

# Research on the integration ecosystem of education subject and education object under the background of artificial intelligence + education

## —Connotation and model construction

Yajun Lin

Chongqing Technology and Business University, Nan'an, Chongqing, China

297060444@qq.com

**Keywords:** Artificial intelligence, Education Subject, Education object, Integrated Ecosystem

**Abstracts:** Artificial intelligence has changed the space-time structure of educational activities. It has broadened the forms and scenes of learning, extended the existing forms of learning resources, and broken through the relationship between the subject and object of traditional education teaching and learning, which has brought great changes of educational idea and learning idea. Based on the current situation of the development of artificial intelligence education practice and education theory, this paper puts forward the connotation and model construction of ecological integration system of artificial intelligence + education subject and education object. It constructs education subject ecosystem, education object ecosystem and artificial intelligence ecosystem, which are not only independent in theory, technology, culture, application, but also mutually integrated development model of coexistence, symbiosis, and cross integration.

## 1. Introduction

As an emerging technology, artificial intelligence technology has entered the field of education, changed the space-time structure of previous educational activities, widened the learning forms and scenes, and shifted from offline relatively fixed physical space to online virtual space. Artificial intelligence also has changed the distribution of learning resources, transformed the paper-based learning materials and published content into electronic digital materials with different forms. The data of learning behavior and learning process can be traced and reproduced, the application of image and speech recognition technology, big data, knowledge map and adaptive learning technology make the quantitative analysis of the learning characteristics of individual students and all students gradually become a reality. The concept of education and learning has changed. The concept of internet education and learning methods have accelerated the penetration of online education, and the application of science and technology has improved learning efficiency. At the same time, it has broken through the relationship between the subject and object of traditional education and the educational ecological environment led by artificial intelligence, which has brought great challenges and uncertainties to the education industry.

From the perspective of national strategy: according to the 2017 State Council's "new generation artificial intelligence development plan", only by grasping the major strategy of artificial intelligence development and building the first mover advantage of China's artificial intelligence development, we can truly achieve the goal of building a new country. Therefore, with the help of AI technology, it has a great significance to realize the transformation and upgrading of the education industry and actively explore the practical problems and solutions of the integration of "Artificial intelligence" and education ecosystem.

From the perspective of educational practice: at present, there are great problems about the application of artificial intelligence. In theory, most of the researchers in education object are concentrated in colleges and universities and some large and medium-sized enterprises, and the vast majority of the conceptual understanding is not high, and the level is uneven, and there is even no access to knowledge in related fields. In technology, "AI + education" is just the superposition of information technology and educational activities, and even the two are opposed. How to build a

hierarchical classification channel between the two will become the biggest difficulty and focus.

## **2. Reflection on the Relationship between Education Subject and Education Object in the Context of Artificial Intelligence + Education**

In March 2017, Chinese government work report included the relevant content of "artificial intelligence" for the first time. In July of the same year, the State Council issued the "development plan for a new generation of artificial intelligence" to provide specific guidance on the development direction of "artificial intelligence + education". In recent years, domestic scholars are also very enthusiastic about the research of "artificial intelligence + education".

At present, domestic scholars in the field of education mainly focus on the application of AI technology, such as the connotation and key technologies of AI [1], the promotion of AI to hybrid teaching [2], and the innovative educational application of deep learning and machine learning [3,4]

Educational researchers and practitioners have less in-depth research on the integration of artificial intelligence system and education system: there is a "domain in the middle" between artificial intelligence and education, indicating that there is a constructive movement interaction between man and machine, artificial intelligence technology and culture and education[5], which only indicates that there is an intermediary domain of interaction between artificial intelligence and education. However, it does not clarify how artificial intelligence and education ecosystem can coexist and develop; The feature of education informatization 2.0 is "ecology + people + intelligence", which is committed to building a new education ecosystem for the whole society [6]. However, there has not been systematic and in-depth research on how artificial intelligence coexists with and dynamically develops between education subjects and education objects, and there is a lack of deep thinking about the dynamic changes in the relationship between education subjects and education objects.

## **3. Connotation and Model Interpretation of Artificial Intelligence + Integrated Ecosystem of Educational Subject and Education Object**

### **3.1. Connotation Interpretation**

AI + education is not only the application of simple AI technology in education and learning platforms established by using Internet technology, but also the deep integration of AI and education, which is a new educational ecosystem. It forms a brand-new field, with teaching model, domain knowledge model and learner model as its core components [1].

"Education ecosystem" is a system based on ecological principles, the process and law of the interaction between education subject and education object, education technology and education environment, and its overall ecological balance. This system includes education subject ecosystem and education object ecosystem. In this definition, the integration and ecological balance are ignored among artificial intelligence ecosystem, educational subject ecosystem and educational object ecosystem.

Therefore, this paper proposes that the integrated ecosystem of artificial intelligence + education subject and education object is not only an education ecosystem, but also pays more attention to the development of education subject ecosystem, education object ecosystem and artificial intelligence ecosystem in the theoretical level, technical level, cultural level, and application level. The development model has independent feature and the characteristic of coexistence, symbiosis, and cross integration. It has the following features:

#### **3.1.1. The Separation between AI + Educational Theory and AI + Educational Practice**

AI + education theory is far more developed than the application of technology, but the foresight of theoretical development has not been fully applied in practice. Therefore, there is a separation between AI + education theory and practice.

### 3.1.2. Contradiction between AI + Education Subject and AI + Education Object

As in the traditional context, in the context of artificial intelligence + education, there is also a contradiction between teaching and learning between the education subject and the education object. The learning platform based on artificial intelligence has innovated the relationship structure between educational subject and education object. The differences between the educational subject and the teaching object in thinking mode, educational concept and so on make it impossible for the two to fully match.

### 3.1.3. Symbiosis of AI + Education Subject and AI + Education Object

In the ecological environment of artificial intelligence, education subject, education object and the theory and practical application of artificial intelligence jointly promote and integrate.

## 3.2. Interpretation of Integrated Ecosystem Model of Artificial Intelligence + Education Subject and Education Object (see Figure 1)

There are practical difficulties in the integration of AI + education at the theoretical, technical and application levels. On the one hand, the depth of AI theory is still at the university level, but it is only limited to professional disciplines. On the other hand, the promotion and application of AI technology is at the technical level. At present, the developing technology of AI technology around the world has not been fully utilized in the field of education.

Therefore, based on the new research perspective, that is, ecosystem, we pay attention to the combination of artificial intelligence and the actual situation of education subject and education object, and put forward the interactive application development between ecological elements (teachers and students, students and students, their knowledge system, people and machines, etc.). Based on the actual development of artificial intelligence and education, the creation of a common integration mode of "artificial intelligence + education ecosystem" is based on three levels: the development level of artificial intelligence, the level of teacher training, and the level of student learning. Each level develops dynamically and integrates hierarchically, especially the construction of the channel between the two. Breaking through unilateral, single-layer and single channel development can finally realize the real integration of artificial intelligence and education system.

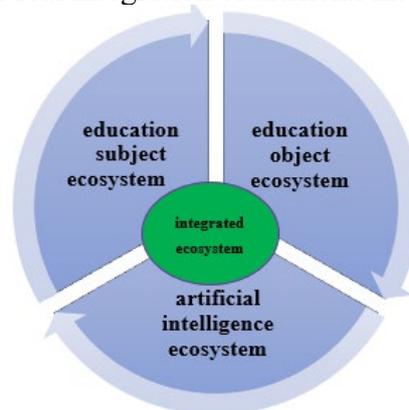


Figure 1 Integrated ecosystem model of artificial intelligence + education subject and education object.

## 4. Realization of Integrated Ecosystem of Artificial Intelligence + Education Subject and Education Object

### 4.1. Based on the Traditional Education Subject, Build an Integrated Ecosystem of Education Subjects

In the development trend of China's online education industry, AI redefines future education. The main body of education subjects, that is, schools and business training institutions engaged in the education industry. They fussed constantly at the theoretical level, technical level, and application

level, and presents different levels.

AI + education has not reached the full application of AI technology at present. Most of them are only online education, and very few organizations have applied high-end AI technology. To solve this bottleneck, it is proposed that the ecosystem of educational subjects includes three elements: theoretical level, technical level and application level. The integration of each aspect with artificial intelligence needs to adopt corresponding unique hierarchical development and realization models: level by level penetration model, imitation leading model and leading demonstration model, and the guarantee mechanism at all levels plays a particularly key role in the ecosystem.

#### **4.1.1. Develop Artificial Intelligence Recognition System of Educational Subject Development Level**

AI + education subjects have the problems of resource distribution gradient, low resource sharing rate and high resource construction cost. On the one hand, the distribution of AI resources presents gradient. Resources are not only unevenly distributed in colleges and universities across the country, but also unevenly distributed in vocational education institutions, middle schools, and even primary schools, resulting in the hierarchical and differentiated development of education subjects at all levels, and the benefits are not balanced. Secondly, the resource sharing rate is low. The sharing rate of distance education is extremely low. These sharing may exist in certain organizations, colleges and universities or in a very small range, and it is not carried out in a large range of colleges and universities or even across the country. At the same time, it leads to repeated construction of resources among colleges and Universities, resulting in huge waste. Thirdly, commercial training institutions pursue excessive profits, resulting in AI + education lacking in the cultivation of literacy and innovation.

We develop an AI recognition system that applies AI technology to the development level of education subjects. Government makes a reasonable layout of AI talent training institutions or organizations at all levels based on national strategy and build a hierarchical training and promotion path from the bottom to the top.

#### **4.1.2. Establish a Step-by-Step Infiltration Model at the Theoretical Level**

Since the establishment of International Society for educational artificial intelligence in 1997, the academic community has studied AI education for nearly 30 years. Due to AI originates from computer science and engineering, its own development is limited by the development of humanities such as cognitive science, neuroscience, psychology, etc., so the process of interdisciplinary application and research development is slow.

To establish a level-by-level talent training system for AI, colleges and universities should take the lead and adopt a level-by-level penetration model at the theoretical level.

In 2017, the State Council carried out a strategic plan for the development of artificial intelligence. In terms of the cultivation of the scientific quality of the underlying AI, it advocated to carry out the national intelligence education project. The Ministry of Education organized the preparation of the "information technology curriculum standard for ordinary high schools", adding AI related elective content such as data and computing, data structure, artificial intelligence, open-source hardware, and so on. At the same time, it was carried out in the form of information technology, maker courses or special artificial intelligence. In terms of AI talent training in colleges and universities, we will increase the enrollment of AI majors in colleges and universities. So far, before December 2020, 145 colleges and universities have set up AI academic organizations, including 96 AI colleges and 66 AI research institutes [7].

#### **4.1.3. Establish the Imitation Leading Model at the Technical Level**

The research fields of artificial intelligence include expert systems, machine learning, pattern recognition, natural language understanding, automatic theorem proving, automatic programming, robotics, games, intelligent decision support systems, artificial neural networks, distributed intelligence, and many other fields [8]. The key technologies of artificial intelligence in education and teaching include intelligent identification technology, learning analysis technology and virtual

reality technology [9]. Among them, expert system, machine learning, natural language understanding, artificial neural network and intelligent agent are widely used in education [10].

The application level of technology in nonprofessional fields in colleges and universities is not high, and the application level of artificial intelligence + education subjects is currently divided into three levels: ① higher education teaching mainly adopts intelligent recognition technology, face recognition learning analysis, and virtual reality technology; ② online education mainly adopts assessment and evaluation, adaptive system and personalized and intelligent tutoring system; ③ compulsory education teaching mainly uses automatic learning situation analysis. In Colleges and universities, artificial intelligence colleges and artificial intelligence enterprises are in a leading position in technology. We establish a mechanism of a low-level education subject imitate to high-level technical operations, which is a gradient level sharing technology mechanism learned through university professional training and enterprise learning.

#### **4.1.4. Establish a Leading Demonstration Model of Artificial Intelligence + Application Level of Educational Subjects**

We establish a co-construction laboratory and innovation cooperation platform to high-level leading demonstration, and innovative cooperation model. At the same time, we establish a variety of leading methods, such as vocational training and internal training. We adopt diversified training methods, such as curriculum teaching, scientific experiments, scientific innovation competitions, qualification certification, etc.

### **4.2. Build an Integrated Ecosystem of Education Object based on the Traditional Education Object**

The paper proposes that education objects ecosystem (educated students and training objects) includes three elements: theoretical level, technical level and application level. The integration of each aspect with artificial intelligence needs to adopt corresponding unique hierarchical development and realization models: gradient classification model, practical training base model and hierarchical training model, and its guaranteed mechanism also plays a particularly critical role in the ecosystem.

In view of the current situation of the actual theoretical level, technical level and application level of the education object, artificial intelligence technology is used to identify the development level, objectively diagnose, and establish the realization mechanism of each level. In the aspect of educational management, we should adopt the gradient classification of education objects, and then carry out targeted education; The realization at the technical level requires the establishment of training bases, which can be in colleges and universities, or in enterprises with a high degree of application of artificial intelligence and adopts a layered training model.

#### **4.2.1. Research and Develop the Hierarchical Recognition System of Educational Objects to Realize Hierarchical Training**

According to the 2021 global AI Education Application Research Report, there is an extreme shortage of scientists, who are trained in colleges and universities, research institutions and scientific research institutes. The training cycle is 10 to 20 years, and there is little full-time scientific research. Algorithmic talents are highly scarce, and they are cultivated in universities, scientific research institutes and enterprises, with a training cycle of 5 to 10 years. There is a shortage of applied talents. They are trained in colleges and universities and enterprises, with high requirements for post comprehensive ability, and the training cycle is 4 to 8 years; Digital blue-collar talents are in urgent need of upgrading. They are mainly trained by enterprises. They are in great demand and belong to the application level. Their ability requirements are gradually rising[7].

We develop an AI recognition system that applies AI technology to the development level of educational objects, Government makes a reasonable layout of AI talent training at all levels based on the national strategy, extends the AI talent training chain, and builds a hierarchical talent training system from the bottom to the top.

#### **4.2.2. Break the Traditional and Standard Talent Training Model and Infiltrate Step by Step**

In order to balance AI resources and save construction costs, we should establish a resource sharing system and model at the university stage, middle school stage and primary school stage, and break out the traditional standardized talent training model.

Through the cloud computing resource platform, an artificial intelligence technology education platform is established, so that anyone who wants to learn can access and learn relevant knowledge, realize the dissemination and teaching of artificial intelligence education theory and technology for the whole society, and university education subjects implement compulsory and paid training to vocational education, high, middle and primary school teaching subjects. On the one hand, the education management department ensures the funding source of smart campus construction at the upper level of strategic planning, and carefully plans and designs the resource allocation to avoid resource waste and repeated construction. On the other hand, we should establish the infiltration of intelligence expenditure and training from high-level AI education subjects to low-level education subjects, establish the training framework of AI discipline theory and application, and from basic quality education to AI technology application to AI theory research.

#### **4.2.3. Break Through the Time and Space Constraints of Learning and Establish a Cloud Technology Training System**

We establish a cloud technology training system and break through the traditional learning scenes and space-time constraints, and cover the three major learning places of school, family and outdoor to refine the fragment time. By testing the technical level of artificial intelligence, it establishes a personalized cloud technology training system and curriculum resources through intelligent technologies such as AI virtual teachers and AI teaching assistants.

#### **4.3. Research on Integrated Ecosystem Model of Artificial Intelligence + Education**

Based on the actual development of artificial intelligence and education, this paper proposes to create an integrated ecosystem model of "artificial intelligence + education subject and education object", which is based on three levels: the development level of artificial intelligence, the level of teacher training, and the level of student learning. Each level is dynamically developed and hierarchical penetration integration, especially the construction of channels between the three.

##### **4.3.1. Government Layout Guidance, Optimize AI + Education Industry Chain**

Since 2019, affected by the epidemic, pervasive online education has developed rapidly in the short term, resulting in repeated layout and resource waste. In the medium and long term, AI + education industry will accelerate the industry reshuffle. Therefore, the strategic layout and guidance of the government are particularly important, and it is necessary to optimize the layout for AI education and training enterprises and education subjects of colleges and universities.

###### **1) Classified boutique operation of artificial intelligence + educational business institutions**

AI + education enterprises are divided into education content providers, technology developers and platform operators according to the operation content. According to the needs of AI + education, AI education content, AI education technology and AI education platform are classified to shape and operate high-quality products.

###### **2) Construct artificial intelligence + basic education, vocational education and higher education linked education gradually**

We open the training channel among basic education, vocational education and higher education, adopt the linked training mode, complete the knowledge depth and width of the education object in the training system, and establish the single-layer rising model and cross-layer training model at the theoretical, technical and application levels.

##### **4.3.2. Establish Artificial Intelligence Education Blockchain to Realize the Integration of Educational Resources**

Through establishing AI + education blockchain, we integrate fragmented education resources,

and integrate AI + education resources across platforms, organizations, and even national borders, so as to achieve low-cost and high resource data flow and sharing.

### 4.3.3. Improve the Step-by-Step Gradient Artificial Intelligence + Educational Talent Training System

We establish a scientific and reasonable artificial intelligence + education talent training system, that is, artificial intelligence + popular science education, artificial intelligence labor training, artificial intelligence talent training and discipline construction, artificial intelligence high-end talent team construction, high-end technology research and development layer by layer, level by level intelligence support and resource sharing. See Figure 2for details.

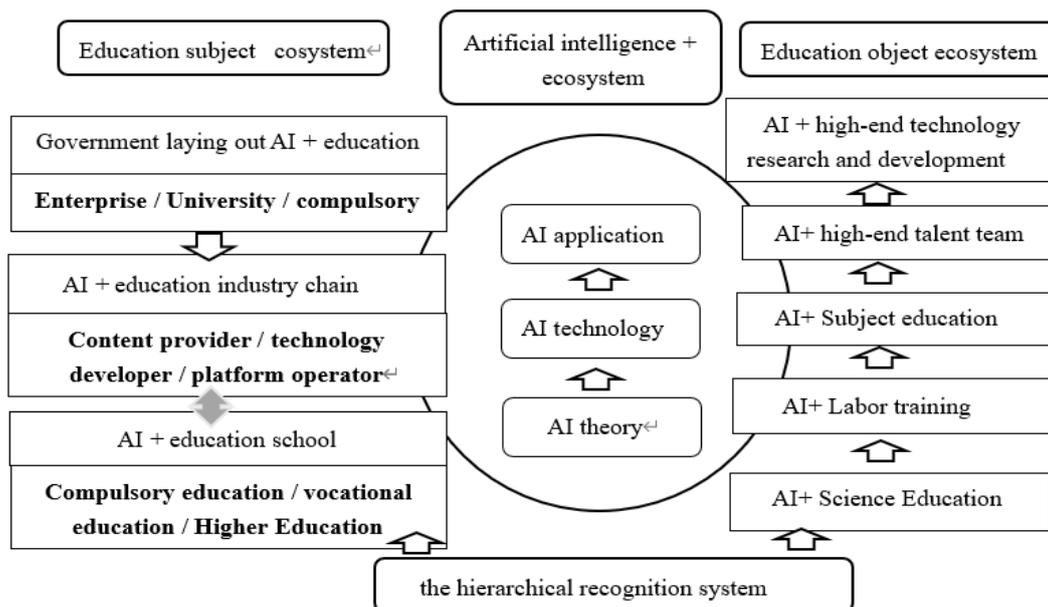


Figure 2 Realization model of integrated ecosystem of artificial intelligence + education subject and education object.

## 5. Conclusion

In the future artificial intelligence + education ecological environment, educational subjects and educational objects will change cognition, share information, make data flow and integrate discipline in their respective artificial intelligence application ecological environment.

### 5.1. Changing Cognition

The formation of educational big data has accumulated the super structure of the theoretical level of education subjects. Educational big data mainly comes from two levels: one level is to construct a digital teaching environment; the second level is to digitize the massive amount of digital information that has been formed. At present, China's AI + education is still on the road of digitalization and flattening of universal education. In the future, it will realize digital and even three-dimensional education, making future education convenient, fair, intelligent, vivid, and sharable.

### 5.2. Sharing Information

Compared with the application of artificial intelligence in the field of education, the educational application of blockchain is still a minority, and blockchain will become an important technology in the field of education in the future. China's educational resources are widely distributed unevenly and can't be effectively shared. the cost of informatization is too high, and students' information is fragmented. Blockchain technology can effectively integrate educational resources and realize the sharing of cross platform and transnational high-quality educational resources, so that students can

enjoy better education at less cost.

### 5.3. Making Data Flow

At present, adaptive education is still in the early stage of development. In the future, through the iteration of technology, the accumulation of data, and the improvement of knowledge maps and model algorithms, learning data will truly become "blood" flowing in the whole education system, making traditional and rigid teaching and research "live", reshaping the structure of teacher-student relationship, and student data-driven will lead the education model of education subjects.

### 5.4. Integrating Discipline

Artificial intelligence + integration with professional education of various disciplines will form the formation of interdisciplinary thinking with artificial intelligence as the core technology.

### Acknowledgements

This research was supported by the Chongqing Education Science the 13th Five-Year Planning Project of "Research on integrated Ecosystem model of artificial intelligence + education ecosystem" (2020-GX-020)

### References

- [1] Zhiming Y., Xiaxia T., Xuan Q., Fei Zh., Yuanmei D. Connotation, key technology and application trend of educational artificial intelligence (EAI)——Analysis of the reports "preparing for the future of artificial intelligence" and "national strategic plan for artificial intelligence research and development" in the United States [J]. Journal of distance education, 2017, (1): 26-35.
- [2] Yonghui D., Bo X., Haijian Ch. The promotion of artificial intelligence to hybrid education and the construction of ecological chain[J]. Modern distance education, 2018, 2:24-31.
- [3] Yong L. Qin L. Cuibo Y. Application of deep learning technology in Education: current situation and Prospect[J]. Research on open education, 2017, (5): 113-120.
- [4] Minhua Y., Xiang F., Zhuiting Zh. Educational application and innovative exploration of machine learning from the perspective of artificial intelligence[J]. Journal of Distance Education, 2017,(3):11-21.
- [5] Hong N., Limin L. "AI + education": the constitutive existence of intermediation[J]. Educational research, 2019,7:27-37.
- [6] Xiaoming C. "Smart +" Campus: a new pattern of school development from the perspective of educational informatization 2.0[J]. Journal of value distance education, 2018:57-68.
- [7] 2021 Research Report on the implementation and application of global AI education, robot industry[J], 2022,01,78-96.
- [8] Haifang W., Feng L. New progress in the application of artificial intelligence in Education [J] Modern educational technology, 2008, S1(19-21).
- [9] Shiyao L. Application and research of artificial intelligence in Higher Education Teaching[J]. Heilongjiang Science, 12(7), 2021, 04:49-51.
- [10] Tianyun Ch., Jianping Zh. Research status of intelligent teaching system (ITS) and its development in China[J]. Audio visual education in China, 2007, 2:95-96.