

Construction of Hong Kong's ICT Curriculum System under Digital Education Policy: A Grounded Theory Approach

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Abstract: Hong Kong, as an area with early development of digital education, has gradually formed a relatively complete information and communication technology (ICT) curriculum system under the impetus of policies. Based on the grounded theory, this paper explores the key elements of curriculum system construction and their relationships through the coding analysis of ICT curriculum policies and documents in Hong Kong. It is found that the construction of ICT curriculum system in Hong Kong is jointly influenced by curriculum objectives, contents, implementation, evaluation and guarantee, and the policy-guided collaborative operation mechanism of the curriculum system. The cultivation of digital literacy and the development of computational thinking constitute the core objectives of curriculum construction. Programming education and digital teaching have become the important starting points of curriculum reform, while teachers' professional development and resource allocation provide support for the operation of curriculum system. Based on the research results, the conceptual model of ICT curriculum system construction in Hong Kong is constructed, and the optimization path is put forward.

Keywords: Digital education policy; Hong Kong; ICT curriculum system; Grounded theory; Digital literacy.

1. Introduction

With the rapid development of digital technology, digital transformation has become an important direction of global education reform. Emerging technologies such as artificial intelligence, big data and cloud computing have been continuously integrated into the field of education, which puts forward new requirements for course content, teaching methods and personnel training objectives [1]. Digital literacy, information literacy and computational thinking have gradually become the core abilities that students should have in the basic education stage. These abilities promote the transformation of information and communication technology (ICT) education from traditional information technology skills training to core literacy training in the digital age [2]. Since the implementation of the information technology education strategy in the late 1990s, Hong Kong Education Bureau has continuously promoted the construction of digital education policies and continuously improved the ICT curriculum system. With the implementation of STEM education, programming education and digital education strategy, Hong Kong has gradually formed an ICT curriculum system covering curriculum objectives, curriculum content, teaching implementation and learning evaluation [3]. At the same time, Hong Kong schools have accumulated rich practical experience in school-based curriculum development, digital learning resources construction and teachers' professional development.

In the process of digital education policy, the construction of ICT curriculum system in Hong Kong still faces some practical challenges. There are differences in digital resource allocation and curriculum implementation ability between different schools; The degree of integration between programming education and traditional ICT courses needs to be improved; The development of teachers' digital teaching ability and curriculum innovation ability is unbalanced; The

supporting role of curriculum evaluation mechanism in the development of students' digital literacy needs to be further strengthened. These problems have affected the implementation effect of digital education policy to a certain extent, and put forward new requirements for the continuous optimization of ICT curriculum system [4].

The existing research focuses on policy analysis or case studies, and pays little attention to the correlation mechanism between the elements of the curriculum system, and lacks the discussion on revealing the logic of the formation of the curriculum system driven by policies from a holistic perspective [5]. Grounded theory emphasizes the induction of concepts, the refinement of categories and the construction of theoretical models from original data, which can effectively explore the internal mechanism behind complex educational phenomena [6]. Based on this, this paper takes Hong Kong's digital education policy as the background, and uses grounded theory to encode and analyze the policy text, curriculum documents and research materials, and identify the core elements that affect the ICT curriculum system and their relationships. On the basis of openness and spindle coding, this paper constructs a conceptual model of ICT curriculum system construction in Hong Kong under the digital education policy, reveals the cooperative operation logic of curriculum objectives, contents, implementation, evaluation and guarantee mechanism, and puts forward optimization suggestions.

2. Current Situation of ICT Curriculum System Construction in Hong Kong

With the continuous promotion of digital education policy, Hong Kong has gradually established an ICT curriculum system with digital literacy training as its core [7]. From course objectives, course content, course implementation to

course evaluation, all links are connected with each other to jointly support the development of students' digital ability [8].

In terms of curriculum objectives, ICT curriculum in Hong Kong has gradually shifted from early information technology application education to digital literacy-oriented ability training. The course focuses on students' ability to operate and apply digital tools, and emphasizes the development of comprehensive abilities such as information acquisition, analysis and processing, innovative practice and computational thinking. Cultivating students' ability to solve practical problems with digital technology has become an important direction of curriculum construction.

In terms of course content, ICT courses in Hong Kong are characterized by the combination of foundation and innovation. The course covers the basic knowledge of information technology, network and information security, digital media applications, data processing, programming and algorithms. Programming education and the cultivation of computational thinking have gradually become the important contents of curriculum reform. Some schools integrate programming learning with science, engineering and other disciplines through STEM education and maker education to enhance students' practical ability and innovative consciousness.

In terms of curriculum implementation, Hong Kong schools generally attach importance to the deep integration of digital technology and teaching activities. Project-based learning, inquiry-based learning and collaborative learning are widely used in ICT curriculum practice to guide students to complete tasks and solve problems in real situations. At the same time, the school actively builds a digital learning environment, and uses online learning platforms, electronic textbooks and digital resources to support teaching activities. Curriculum implementation has gradually changed from teacher-led to a development model that pays equal attention to students' participation and independent inquiry.

In terms of curriculum evaluation, Hong Kong emphasizes

the role of evaluation in promoting the learning process and pays attention to the dynamic monitoring of students' ability development. In addition to traditional knowledge evaluation, multiple evaluation methods such as project achievement display, learning file record and classroom practice performance are widely used. The evaluation content pays more attention to students' problem solving ability, innovation ability and cooperation ability. The evaluation results are not only used to reflect the learning effect, but also provide reference for curriculum improvement and teaching optimization.

3. Grounded Theory Coding Analysis

In order to explore the logic of the construction of ICT curriculum system in Hong Kong under the digital education policy, the grounded theory method is adopted to sort out the policy documents, curriculum guidelines, implementation cases and research literature. According to the path of "open coding-spindle coding-selective coding", the concept, category and relationship are refined, and the conceptual model of ICT curriculum system in Hong Kong is formed.

3.1. Open coding analysis

The task of open coding is to analyze the original data sentence by sentence and extract concepts without presupposing the theoretical framework. During the research process, the relevant texts are coded and arranged around the course objectives, course contents, course implementation, course evaluation and guarantee mechanism. After eliminating the information with low repetition and correlation, several initial concepts are extracted. These include: digital literacy training, computational thinking development, school-based curriculum development, programming education integration, project-based learning, digital resource support, multi-evaluation mechanism, teacher professional development and so on.

Table 1. Results of Open Coding (Excerpt)

Raw Data	Initial Concept	Initial Category
ICT courses emphasize the cultivation of core competencies in the digital age	Digital literacy cultivation	Course Objectives
Courses focus on computational thinking training	Computational thinking development	Course Objectives
Schools can develop characteristic courses based on actual conditions	School-based curriculum development	Curriculum Construction
Programming education is gradually integrated into regular courses	Programming curriculum construction	Curriculum Content
Project-based learning is widely applied in classroom practice	Project-based learning	Curriculum Implementation
Build an e-learning platform to support teaching	Digital resource support	Curriculum Guarantee
Adopt multiple methods to evaluate the learning process	Multiple evaluation mechanism	Curriculum Evaluation
Strengthen teachers' digital teaching training	Teacher professional development	Curriculum Guarantee

Through continuous comparative analysis, six initial categories are finally formed: curriculum objectives, curriculum content, curriculum implementation, curriculum evaluation, curriculum guarantee and policy support. These categories comprehensively reflect the main elements of the construction of ICT curriculum system in Hong Kong.

3.2. Spindle coding analysis

On the basis of open coding, spindle coding is further used to integrate and classify the relationships among categories. Through the analysis, it is found that the six initial categories have formed a curriculum construction system that is interrelated and coordinated under the promotion of digital education policy.

Table 2. Results of Axial Coding

Main Category	Corresponding Initial Categories
Policy-driven Mechanism	Policy Support
Curriculum Objective System	Digital Literacy Cultivation, Computational Thinking Development
Curriculum Content System	Integration of Programming Education, Curriculum Content Update
Curriculum Implementation System	Project-based Learning, Digitalized Teaching
Curriculum Evaluation System	Multiple Evaluation Mechanism, Learning Feedback
Curriculum Guarantee System	Teacher Professional Development, Digital Resource Support

The digital education policy provides macro guidance and institutional guarantees for ICT curriculum construction, and is an external driving force for the development of the curriculum system; The curriculum objective system determines the direction of curriculum construction; The curriculum content system is an important carrier for achieving goals; The curriculum implementation system undertakes the functions of curriculum transformation and practice; The course evaluation system is responsible for monitoring and providing feedback on the effectiveness of course operations; The curriculum guarantee system provides continuous support for curriculum construction through resource allocation and faculty development.

4. Mechanism Model of ICT Curriculum System Construction in Hong Kong

By comparing and integrating the logical relationship between the main categories, the "Hong Kong ICT curriculum system construction mechanism driven by digital education policy" is determined as the core category. The system construction is a dynamic process of policy guidance, multi-factor coordination and continuous optimization. Digital education policy provides direction and institutional support

for curriculum reform; The curriculum objective system defines the requirements for cultivating digital literacy and computational thinking; The course content system is organized and updated around the goal, and incorporated into programming and other content; The curriculum implementation system is promoted by project-based, inquiry-based and digital teaching; The curriculum evaluation system obtains feedback by means of multiple evaluations, which in turn promotes curriculum improvement. The guarantee factors such as teachers' professional development, digital resources construction and school-based curriculum development run through the whole process and continue to affect the system operation.

Based on this, a conceptual model for the construction of the ICT curriculum system in Hong Kong is constructed: Digital education policies serve as external driving forces that act on core aspects such as goals, content, implementation, and evaluation, promoting continuous optimization of the curriculum; Evaluation feedback promotes goal adjustment, content updates, and teaching improvement in reverse, forming a dynamic cycle; The security system provides resources and capability support. A model of the construction mechanism of ICT curriculum system in Hong Kong is constructed, as shown in Figure 1.

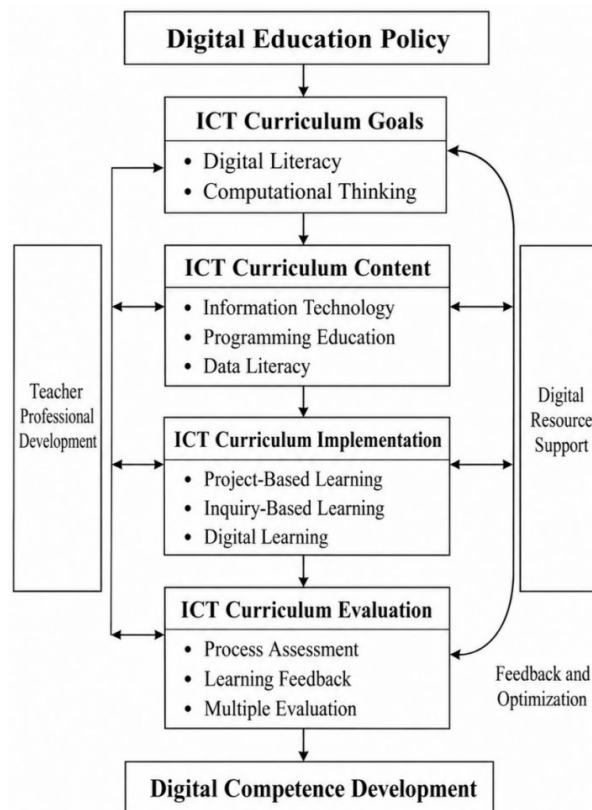


Figure 1. Model of ICT curriculum system construction mechanism in Hong Kong

Digital education policy drives system construction through key links, and teachers' professional development and digital resources provide operational guarantee. Evaluation feedback continues to play a role in curriculum optimization.

5. Optimization Path of ICT Curriculum System Construction in Hong Kong

5.1. Improve the curriculum content system

Under the background of digital education, the content of ICT courses should continuously adapt to the changes of technological development and personnel training needs. Hong Kong should further optimize the curriculum content structure and build a progressive curriculum system consisting of digital literacy, information processing, network security, computational thinking and innovative practice. While maintaining the continuity of basic information technology education, we should absorb the contents of emerging fields such as artificial intelligence and data analysis in time to enhance the times and foresight of the course. In addition, we should give full play to the advantages of school-based courses and develop characteristic courses according to the development orientation of different schools and the characteristics of students.

5.2. Strengthening the integration of programming education

Programming education has become an important way to cultivate computational thinking, but there is still a problem that programming courses and ICT courses are separated from each other in some schools. Therefore, it can promote the transformation of programming education from independent module to deep integration of curriculum system, and infiltrate programming thinking into information technology learning and digital practice activities. According to the development characteristics of students in different classes, a gradient training system from graphic programming to text programming is established to realize the continuous connection of programming ability training. It is also necessary to strengthen the coordinated development of programming education and STEM education, and guide students to improve their problem-solving ability through project practice.

5.3. Innovative curriculum implementation methods

Curriculum implementation is an important link in transforming curriculum objectives into students' abilities. Hong Kong schools should further promote the deep integration of digital technology and classroom teaching, actively explore teaching models such as project-based learning, inquiry based learning, and collaborative learning. In teaching, emphasis can be placed on creating real-life problem scenarios, guiding students to use digital technology to solve practical problems, and achieving an organic combination of knowledge learning and practical application. At the same time, it is necessary to fully utilize online learning platforms and digital resources to build a learning environment that integrates online and offline.

5.4. Improve teachers' digital literacy

Teachers are an important driving force for the construction of ICT curriculum system. Facing the new requirements of digital education transformation, schools and education management departments should establish a normalized teacher training mechanism to improve teachers' digital technology application ability, curriculum development ability and digital teaching design ability. In the emerging fields such as programming education and artificial intelligence education, special training and practical guidance should be strengthened to help teachers update their knowledge structure in time. In addition, teachers should be encouraged to participate in school-based teaching research and curriculum innovation practice to promote the sharing of teaching experience and professional growth.

5.5. Improve the curriculum guarantee mechanism

The construction of ICT curriculum system can not be separated from the support of perfect guarantee system. It is necessary to continuously optimize the allocation of digital education resources and narrow the gap between different schools in terms of equipment, platforms and curriculum resources. It is also necessary to strengthen the construction of digital education infrastructure and improve the level of digital teaching environment in schools. It also establishes a collaborative promotion mechanism of curriculum construction, teaching implementation and learning evaluation to ensure the continuous improvement and optimization of the curriculum. With the help of policy support, resource guarantee and system construction, it will provide some support for the high-quality development of ICT curriculum system in Hong Kong.

6. Conclusions

With the rapid development of digital education, the construction of ICT curriculum system has become an important way to cultivate students' digital literacy, computational thinking and innovative ability. Based on the grounded theory research method, this paper extracts the core elements through open coding and spindle coding, and constructs the conceptual model of ICT curriculum system construction in Hong Kong.

The construction of ICT curriculum system in Hong Kong is a dynamic process under the guidance of digital education policy, which is promoted by multi-dimensional factors such as curriculum design, teaching practice, evaluation feedback and resource guarantee. Policy provides direction and system support, curriculum goal determines the development direction, content integration programming education cultivates digital ability, implementation promotes the transformation from knowledge to ability, and evaluation promotes the continuous improvement of curriculum. The elements are interrelated and mutually promoted, which together constitute the basic logic of the operation of the ICT curriculum system in Hong Kong.

In practice, Hong Kong has achieved positive results in digital literacy training, programming education promotion and digital teaching. However, there are also some problems, such as uneven curriculum update, poor integration of programming education, great difference in teachers' digital

ability and uneven resource allocation. In the future, we should improve the course content, promote the cooperation between programming and ICT courses, innovate teaching methods, improve teachers' digital literacy, and improve the resources and system guarantee.

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