

The Theoretical and Knowledge System of Educational Technology Discipline in China

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Abstract: *“Educational Technology” is a complete and indivisible whole formed by the fusion two elements of education and technology. This expansive field encompasses research and practical applications aimed at addressing educational and instructional problems through technology. The conventional practice of relying on a singular definition to elucidate educational technology has resulted in confusion and operational challenges. This article introduces the concept of a definition group of educational technology, delves into the discipline’s research objects, research purpose and tasks, research domain and scope, disciplinary foundation, research methods, visual representation of the disciplinary structure, and the logical starting point and positioning, and establishes distinct theory and knowledge systems for educational technology discipline in China, offering a comprehensive interpretation of the discipline’s connotations and extensions.*

Keywords: educational technology; discipline; definition group; connotation; extension; theoretical system; knowledge system

“Educational Technology” is formed by the fusion of two elements of education and technology, yet education + technique \neq educational technology. Just as water is composed of two elements, hydrogen and oxygen, the simple addition of mixing of hydrogen and oxygen cannot form water; it must undergo chemical reactions (fusion) under certain conditions to form. Similarly, educational technology is the result of the organic fusion of education and technique. In genuine educational technology, it forms a cohesive and indivisible whole without distinguishing between education and technique.

This article aims to explain the concepts and connotations associated with the field of educational technology, seeking to foster a comprehensive understanding of this domain¹.

1. Due to space constraints, this article only presents the conclusions to the pertinent issues. For a more in-depth understanding and access to additional supporting materials and the argumentation process, please refer to my monograph, "Foundations of Educational Technology 教育技术学论纲," published by East China Normal University Press, ISBN 978-7-5760-0308-6, as well as other relevant articles.

1 Educational Technology Definition Group

Educational technology is an expansive field encompassing all research and practices that apply technologies to address educational and instructional problems. China's educational technology field has unique characteristics, comprising of three integral components: educational technology discipline (including majors), the educational technology cause, and the educational technology industry. It involves various aspects such as fields, disciplines, theories, practices, as well as institutions, mechanisms, and sustainable development.

What is commonly referred to as “educational technology” can sometimes denote the concept itself, defining what educational technology is or what falls under its purview. At times, it signifies the practical applications of educational technology, encapsulating the work and activities related to it. On occasion, it points to the theoretical construction of educational technology, including the discipline and majors. In certain instances, it may even encompass the entire field of educational technology. Without specific clarification, this ambiguity can lead to differences in understanding and prolonged debates. Therefore, before delving into discussions or considerations regarding educational technology, it is crucial to establish the specific context. To provide a clear explanation of “educational technology,” it becomes imperative to address fundamental questions such as what it is, why it exists, the principles guiding it, its potential applications, and the methodologies involved. For a long time, we have been accustomed to using a single definition to explain educational technology, which has caused confusion in understanding and embarrassment in practice.

Looking at the definitions of educational technology both domestically and internationally, the focus is primarily on delineating the field or its applications. It often emphasizes what educational technology can achieve or the methods involved, yet it falls short of providing a clear explanation of what educational technology truly is. Consequently, this ambiguity has led to a lack of a defined research object in educational technology, a broad scope without clear boundaries, leaving those involved in educational technology at a loss.

1.1 Expression of “Educational Technology Definition Group”

1.1.1 Proposal and revision of the concept of “definition groups”

To address the aforementioned issues, the author introduced a multi-tiered conceptual approach in 1998. The term “educational technology” is a compound concept belonging to different levels. Its definition should manifest as a “system” rather than being exclusively encapsulated by a single expression. Failure to do so may lead to theoretical and practical confusion. Depending on the levels of discourse, educational technology can be broken down into three levels: the essence of educational technology, narrow educational technology, and broad educational technology (Research Group on “Developing Educational Technology, Promoting Modernization of Education,” 2001).

In 2002, starting from the connotation of educational technology, the proposition of “definition system of educational technology” was first proposed: The narrow level of educational technology was designated as the practical level, and the broad level of educational technology

was named the theoretical level, while the essence level remained unchanged.

In 2005, during the deepening and improving of the “Series of Papers on the Theory and Practice of the Educational Technology Discipline (Papers 1-5),” added a comprehensive concept of the “educational technology field.” Subsequently, this field concept, combined with the concepts of three levels, collectively formed the complete “educational technology definition system.”

In 2008, to commemorate the author’s 50 years of involvement in educational technology, the China Association for Educational Technology edited and published the book, *Selected Works of Li Long on Educational Technology*. The author made final revisions to the educational technology definition system. Subsequently, to avoid excessive use of the term “system.” the designation was modified to “educational technology definition group.”

1.1.2 Complete articulation of the definition group of educational technology

From 1998 to 2008, after a full decade of research, reflection, and continuous revision, the expression of the definition group that comprehensively reflects the connotation of educational technology was determined.

(1) Concepts in the field of educational technology

Educational technology is a research and applied field focused on appropriately employing relevant means and methods to enhance educational performance.

(2) Concepts at the noumenon level

Educational technology is a collective term for the means and methods used by humans in education and teaching activities.

(3) Concepts at the practical level

Educational technology is a practical activity that utilizes relevant means and methods to improve educational performance under the guidance of advanced educational ideas and theories.

(4) Concepts at the theoretical level

Educational technology is a discipline that studies the theories, laws, and methods of applying relevant technologies to improve performance in education.

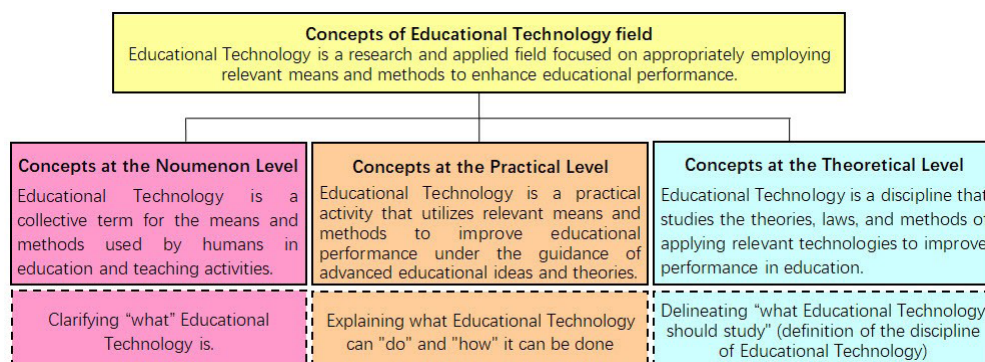
(5) The expression of the complete “education technology definition group”

The above concepts at the noumenon level of educational technology clarify “what” educational technology is. The concepts at the practical level explain what educational technology can “do” and “how” it can be done. The concepts at the theoretical level delineate “what educational technology should study,” namely, the definition of the discipline of educational technology. Together with the concepts of the field, they collectively form the definition group

of educational technology, providing a complete elucidation of the basic connotation of the educational technology. Its structure is shown in Figure 1.

Figure 1

Educational Technology Definition Group



Note. Adapted from "Field, Discipline, and Majors of Educational Technology" by L. Li, 2005, *China Educational Technology*, (12), 5-10.

The above definition group provides a common platform for us to engage in various research and practice in the field of educational technology, and also lays the foundation for our interactions with other disciplines. The three levels of concepts that constitute the definition group can also be used separately according to their relevant scopes. When discussing and understanding what educational technology is, the concepts at the noumenon level of educational technology should be employed. When addressing practical issues in education and engaging in actual work related to educational technology (electrified education), the concepts at the practical level of educational technology is clearer and more concise that help ease understanding and facilitate practical application. When engaging in research on educational technology theory and practice, as well as disciplinary and professional construction, the concepts at the theoretical level of educational technology should be taken as the basis, which include the "objects, objectives, tasks, field, scopes, and methods" of educational technology research.

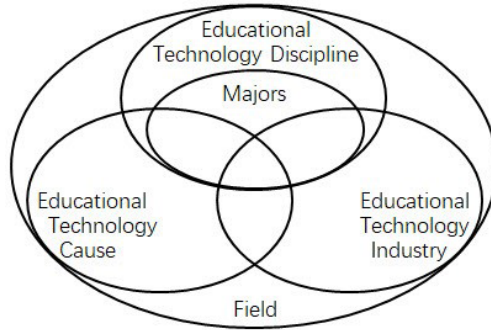
1.2 The Relationship between Relevant Concepts in the Field of Educational Technology in China

1.2.1 The field of educational technology in China

China's educational technology fully inherits the research achievements of electrified education in that "electrified education is a science, a cause, and also an industry" (Nan, 1997, p. 6). That is to say, China has a unique and complete field of educational technology in the world, which includes three parts: educational technology discipline (including majors), educational technology cause, and educational technology industry, as shown in Figure 2.

Figure 2

Composition of China's Educational Technology Field



Note. Adapted from “Field, Discipline, and Majors of Educational Technology” by L. Li, 2005, *China Educational Technology*, (12), 5-10.

From Figure 2, the discipline (including majors) is just a part of the educational technology field. Therefore, in the construction of discipline, grasping both the connotation and extension of the discipline is important. Incorporating all issues within the field of educational technology, including those within the broader field of education, into the discipline of educational technology should be avoided as this may lead to an undue “generalization” of the discipline. At the same time, important to note that disciplines should not be used to replace the entire field. Using a single theory or model to “regulate” the educational technology industry can lead to impatience, superficiality, and an eagerness for quick success in educational technology practice. Currently, many issues in the development of educational technology are closely related to the confusion of boundaries between fields and disciplines.

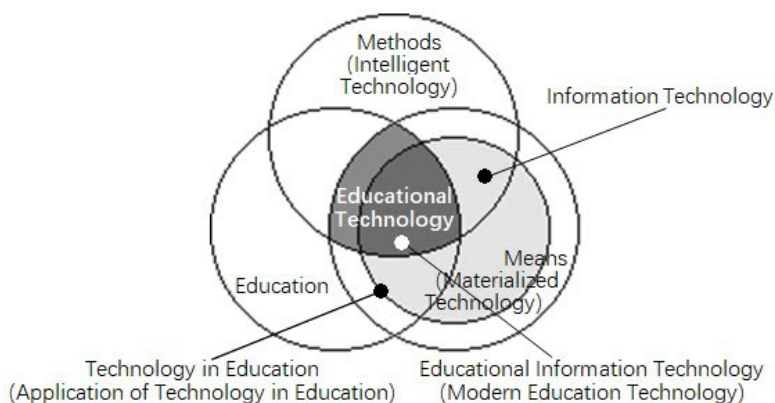
Educational technology is not equal to instructional technology; it also includes education system design, the development of the education ecological environment, and more. Therefore, the connotation and development of the discipline of educational technology from a macro perspective does not artificially “narrow” it down to an “instructional technology” discipline that only focuses on the teaching level. In addition, in the process of implementing educational informatization, not only does educational technology personnel participate, but also a large number of education and psychology experts and scholars, frontline teachers, as well as companies and enterprises engage in computer networks, mobile communication, and artificial intelligence actively participate. We need to learn from the spirit of inclusiveness of electrified education predecessors that inherit and carry forward the glorious tradition of “nationwide electrified education as one family,” and highlight the characteristics of China’s “Big e-Education (大电教).” This will help unite all forces promoting educational modernization, and jointly participate in the practice of digital transformation in education.

1.2.2 Relationship between educational technology, modern educational technology, and educational information technology

Based on the concept at the noumenon level of educational technology, Figure 3 illustrates the components of educational technology. In the diagram, “means” refers to the materialized form of technology, while “methods” refer to the intelligent form of technology. The combination of both constitutes technology in its complete sense. From the figure, it can be observed that when only “means” (materialized technology) is present without “methods” (intelligent technology), the integration of education with “means” (materialized technology) can only be termed as “technology in education” or “the application of technology in education,” rather than “educational technology.” Only when both “means” (materialized technology) and “methods” (intelligent technology) coexist and their integration with education forms the “intersection” of the three, can it be termed as “educational technology,” as indicated by the darkly shaded portion in Figure 3.

Figure 3

Constituent Elements of Educational Technology



Note. Adapted from “Positioning of the Discipline of Educational technology: Two Discussions the Theory and Practice of the Discipline of Educational technology,” by L. Li, 2003, *e-Education Research*, (11), 18-22.

From Figure 3, it can also be seen that “information technology” (depicted by the light shaded portion) is a part of “technology,” or the part where it intersects with “education” and “methods” is called “educational information technology” (indicated by the deepest shaded portion in the figure).

This reveals that “educational information technology” is a component of “educational technology” rather than its entirety. In other words, “educational information technology” is not synonymous with “educational technology,” its connotation is smaller than “educational technology.” By comparing the connotation of modern educational technology, it can be seen that “educational information technology” is basically equivalent to modern educational technology.

1.2.3 Relationship between electrified education, informatization education, smart education, intelligence education, and modern educational technology

Electrified education refers to the use of modern educational technology in educational activities under the guidance of modern educational ideologies and theories to achieve the optimization of the educational process (Nan, 1998).

Informatization education is a new educational method guided by modern educational ideologies and theories. It mainly utilizes modern information technology to develop educational resources, enhance the educational process, and aims to cultivate and improve students' information literacy. As Nan (2011) described, "Informatization education is the term used in the new stage of the electrified education's development, ...informatization education is the manifestation of electrified education in the information age" (p. 17).

The essence of smart education lies in building an intelligent environment through the application of intelligent technology (clever technology), enabling both teachers and students to use smart teaching and learning methods. This transformation turns the impossible into possible, transcending small abilities to great ones, and ultimately nurtures individuals with a strong value orientation, high cognitive quality, and robust implementation abilities (Zhu & He, 2012).

Intelligence education is a new field formed by the combination of artificial intelligence and learning science, aiming to use artificial intelligence technology to observe and understand more deeply and meticulously how learning occurs and how it is influenced by various external factors, thereby creating conditions for efficient learning (Ru et al., 2019).

Modern educational technology refers to the application of information technology, with computers as its core, in the field of education and teaching (He, 1999).

After a thorough comparison of the basic concepts of electrified education, informatization education, smart education, intelligence education, and modern educational technology proposed by multiple experts and scholars in China, their research objects and objectives are basically the same, with similar essence. However, smart education and intelligent education pay more attention to the impact and innovation of new technologies (big data, virtual simulation, and artificial intelligence) on education.

1.2.4 Relationships among relevant concepts in the field of educational technology in China

Building upon the preceding discussion, the relationships among concepts related to educational technology can be outlined as follows:

(1) The research objects and objectives of electrified education and modern educational technology are essentially the same.

(2) Informatization education is the electrified education in the information age.

(3) Educational information technology is basically equivalent to modern educational technology.

(4) Educational information technology is a part of educational technology, rather than its entirety.

(5) Modern educational technology represents the contemporary phase of educational technology, placing a greater emphasis the application of information technology in education.

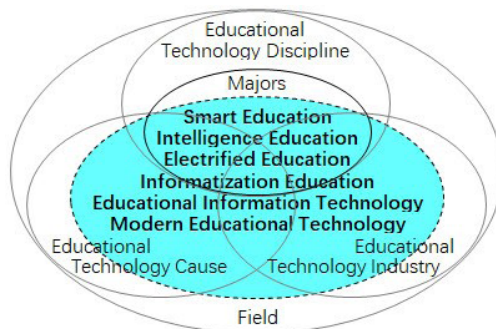
(6) Smart education serves as an educational model integrating modern information technology and advanced educational concepts (Zhu et al., 2023). The research framework includes three elements: a smart environment based on technological innovation applications, a smart teaching method rooted in methodological innovation, and a smart evaluation grounded in talent concept transformation (Gu et al., 2021). From here, we can glimpse at the clues of the “post-educational technology stage.”

(7) Artificial intelligence technology is a part of information technology, so intelligent education is a component of educational information technology, not its entirety.

From this, the concepts of electrified education, informatization education, educational information technology, smart education, intelligent education, and modern educational technology have similar connotations and are all part of educational technology, that is, a “subset” of educational technology. Educational technology is their “collection”. Therefore, concepts such as electrified education, informatization education, educational information technology, smart education, intelligent education, and modern educational technology are not the same level of concept for educational technology. The relationship between them can be illustrated by the composition diagram of China’s educational technology field, as shown in Figure 4.

Figure 4

Schematic Diagram of the Position of Informatized Education in the Field of Educational Technology



Note. Adapted from *Selected Works of Li Long on Educational technology* (p. 99), by China Association for Educational Technology, 2009. Central Radio and Television University Press.

From Figure 4, it is evident that smart education, intelligence education, electrified education, informatization education, educational information technology, and modern educational technology include certain aspects of the educational technology undertakings and the educational technology industry. They are also integral components of the educational technology discipline (including majors), yet they do not represent the entirety of educational technology.

Electrified education has established a robust foundation for the development of educational technology in China, and the progress in educational technology has, in turn, provided additional theoretical foundations and practical avenues for electrified education. Accurately understanding the connotations of these concepts and their interrelationships to avoid getting entangled in meaningless “name controversy” is important.

2 The Connotation of the Educational Technology Discipline

Based on the concept of the educational technology discipline, which states that it is “educational technology is a discipline that studies the theories, laws, and methods of applying relevant technologies to improve performance in education,” the connotation of the discipline includes the following aspects.

2.1 Research Object

The definition of “object” in “Cihai 辞海” refers to the entity that is observed and studied (Cihai Editorial Committee, 1999, p. 600). The research object of a discipline is naturally the entity of observation and thinking in this discipline (academic community). However, entities and objects are two interrelated and not entirely identical concepts. Qu (1986) proposed that:

The research object is a concept at the epistemological level, which is not completely consistent with objective existence. The objects always map to a certain subject, and the understanding of the object by the subject always starts from a certain perspective. Moreover, the subject’s understanding of the object is largely attributed to the methods of cognition. (as cited in Guo, 2002, p. 13)

Due to differences in the academic experiences and mastery of disciplinary knowledge among cognitive subjects, along with variations in perspectives and methods for addressing research problems, the understanding of the research object in a discipline can differ. In other words, a discipline may have several descriptions of the research object, all originating from a particular perspective, and there is no absolute right or wrong. The author believes:

The research object of educational technology discipline can be divided into two levels: the broad sense research object is educational technology issues; the narrow sense research object is the educational application of related technologies (Li, 2020, pp. 250-251).

2.1.1 Broad sense research object

The broad sense research object of educational technology discipline is “educational technology issues”. This includes technical issues in education, education issues related to technology, and questions regarding the relationship between technology and education.

Technical issues in education refer to those technological issues that hold educational value. Education issues related to technology encompass problems in education that arise from the introduction of technology into the educational domain. The relationship between technology and education primarily involves issues related to the “ecological changes” caused by technology

entering the educational domain, the value of technology in education, and methodological issues supported by technology. In essence, this involves the establishment of a comprehensive educational technology value system, thereby fostering research and construction in the philosophy of educational technology. At present, full attention should be paid to the relationship between big models, generative artificial intelligence, and education to promote the health and compliance with ethical requirements development of education.

2.1.2 Narrow sense research object

The narrow sense research object of educational technology discipline is the “the educational application of related technologies,” which can also be expressed as “technology in education.” The object it describes is clear and easy to understand and master and can be used as a research object for the branch discipline of educational technology. For example, the research object of electrified education is the “application of modern educational media,” the research object of informatized education is the “educational application of modern information technology,” and the research object of educational information technology is “information technology in education,” and so on.

2.1.3 Relationship between broad sense and narrow sense research objects

The narrow sense research object expresses the most direct research problem of educational technology discipline, falling within the realm of the “technological技” aspect. The broad sense research object directly demonstrates the direction and scope that educational technology disciplines should study, belonging to the “philosophical道” aspect, possessing a higher level of generality and abstraction. For the educational technology discipline to thrive within the academic landscape, it needs to elevate from the “technological技” aspect to the “philosophical道” aspect.

2.2 Research Purpose and Tasks

2.2.1 Research purpose

The purpose of educational technology discipline research is to enhance the performance of education.

According to the explanation in the “Modern Chinese Dictionary,” performance (绩效) includes two parts: achievement (绩) and effectiveness (效) (Institute of Language, CASS, 1996, p. 602). Achievement refers to the results of work, reflecting goal management and duty requirements. Effectiveness refers to effects, efficiency, and benefits, embodying aspects such as quantity, quality, time, and returns.

Educational technology aims to, through its research and practice, not only enhance educational effects but also improve efficiency and benefits. For instance, in the process of educational informatization, various new technologies are applied to educational practices, leading to improvements in the learning environment, significant enrichment of educational resources, changes in students’ learning methods and teachers’ teaching methods, and the

expansion of educational scale, among other aspects. The focus of the educational technology discipline is on whether the quality of education has been improved, whether the imbalance in education among different regions has been addressed, and whether the inputs and outcomes in various aspects are within reasonable ranges. It also explores how to promote the coordinated development of educational effects, efficiency, and benefits through rational interventions.

2.2.2 Research tasks

The tasks of educational technology discipline research are to propose theories, laws, and methods for using relevant technologies to improve educational performance.

Every mature discipline has a comprehensive knowledge system derived from its theoretical framework. The discipline of educational technology needs to draw upon its theoretical framework to systematically summarize and propose theories, laws, and methods for utilizing relevant technologies to improve educational performance. This process aims to cultivate professionals in educational technology with the necessary knowledge and skills and to use educational informatization to promote educational modernization.

2.3 Domain and Scope of Research

2.3.1 Research domain

The research domain of educational technology discipline is divided into two parts: theory and practice. The theoretical research domain reflects the connotation of the discipline of educational technology, while the practical research domain reflects the extension of the discipline of educational technology.

(1) Theoretical research domain

The theoretical research domain of educational technology discipline mainly solves the problems such as “what is it, what can I do, what according to, how to do, and why do it” within the discipline. This field aims to construct and improve the theoretical framework of the discipline and further establish the knowledge system of the discipline.

(2) Practical research domain

The practical research domain of educational technology discipline, also known as the application domain of educational technology, mainly consists of three major systems:

- ① School education system: Deepening teaching reforms and enhancing students’ core competencies; conducting practical research on the deep integration of information technology and teaching; and optimizing the learning process and resources, improving teaching quality and benefits of running a school, and more.
- ② Distance education system: Developing online courses and teaching resources, and building a learning support service system; conducting research on distance education and open education models, and more.

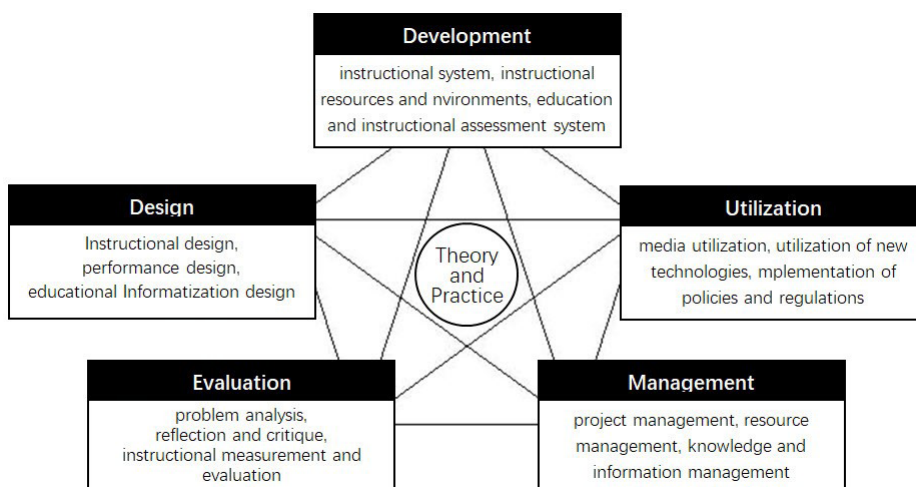
- ③ Social education system: Conducting research on community education, lifelong education, enterprise and cause training, and human resource development; promoting the application of performance technology, and more.

2.3.2 Research scope

The scope of research in educational technology discipline in our country is consistent with the definition in AECT1994, which includes the design, development, utilization, management, and evaluation of processes and resources related to teaching (learning), but the content is not entirely the same, as shown in Figure 5.

Figure 5

Scopes of Educational Technology Research in China



Note. Adapted from *Foundations of Educational Technology: The Past, Present, and Future of Educational Technology* (p.254), by L. Li, 2020, , East China Normal University Press.

The design scope mainly refers to the instructional design at various levels of the instructional system, and the performance design that has developed as a result. Of course, educational informatization (including the digital transformation of education), ranging from top-level design to the design of specific implementation projects is also an important aspect of educational technology research.

The development scope mainly refers to the integration of relevant theories and technologies, especially information science and technology, for the development and research of instructional systems and other related systems. For example, scope can include the development of teaching systems, development of teaching resources and environments, and development of education and teaching evaluation systems supported by big data and artificial intelligence technology.

The utilization scope mainly refers to the application of various means and methods,

especially information technology means and methods, in education, teaching, and related systems to improve their performance. This includes media utilization, utilization of new technologies (big data, virtual simulation, artificial intelligence), and the implementation of policies and regulations.

The management scope mainly refers to the big data management of related systems, such as projects, resources, knowledge, and information.

The evaluation scope primarily involves analyzing educational and teaching issues, conducting retrospective reflection and criticism of the process and results of implementing educational technology, establishing scientific evaluation standards for relevant systems, and conducting educational and teaching measurement and evaluation with technical (especially big data and artificial intelligence) support.

2.4 Discipline Foundation and Research Methods

2.4.1 Discipline foundation

In the article “The Composition of The Knowledge System of Educational Technology Discipline Three Discussions on the Theory and Practice of Educational Technology Discipline,” the author previously proposed that the discipline foundation of educational technology includes research on philosophical, methodological, theoretical, and technical foundations. In the research results of the “fifteenth five-year plan” project titled “research on the development of educational technology theory” the philosophical foundation and methodological foundation were merged, and the foundation of the educational technology discipline was decomposed into four parts: philosophical foundation, theoretical foundation, technical foundation, and artistic foundation. Because the communication theory in the above “theoretical foundation” mainly refers to educational communication theory, it still belongs to the educational domain. Therefore, in 2008 it was further clarified that the discipline foundation of educational technology consists of four parts: philosophical foundation, educational foundation, technical foundation, and artistic foundation. Inheriting and developing the argument of “the talent issue in electrified education can be divided into three aspects: first, technology, second, art, and third, education (Shu, 1947, p. 112)”.

(1) Philosophical foundation

Philosophical orientation refers to the way things are viewed, including values, epistemology, and methodology. Therefore, the philosophical foundation of the discipline of educational technology is composed of the values and epistemology of education and technology, as well as the systematic methodology guided by the theory of complexity science. Complex science, in turn, is composed of the traditional three theories (system theory, control theory, information theory), the new three theories of self-organization theory (dissipative structure theory, synergy theory, catastrophe theory), and the latest three theories of —nonlinear science (chaos theory, fractal theory, hypercycle theory).

(2) Educational foundation

The educational foundation consists of three parts: learning theory, instructional theory, and educational communication theory. Together, they support the theoretical building of educational technology discipline. With the increasing integration of new technologies into the field of education, a significant transformation in the “learning and teaching” approaches has occurred. In addition to traditional learning theories such as behaviorism, cognitivism, and humanism, there is a growing emphasis on the supportive role of new learning theories such as constructivism, situated cognition, connectivism, distributed cognition, embodied cognition, and activity theory.

(3) Technological foundation

The technological foundation includes multimedia technology, network communication technology, and artificial intelligence technology. Multimedia technology refers to the comprehensive processing and management of various media information such as text, data, graphics, images, animation, and sound through computers. This enables users to engage in real-time information interaction with computers through various senses. Network communication technology involves the collection, storage, processing, and transmission of information resources in various forms such as text, graphics, images, and sound, through computers and network communication devices, facilitating the full sharing of information resources. Artificial intelligence (AI) is the study and development of theories, methods, and technologies for simulating, extending, and expanding human intelligence. Its main direction is to develop functions related to human intelligence such as reasoning, deep learning, and problem-solving abilities. Currently, more attention should be paid to the impact of big data models and generative artificial intelligence on education.

(4) Artistic foundation

Education is both a science and an art. Educational activities not only need to adhere to educational principles and laws but also should embody uniqueness and artistic qualities. The development of educational media resources should not only focus on educational, scientific, technological, and practical aspects but also fully leverage artistic qualities. Artistic proficiency relies on the support of literary, artistic, and aesthetic theories. Therefore, the artistic foundation of the educational technology discipline consists of three parts: literary theory, artistic theory, and aesthetic theory.

2.4.2 Research methods

Scientific research methods refer to the tools and means used in research to discover new phenomena and things, or to propose new theories and viewpoints, and to reveal the inherent laws of phenomena. Generally, scientific research methods can be classified into philosophical research methods, general research methods, and specialized research methods:

(1) Philosophical research methods refer to using the methodology of complex scientific research to guide the overall process of scientific research and the selection of specific research methods. Mainly, they include dialectical methods, phenomenological methods, and systems science methods.

(2) General research methods consist of experiential methods and theoretical methods:

experiential methods primarily include literature review, survey, observation, and experimental research; theoretical methods mainly involve mathematical methods and logical methods.

(3) The specialized research methods mainly include content analysis supported by big data, model construction, empirical research, action research, and design-based research, etc.

The characteristic of research methods in the field of educational technology is, under the guidance of the “holistic optimization” methodology, the effective selection and integration of existing methods, particularly employing new technology-supported visualization methods for specific research.

2.5 Visualization Display of Educational Technology Discipline Structure

2.5.1 Hierarchical structure of the discipline

The structure of the educational technology discipline is composed of multiple levels, with branches and cross-relationships existing between these levels, forming a complete and organic entity.

(1) Research domain —first level of the disciplinary structure

The research domain of educational technology discipline includes two aspects: “theory” and “practice,” and both are independent of each other and closely related.

As a discipline, educational technology often interweaves theoretical research and practical application. The emphasis may vary when engaging in specific tasks. For professionals in the field of educational technology, even though their roles differ—some focusing on theoretical research and others on practical application—the goal remains the same: to enhance educational performance and ultimately promote “human development.” Therefore, when conducting theoretical research, it should be in line with the national conditions and reality, and able to solve the problems raised in practice. The research should also pay attention to summarizing laws from practice and enriching theoretical achievements to better guide practice and promote the development of education cause. When engaging in practical work, attention should be paid to using theory as a guide, avoiding blindness and arbitrariness, and improving work efficiency and benefits. Consciously paying attention to discovering problems and summarizing patterns from practice and elevating them to theory should be practiced.

(2) Research objects—second level of the disciplinary structure

According to the definition provided by AECT 1994, the object of educational technology research is the “processes and resources related to teaching (learning).” Educational technology typically does not separately study the composition of technology (this is the content of research in related technical disciplines). But, it is to study how to apply technology to solve educational and teaching problems in the processes and resources related to teaching (learning), and analyze the position and role of technology in it through the study of processes and resources. Educational objectives are primarily (though not exclusively) achieved through the learning of the students. Therefore, in the realm of theoretical research, there is a greater emphasis on studying the learning processes and learning resources.

Effectively conducting in-depth research on learning processes and learning resources needs to base the investigation on specific theories, methodologies, and optimized organizational structures. Therefore, both the disciplinary foundation and the development of the discipline are also subjects of theoretical research in the domain.

In the process of human growth and development, school education plays a crucial role. In a sense, it has a decisive impact on an individual's entire life. However, with the progress of society, the knowledge acquired, and education received in schools are no longer sufficient to meet the rapidly evolving needs of society. Lifelong education has been placed on the agenda, and in line with this, distance education is experiencing rapid development. Distance education not only provides learning opportunities free from the constraints of time, location, and geographical differences but also offers content suitable for individuals of different ages, professions, educational levels, and non-educational backgrounds. Therefore, distance education is becoming a new growth point for educational technology in the process of promoting educational modernization. In addition, educational technology also plays a role in promoting the development of enterprises and cause within the social system.

Therefore, the objects of application and research in the domain of educational technology practice include school education systems, distance education systems, and social education systems, thereby expanding the epitaxy of the discipline of educational technology.

(3) Research scope——third level of the disciplinary structure

The scope of educational technology research includes the “design, development, utilization, management, and evaluation” of related processes and resources, as well as the study of their concepts and connotations. The relevant processes and resources mainly refer to the learning process and learning resources.

Furthermore, research and application in educational technology require a foundation in relevant disciplinary knowledge, including philosophical, educational, technological, and artistic bases. The research on the development of the discipline of educational technology encompasses the development history, fundamental theories, professional development, and research methods within this discipline.

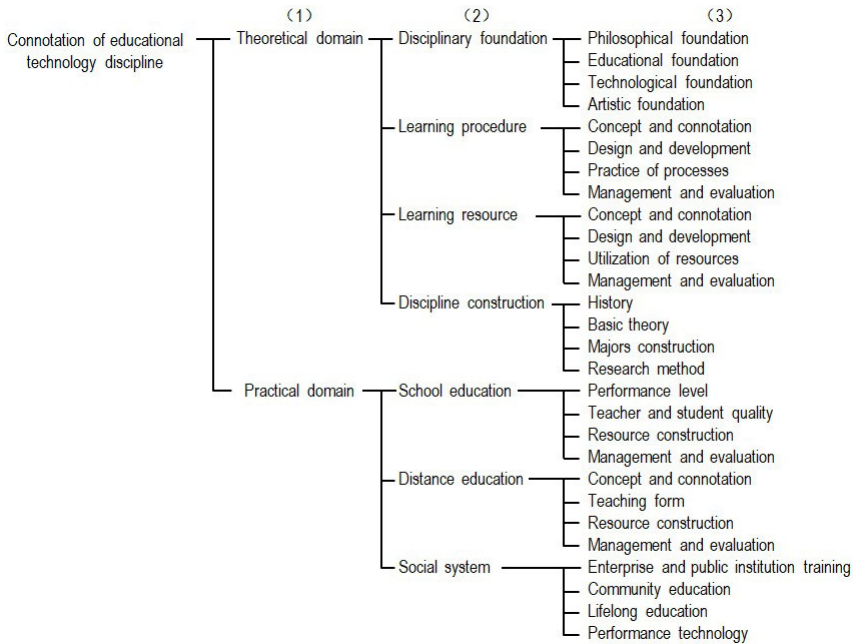
In the practical domain, the application research of educational technology in school education includes improving performance levels, enhancing the quality of teachers and students, strengthening resource development, and effective management and evaluation. In the application research of educational technology in distance education, it involves clarifying its concepts and content, selecting effective teaching forms, strengthening resource development, and ensuring proper management and evaluation. In the application research of educational technology in social education, it covers enterprise and cause training, performance technology, community education, and lifelong education. This includes formal education, social education, popular science education, family education, corporate training, and all aspects that meet the developmental needs of learners.

2.5.2 Framework of the discipline

In summary, we can draw the framework of educational technology discipline in the form of a tree structure, as shown in Figure 6.

Figure 6

Framework of Educational Technology Discipline



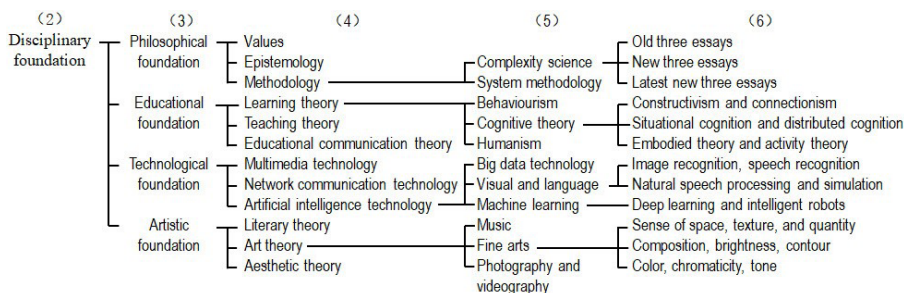
Note. Adapted from “The Composition of the Knowledge System of Educational Technology Discipline: Three Discussions on the Theory and Practice of Educational Technology Discipline,” by L. Li, 2004, *e-Education Research*, (2), 3-8.

Figure 6 shows the content of the first, second, and third levels within the structure of educational technology discipline. Each item in the third level can be further divided into several sub-items, thus forming the fourth level, and so on.

In the theoretical domain, the “disciplinary foundation” can be divided into four parts (the third level) philosophical foundation, educational foundation, technological foundation, and artistic foundation. The philosophical foundation consists of values, epistemology, and methodology. The educational foundation consists of learning theory, teaching theory, and educational communication theory. The technical foundation consists of multimedia technology, network communication technology, and artificial intelligence technology. The artistic foundation consists of literary theory, art theory, and aesthetic theory. The above content constitutes the fourth level of the “disciplinary foundation.” If necessary, further decomposition can be carried out, as shown in the example in Figure 7, to form the fifth and sixth levels.

Figure 7

Diagram Illustrating the Unfolding of Disciplinary Foundation

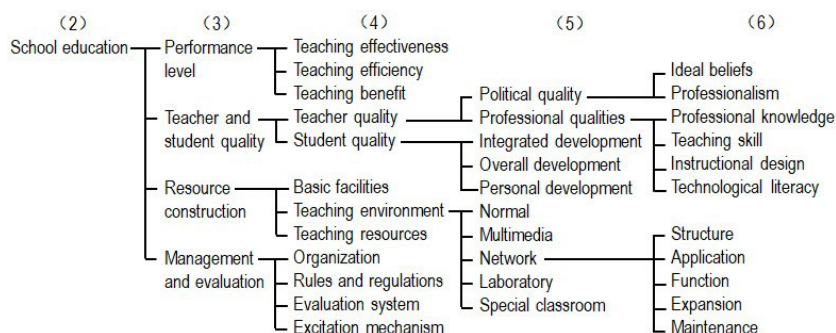


Note. Adapted from “The Composition of the Knowledge System of Educational Technology Discipline: Three Discussions on the Theory and Practice of Educational Technology Discipline,” by L. Li, 2004, *e-Education Research*, (2), 3-8.

In the practical domain, “school education” can be decomposed into four parts (the third level): performance level, teacher and student quality, resource construction, and management and evaluation. Performance level includes improving teaching effectiveness, efficiency, and benefits. The quality of teachers and students includes improving the quality of teachers, students, and establishing a new type of teacher-student relationship. Resource construction includes the improvement and enrichment in school’s basic facilities, teaching environment, and teaching resources in schools. Management and evaluation include optimizing organizational structure, improving rules and regulations, establishing evaluation systems, and establishing incentive mechanisms. The above content constitutes the fourth level of the “school education” section. If necessary, further decomposition can be carried out, as shown in the example in Figure 8, to form the fifth level, the sixth level, and so on.

Figure 8

Diagram Illustrating the Unfolding of School Education



Note. Adapted from “The Composition of the Knowledge System of Educational Technology Discipline: Three Discussions on the Theory and Practice of Educational Technology Discipline,” by L. Li, 2004, *e-Education Research*, (2), 3-8.

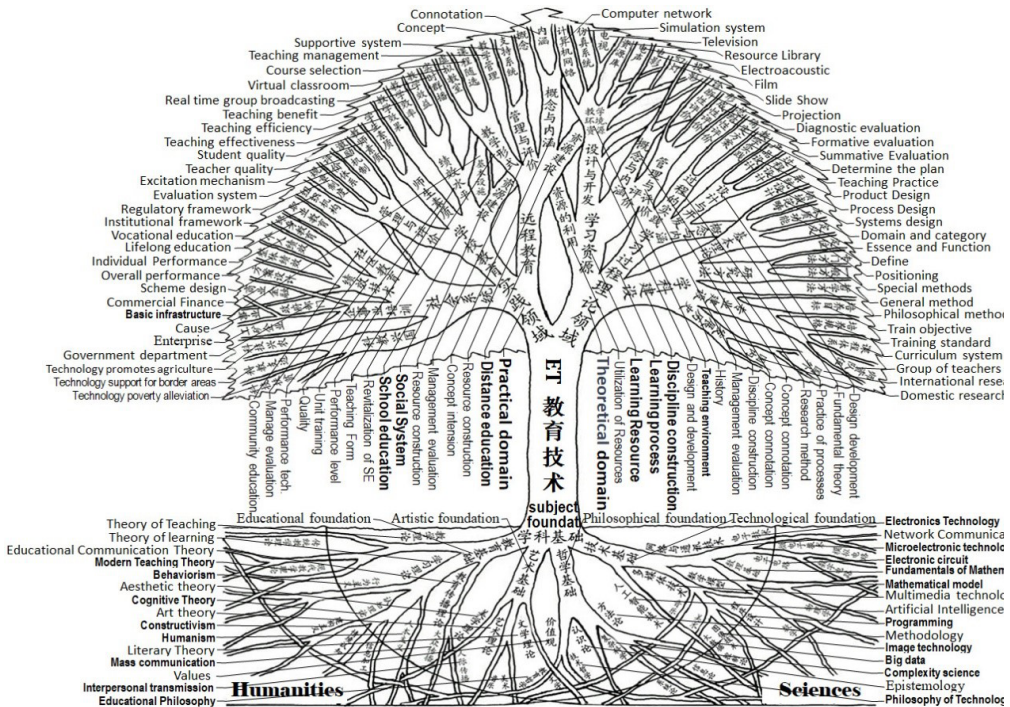
The above are just two examples, and the other projects in Figure 6 can also be expanded one by one.

2.5.3 Educational technology discipline tree

To more vividly and clearly represent the system of educational technology discipline structure, the author designed it in the shape of a tree, referred to as the educational technology discipline tree, as shown in Figure 9.

Figure 9

Educational Technology Discipline Tree



Note. Adapted from “The Composition of the Knowledge System of Educational Technology Discipline: Three Discussions on the Theory and Practice of Educational Technology Discipline,” by L. Li, 2004, *e-Education Research*, (2), 3-8.

From Figure 9, it is clear to see the hierarchy and content of the disciplinary structure:

(1) The foundation of educational technology is profound and rooted in numerous related disciplines. It encompasses both disciplines of natural sciences and humanities. In this soil where arts and sciences intersect, the new seedling of educational technology has grown, reflecting the characteristics of an interdisciplinary discipline from the beginning. Although it may not be fully developed now, one day it will grow into a towering tree and stand tall in the forest of disciplines.

(2) Although the disciplinary structure is divided into two major domains of theory and practice, they are intricately connected. While a particular research focus may emphasize one area, it will never be exclusively related to one field without any connection to the other.

(3) Educational technology institutions at all levels and types can find their positions within

the discipline structure of educational technology according to their missions, establishing their development directions. Educational technology professionals and students can also determine their own development directions or research fields by aligning their work or research focus with the disciplinary structure.

2.6 Discipline's Logical Starting Point and Discipline Positioning

2.6.1 Logical starting point of the educational technology discipline

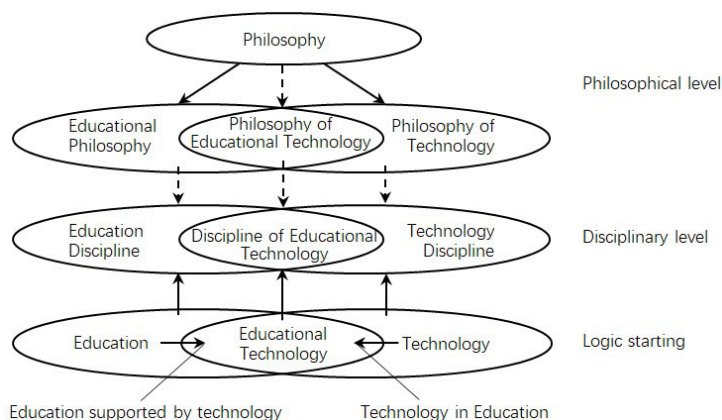
Qu Baokui once pointed out:

Since the question of the logical starting point is a fundamental issue in philosophy and particularly logical research, its understanding cannot be separated from relevant theories in philosophy and logic. The logical starting point, also known as the logical beginning or logical inception. It refers to the initial category of a science or discipline structure, the starting point of a theoretical system, and the first definition that allows the entire logical system to unfold and be richly completed. In Hegel's words, it is "what science should begin with" (Qu & Zheng, 1998, p. 3)

Generally believed is that the logical starting point the disciplines of educational technology is "technology in education" or "education supported by technology," used to represent the difference in the logical starting points between disciplines of educational technology, and education discipline and technology discipline. However, "technology in education" or "education supported by technology" itself encompasses both "education" and "technology" elements. In other words, these concepts are constituted by the elements of "education" and "technology." Therefore, they are intermediate products, and the true logical starting point of educational technology disciplines should include both "education" and "technology" two elements, as shown in Figure 10.

Figure 10

The Logical Starting Point of the Educational Technology Discipline



Note. Adapted from "Positioning of the Discipline of Educational Technology: On the Theory and Practice of the Discipline of Educational Technology," by L. Li, 2003, *e-Education Research*, (11), 18-22.

The discipline that studies the laws, principles, and methods of education is called pedagogy (Zhang, 1985, p. 181); correspondingly, the discipline that studies the theory, laws, and methods of technique should be called science of technology.

From Figure 10, the logical starting point of pedagogy is “education,” while the logical starting point of technology science is “technology.” Discipline of educational technology is the integration of pedagogy and technology science, reflecting the theories, laws, and methods of “technology in education” or “education supported by technology.” “Technology in education” or “education supported by technology” all consist of the two elements of “education” and “technology.” Therefore, the logical starting point of the discipline of educational technology should be the dual structure of “education and technology.” Any content that belongs to the research of educational technology should include both “education” and “technology” two elements. Otherwise, it does not belong to the research scope of educational technology. It is only due to different focuses that the logical starting point will have different manifestations such as “technology in education” or “technology supported education.”

After the above research findings were officially published, some scholars mistakenly understood that the discipline of educational technology had two logical starting points: education and technology. In response to this, in 2013, the author further clarifies the logical starting point of educational technology discipline as:

The logical starting point of the educational technology discipline is “educational technology,” as it is formed by the integration of the two elements of “education” and “technology,” thus possessing a dual structure. (Li, 2020, pp. 269-275)

2.6.2 Positioning of the educational technology discipline

In the field of educational science, pedagogy is a knowledge system that reflects the laws of education and belongs to the category of science. Educational technology studies the theories, laws, and methods of using relevant technologies to improve educational performance and belongs to the category of technology. Therefore, inappropriate is to classify educational technology as part of pedagogy. The author believes that the accurate positioning of the discipline of educational technology should be:

Educational technology is a comprehensive applied discipline within the field of educational science, falling under the category of technology science. It possesses a methodological nature and dual attributes; serving as a connecting bridge between educational science and the practice of education and teaching (Li, 2005).

In other words, educational technology should be a first-level discipline in the field of educational science, alongside pedagogy. Due to its dual structure in logical starting points, the discipline of educational technology itself also possesses dual attributes; it has both educational and technological attributes.

Examining the domain and scope of research in the disciplines of educational technology, it becomes evident that the connotation of this discipline is extensive and complex. It is difficult to construct it as a second-level discipline. Therefore, the root cause of the various

problems that have emerged now, including the serious disconnection with the current education informatization, is the inaccurate positioning of the discipline.

According to the accurate positioning that “educational technology is a first-level discipline in the field of educational science,” corresponding branch (second-level) discipline can be established based on the dual attributes of the discipline, as shown in Table 1?

Table 1

Discipline of Educational Technology in the Field of Educational Science

Discipline Category	first-level Discipline	Branch (second-level) Discipline	Remarks
Education	Pedagogy (Educational Science)	omit	
		Informatization Education (Modern Educational Technology) Smart Education Intelligent Education	Educational Attributes
	Educational Technology	Information Technology Education	
		Educational Intelligence Technology (Educational Information Technology)	
		Education Software Engineering	Technical Attributes
		Digital Media Technology	
		Educational Equipment Technology	
	Physical Education	omit	

From the above table, the establishment of branch disciplines can effectively decompose and plan the extensive disciplinary system of educational technology. Each branch discipline not only possesses the foundational knowledge and core competency requirements essential to educational technology discipline but also has their own emphasis, showcasing the knowledge and competency systems of the branch disciplines from different perspectives. The sum of all branch disciplinary knowledge and competency systems represents the complete knowledge and competency system of the educational technology discipline.

3. Theoretical and Knowledge System of Educational Technology Discipline

The theoretical system of a discipline needs to answer five questions (5W): what it is, why, what according to, what can be done, and how to do it. Subsequently, this theoretical framework expands into the knowledge system of the discipline.

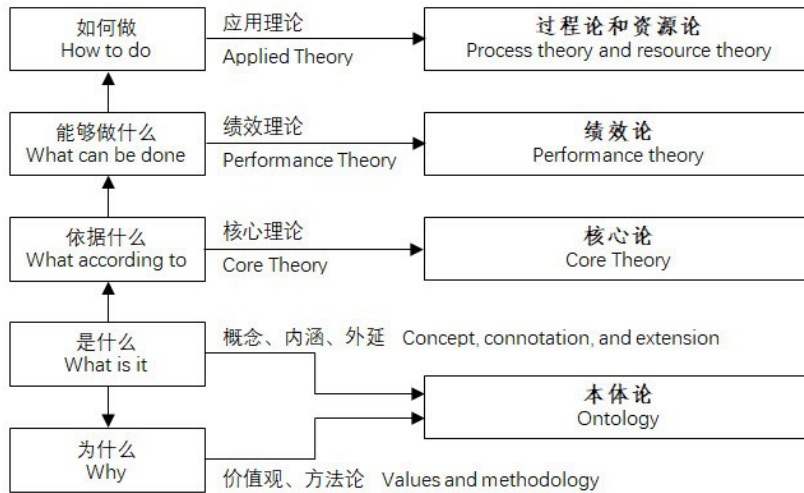
3.1 Theoretical Framework of the Educational Technology Discipline

2. The connotation of each branch discipline can be found in the relevant content of the fourth article in this series, "Construction of Educational Technology Majors and Talent Cultivation".

The theoretical framework of the educational technology discipline consists of five components: ontology, core theory, process theory, resource theory, and performance theory.

Figure 11

The Relationship Between the Theoretical Framework of Educational Technology and the Fundamental Questions of the Discipline



Note. Adapted from *Foundations of Educational Technology: The Past, Present, and Future of Educational Technology* (p.396.), by L. Li, 2020, East China Normal University Press.

From Figure 11, ontology corresponds to the questions of “what is it” and “why,” core theory corresponds to the questions of “what according to,” process theory and resource theory correspond to the questions of “how to do,” and performance theory corresponds to the questions of “what can be done.”

3.1.1 Ontology

Ontology clarifies the basic concepts, connotations, and extensions of the discipline of educational technology, as well as its values and methodologies. It clarifies “what is” and “why” in the educational technology discipline.

3.1.2 Core theory

The content covered in the core theory involves the theory and methods for cultivating the core competencies of educational technology professionals. It reflects the theory and methods of “what according to” in the disciplines of educational technology to improve educational performance, which is clarifying the core theory of educational technology disciplines and emphasizing the irreplaceable nature of this discipline.

3.1.3 Process theory and resource theory

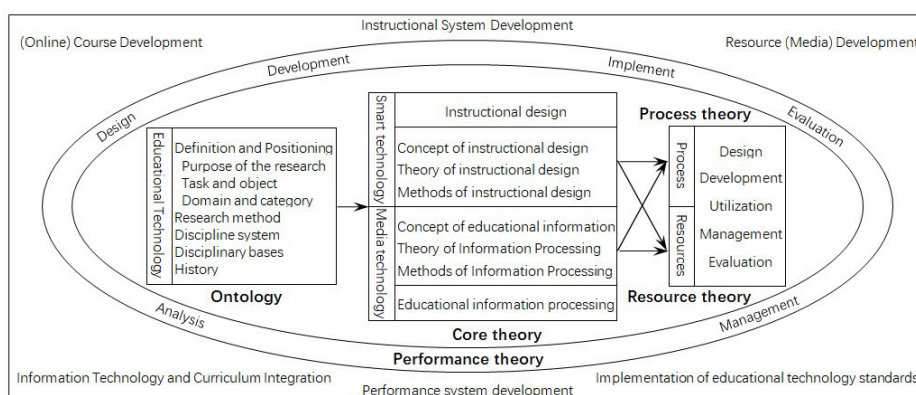
Process theory and resource theory explore the optimization and integration of related processes and resources from the perspective of technology (means and methods), elucidating the applied theories guiding educational technology practices, and addressing the question “how to do” in the educational technology discipline.

3.1.4 Performance theory

Performance theory aims to clarify the functions of educational technology discipline, explicitly clarifying what it can do. It explains how the discipline can contribute to the improvement of educational performance from various aspects. Performance theory is typically categorized under applied theory. The theoretical framework of educational technology discipline can be represented by Figure 12.

Figure 12

Theoretical Framework of the Educational Technology Discipline



Note. Adapted from “The Composition of the Knowledge System of Educational Technology Discipline - Three Discussions on the Theory and Practice of Educational Technology Discipline,” by L. Li, 2004, *e-Education Research*, (2), 3-8.

3.2 The Theoretical System of the Educational Technology Discipline

The theoretical system of educational technology discipline (i.e., fundamental theory 基本理论) consists of three parts: basic theory (基础理论), core theory (核心理论), and applied theory (应用理论).

3.2.1 Basic theory (基础理论)

The basic theory reflects the knowledge content of ontology within the theoretical framework of the educational technology discipline, which is divided into two parts: ontological theory and

values and methodologies.

(1) Ontology theory

Ontology theory aims to answer the question of “what is” in the discipline of educational technology. It includes the development history of educational technology both domestically and internationally. Overview of educational technology is included (definition group of educational technology; objects, purposes, tasks, domain and scope of educational technology discipline research; disciplinary foundation of educational technology; the logical starting point and disciplinary positioning of educational technology discipline). It includes the composition of the theoretical system and knowledge system of the educational technology discipline.

(2) Values and methodologies

Values and methodologies need to answer the question of “why” in the discipline of educational technology, elucidating the philosophical implications of educational technology.

3.2.2 Core theory (核心理论)

Core theory reflects the knowledge content of the “core theory” within the theoretical framework of educational technology discipline. It constitutes a unique knowledge system specific to this discipline, irreplaceable by other disciplines, and serves as the foundation for developing core competencies in professionals within the discipline. The core theory of the educational technology discipline consists of instructional design theory and educational information processing theory.

(1) Instructional design theory

Improving the performance of education and instruction involves the top-level design of the education system, optimization of the teaching process, and development of teaching resources, all of which cannot be separated from the theoretical guidance and practical operation of instructional design. Instructional design, representing the intelligent (non-material) technology in educational technology, encompasses three aspects: the concept of instructional design, the theory of instructional design, and its methods. Professionals in educational technology must master essential knowledge and methodology to develop the core competency of instructional design.

(2) Educational information processing theory

The educational and teaching activities can essentially be seen as the process of disseminating and interactive of educational and teaching information. Therefore, the research on the generation, processing, dissemination, utilization, management, and evaluation of educational and teaching information, namely the theory of educational information processing, should serve as a guiding theory for media (materialized) technology in educational technology. It includes three parts: the basic concept of educational information, the theory and methods of educational information processing, and the knowledge and methods that educational technology professionals must master to form the core ability of educational information processing. Currently, attention should

be paid to the impact and innovation of big data models and generative artificial intelligence on the theory and methods of educational information processing.

3.2.3 Applied theory (应用理论)

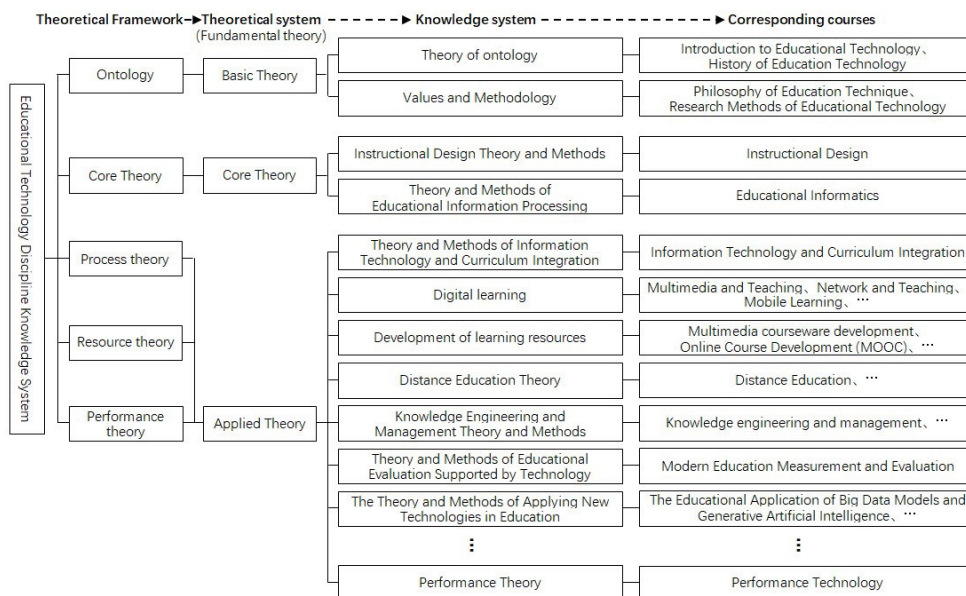
Applied theory reflects the knowledge content of “process theory,” “resource theory,” and “performance theory” within the theoretical framework of educational technology discipline. This includes theories such as information technology integration with curriculum, multimedia teaching, online teaching, distance education, knowledge engineering and management, educational assessment under technological support, educational application of new technologies (e.g., big data, artificial intelligence), and performance technology (Smith, 1986).

3.3 Composition of the Knowledge System in the Educational Technology Discipline

The theoretical system of a discipline generally refers to the composition of its fundamental theories(基本理论). The fundamental theory of educational technology discipline is generated based on its theoretical framework, and then expanded to form the knowledge system of the discipline; finally, according to the requirements of the knowledge system, corresponding courses are set up, as shown in Figure 13.

Figure 13

Knowledge System of the Educational Technology Discipline



Note. Adapted From *Foundations of Educational Technology: The Past, Present, and Future of Educational Technology* (p.443), by L. Li, 2020, East China Normal University Press.

From Figure 13, starting from the theoretical framework, the theoretical system (fundamental theory) has expanded to form the knowledge system of educational technology discipline; then, corresponding courses are set up based on this to meet the knowledge and ability needs of educational technology talents.

Although the knowledge system of the educational technology discipline is closely related to disciplines such as education and computer science, it is by no means replaceable by them. With the deepening development of educational informatization and digital transformation of education, new knowledge and applications can be gradually added to the knowledge system of the discipline of educational technology.

4. Conclusions

In summary, this article proposes the concept of the definition group of educational technology, discusses the research objects of the educational technology discipline, the research purpose and tasks, the research domain and scope, the disciplinary foundation and research methods, the visual display of the disciplinary structure of educational technology, as well as the logical starting point and disciplinary positioning of the discipline. All this have constructed a theoretical system and knowledge system for the discipline, and comprehensively interpreted the connotation and extension of educational technology discipline.

Comparing the content of the educational technology definition group presented in this article with the AECT 1994 (Seels & Richey, 1994) and AECT 2005 (Januszewski & Molenda, 2008) definitions, it is evident that this definition group has evolved based on the excellent traditions of electrified education in China while incorporating innovations inspired by the AECT 1994 definition. The consistency between the definition group and the AECT 1994 and AECT 2005 definitions reflects the commonality in the field of educational technology, and inconsistency precisely reflects the individuality of different countries in the field of educational technology, See Table 2.

Table 2

Comparison of Relevant Concepts

Item	Definition Groups of Educational Technology Provided in This Article	AECT 1994 Definition	AECT 2005 Definition
Key Words	Educational Technology	Instructional Technology	Educational Technology
Nature of Definition	Definition group: including concepts of field, as well as concepts at the noumenon, practical, and theoretical levels of Educational technology	Field definition	Field definition

Research Levels	Macro and micro levels	Micro level	Macro level
Research Objects	Educational technology issues (broad sense) Educational applications of related technologies (narrow sense)	Processes and resources related to learning	Appropriate technical processes and resources
Research Purpose	Improving educational performance	For (Promoting) learning	Promoting learning and improving performance
Research Tasks	Exploring theories, laws, and methods for improving educational performance using relevant technologies	Design, development, utilization, management, and evaluation of learning processes and resources	Research on the creation, use, and management of appropriate technological processes and resources, as well as ethical standards and performance technologies in educational technology
Research Domain	Theory and practice	Theory and practice	study and ethical practice
Research Scope	Design, development, utilization, management, and evaluation	Design, development, utilization, management, and evaluation	Creation, use, and management
Publication	Proposed in 1998, published in 2003, and officially confirmed in 2008	Published in 1994	Disseminated online in 2004, approved in 2005, officially published in 2008

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