scientifically and effectively. Feedback and improvement refers to the use of digital technology to provide timely feedback on curriculum evaluation results for evaluation objects and appropriate help and support, so as to use the feedback information of digital technology to improve curriculum.

5. Summary

In the digital era, the field of education is undergoing great changes, and digital transformation drives the progress of educational reform. The digital transformation of education has a wide coverage and far-reaching influence, and needs continuous innovation, development and breakthrough. Curriculum digital transformation will serve as an important engine to lead and promote the digital transformation of education. Through the dialogue with Tyler Rationale, this paper defines the connotation of curriculum digital transformation, and puts forward the research framework of curriculum digital transformation from four dimensions, so as to provide reference for promoting curriculum digital transformation. It should be noted that the four dimensions of curriculum objectives, curriculum content, curriculum implementation and curriculum evaluation constitute the whole process of "teaching" and "learning", and it is also a cyclic and continuous improvement process. Curriculum digital transformation is not simply curriculum-centered or digital-technology-centered, but the integration and innovation process of digital technology and curriculum, and the interaction process of digital technology and curriculum, which cannot be isolated.

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