Research on the Impact of Generative Artificial Intelligence on Future Education Reform

Jiao Gang

School of Marxism, Beijing Jiaotong University, Beijing 100044; China

E-mail: 18595055982@163.com

Abstract. At present, human beings have entered the era of digital intelligence, and the application of generative artificial intelligence has set off a wave of use around the world. The cognitive understanding, language analysis, basic dialogue, text creation, logical reasoning and other related technologies possessed by generative artificial intelligence have exerted a very strong influence and penetration on all stages of education and teaching activities, which will lead to great changes and comprehensive remodeling of the future education form. This paper systematically introduces the new development of generative artificial intelligence technology, and analyzes its basic concepts and technical characteristics on this basis. Based on the text model, this paper expounds the unprecedented driving force of generative artificial intelligence in promoting the development of generative educational resources, creating new intelligent teaching methods, and realizing the coordinated development of machines and human beings, and makes an objective analysis of the changes of future educational forms.

Keywords: generative artificial intelligence ; educational form ; big language model

1   Introduction

At present, generative artificial intelligence is reshaping our cognition and understanding of existing learning, work, life and even way of thinking. Especially represented by ChatGPT and GPT-4, they already have some basic characteristics of general artificial intelligence, and are promoting the transformation of Internet resource production mode to artificial intelligence generation content paradigm. [1] It makes the current role of artificial intelligence in digitization, informatization and networking practice more prominent and more obvious. In the field of education, related technologies such as cognitive understanding, language analysis, basic dialogue, text generation, and logical reasoning of generative artificial intelligence have a very strong influence and penetration on education and teaching activities at all stages. This paper mainly studies the application of generative artificial intelligence technology in the future education field, and the opportunities brought by generative artificial intelli-

gence for the future development of education field, in order to provide reference for promoting the high-quality development of education field in the future.

2   The Concept, Basic Architecture and Technical Characteristics of Generative Artificial Intelligence

2.1   The Concept and Basic Architecture of Generative Artificial Intelligence

Tracing the origins of generative development, we can go back to the ' Turing Test ' of the 1850s.In 1950, computer pioneer Alan Turing proposed a test for arti-ficial intelligence (AI) that came to be named after him: A machine with AI should be able to chat with a human and convince them it was human.[2]As an important driving force for a new round of scientific and technological revolution and industrial transformation, the rapid development of generative artificial intelligence technology provides unlimited possibilities for the innovative, revolutionary and subversive development of modern education and teaching. In September 2023, the United Nations Educational, Scientific and Cultural Organization officially released the " Guidelines for the Application of Generative Artificial Intelligence Education and Research, " which for the first time scientifically explained the concept of generative artificial intelligence from the perspective of artificial intelligence 's simulation of human thinking representation symbol system : Generative artificial intelligence refers to artificial intelligence technology that uses complex algorithms, models and rules to learn from large-scale data to create new original content.At present, this technology has been able to use human language, text, sound, image, coding and other formats to carry out pattern recognition, and generate new content independently. The text-generated artificial intelligence uses the general text converter of artificial neural network technology, which is collectively referred to as the ' big language model ' by the academic community. In addition, the scientific community usually divides the forms of artificial intelligence into three categories, namely weak artificial intelligence, strong artificial intelligence and super artificial intelligence. Different types of artificial intelligence forms have different characteristics and advantages, from weak artificial intelligence technology that is good at a single field to strong artificial intelligence that is highly similar to human beings, and then to super artificial intelligence that is almost completely beyond human beings in all aspects, reflecting the progressive development mode of ' AI + education ' mode from shallow to deep, from local to comprehensive, and the impact on education has gradually upgraded from local strengthening and system strengthening to high personalization.Not only in the field of education, generative artificial intelligence has achieved deep integration and mutual embedding in many fields. The collaborative progress and all-round innovation among the components in the technical architecture play a vital role in promoting the healthy and sustainable development of the generative artificial intelligence industry chain. The generative artificial intelligence technology architecture consists of multiple levels and has a complex structure. (As shown in Figure 1)

APPLICATION LAYER	Intelligent products	robot		self-driving car		Intelligent customer service		Smart speaker
	Solution	Security, finance, medical care, transportation, education, manufacturing, Internet, electricity						
TECHNOLOGY LAYER	Subdivision direction	image recognition target tracking Video Understanding		Voiceprint recognition speech synthesis Voice Assistant		Emotional analysis machine translation Content recommendation		Autonomous driving Autonomous robots
	Application algorithm	Computer Vision	Intelligent Voice	natural language processing		Markov decision programming		Recommended search
	Theoretical algorithm	Traditional machine learning (linear regression/SVM/GBDT, etc.)				Deep Learning (CNN/RNN)		reinforcement
	platform framing	Tensor low		Caffe		pytorch		MxNet
BASE LAYER	Data resources	general data		industry data			Data collection and annotation	
	system platform	operating system		Cloud computing platform			Big data platform	
	Hardware facilities	Computing resources (GPU/FPGA/ASIC)		network device		storage device		sensor

Fig. 1. Generative artificial intelligence structure

It can be seen from the above figure that the basic level is composed of key elements such as hardware equipment, system platform, and data resources. Their role is to provide convenience in material, production, storage, and calculation for the smooth operation of the model. The technical level is mainly composed of a variety of different algorithms for data production and processing, in order to better support the generation of the upper content ; the application level is directly facing different users to meet their basic needs.

2.2   Technical Characteristics of Generative Artificial Intelligence

At present, this technology has been able to use human language, text, sound, image, coding and other formats to carry out pattern recognition, and generate new content independently. This technology has the following three characteristics :

First, the technical ability is extraordinary. The big language model of generative artificial intelligence is a deep learning model based on massive text data training. It can not only generate natural language text, but also deeply explain and understand the meaning of the text, and deal with various natural language tasks, such as text editing, summarization, question answering, translation, expansion and so on. For example, taking ChatGPT as an example, for example, when users input key information words such as ' hello ', large language models will analyze the input data according to natural language processing techniques such as lexical analysis and semantic analysis after receiving instructions, so as to understand the user 's intention.(as shown in Figure 2).
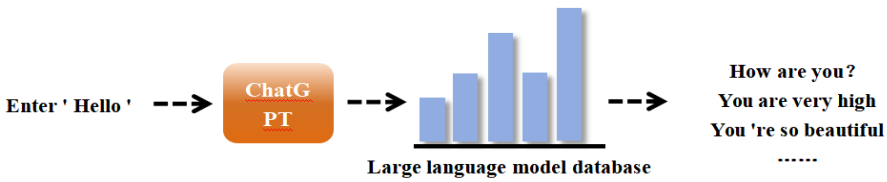
Fig. 2. Analysis of the working principle of ChatGPT

Second, the training methods are flexible and diverse. The large language model is similar to the human thinking process in many ways, not like a machine based on simple logical judgment. Large language models such as ChatGPT usually flexibly adopt the development and training methods of pre-training and fine-tuning, which makes ChatGPT significantly improve in dealing with language difficulty, thinking logic, context understanding, knowledge acquisition and expression, and makes its practical effect and accuracy in the application field more and more perfect. This is why many people find that ChatGPT 's discussion is concise, clear, standardized and neat. What is more rare is that it is highly consistent with the daily thinking habits and expressions of the public, and no longer has a rigid mechanical taste.In order to better solve the lack of effective labeled data in the deep learning model driven by genera-tive artificial intelligence data, and to solve the significant problems such as long time-consuming, low efficiency, high cost, and poor endogenous generation effect by using human labeled data, the large-scale language model of generative artificial in-telligence first uses a large corpus for pre-training, so as to obtain the ability to solve and eliminate general tasks, so as to ensure that the generated content is more opti-mized.

Third, the scope of application is very broad. The large language model of genera-tive artificial intelligence, which is pre-trained on the mixed source corpus, not only has strong technical ability and adaptability, but also captures rich multi-domain knowledge, which can be widely used in office, education, medical, financial, scientific research, management and other fields. For example, taking ChatGPT as an example, ChatGPT became the fastest-growing online app for consumers in history, reaching one million users in the first five days after its release and 100 million in its first two months (dwarfing, for example, TikTok, which took nine months to reach the latter mile-stone).[3] The basic capabilities of ChatGPT include text generation analysis, code generation, dialogue interaction, machine translation, image generation, video genera-tion, etc. Applying these basic capabilities to many fields is expected to drive the remodeling and transformation of the development of many fields. (As shown in Figure 3). It can be seen from Figure 2 that the application of ChatGPT to the field of office software can create efficient production tools and deepen the intelligent office experience. In terms of health care, ChatGPT can also provide guidance and consulta-tion, clinical research assistant, electronic medical record assistant and other functions. In terms of financial management, ChatGPT can empower risk management, transac-tion analysis, and customer support ; in terms of educational research, ChatGPT has application potential in personalized learning, intelligent tutoring, and educational

content generation.Microsoft Copilot for Microsoft 365 is an AI-driven productivity tool that coordinates large language models and uses deep learning techniques and large data sets to understand, aggregate, predict, and generate content to help users complete a variety of office tasks.
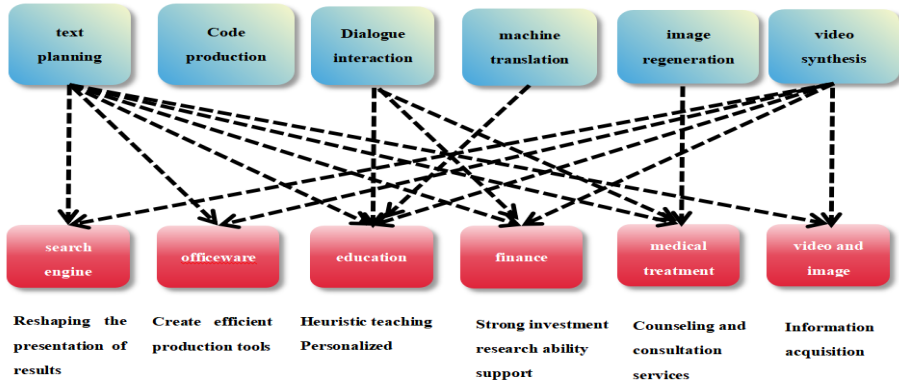

Fig. 3. The application case of ChatGPT in many fields

3   The Technological Advantages of Generative Artificial Intelligence in Promoting Future Education Reform

Generative artificial intelligence is a technology based on physical information generated by algorithms and mathematical models. It has a free or semi-free learning framework that generates ' humanoid ' information through imitation, learning and statistics. [4] It has brought unprecedented huge thrust to the development of education digitalization and networking in many aspects such as technical logic, technical theory, technical application and technical value.With the continuous evolution of generative artificial intelligence technology, it will play a more important role in the process of education development and reform, thus profoundly changing the existing learning mode of human beings. The wide application of this technology is expected to have a significant impact on many aspects of education.

3.1   Promote the Development of Generative Educational Resources and Realize the Rational Allocation of High-quality Educational Resources

The digital transformation of education is considered to be a process of integrating digital technology into education to create an intelligent environment, empower teaching scenarios, and promote changes in teaching and learning. [5] In the era of artificial intelligence, digital transformation has realized the integration of all levels of education and digital technology, and created the embedded model of technology, application, system and human-centered- ' TASH '.(As shown in Figure 4).
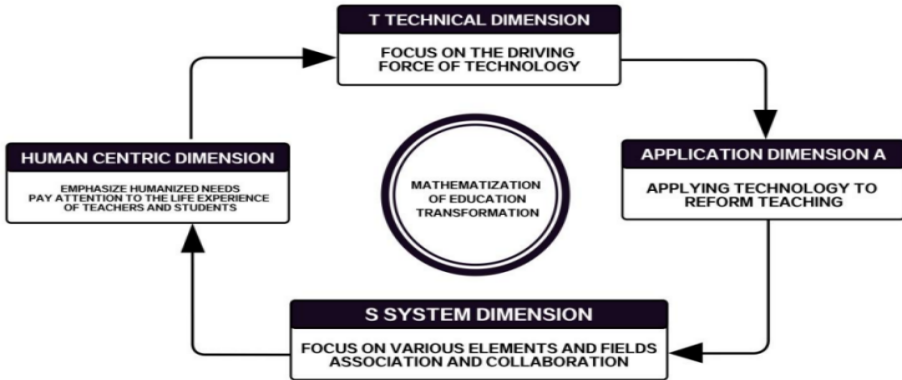
Fig. 4. The embedded model of technology, application, system and humanism

Among them, the technology is like the brick of the building, the application is similar to the brick wall, the system means the frame of the house, and the people represent the owner of the house, which reflects the ultimate goal of the building is to meet the practical needs of the people. Therefore, it can be seen that each factor in the ' TASH ' model has its unique practical function. Their combination can continuously promote the development of digital education, realize the transformation of educational resources acquisition from the original ' people looking for resources ' to ' resources looking for people ', and greatly improve the teaching efficiency. Different from search engines, generative artificial intelligence provides not a simple resource retrieval service, but through the independent screening and combination of digital education resources, it generates text results with reasonable structure, clear logic and correct content to meet the individual needs of the subject.

3.2   Create a New Intelligent Teaching Method to Improve the Efficiency of Teachers and Students

Due to the high difficulty of abstract concepts, traditional teaching methods make it easy for students to lose interest in learning, and also lead teachers to face the difficulties and limitations of traditional teaching methods, which cannot adapt to the individual needs of different students. Generative artificial intelligence can produce high-quality, diversified and personalized content with its excellent content generation and screening ability, which greatly meets the needs of teachers in teaching work. Whether it is in the teaching preparation stage, the material accumulation process, the classroom teaching time, the after-class tutoring link, the homework design or the final assessment stage, the generative artificial intelligence can provide effective services and support. Such as the automatic generation of teaching plans, the one-click production of courseware, the expansion and correlation of classroom knowledge, the design of question and answer links, etc., effectively reducing the daily work burden of teachers. Through the intelligent education system, teachers can more accurately grasp the students ' learning situation, so as to better guide students ' learning. More-

over, generative artificial intelligence can also rely on its own interactive functions to independently obtain learning situations and specific requirements from dialogues and questions and answers with educates, and then form diversified teaching materials such as text, sound, image, video, etc., to stimulate students ' interest in learning.Generative artificial intelligence can also provide students with the best learning plan to meet their individual needs by analyzing the learning foundation, learning style, learning status, learning expectation and other factors of different students, and make a one-to-one learning system to strengthen students ' creativity, thinking ability and innovation ability.

3.3   Realize the Coordinated Development of Machines and Human Beings, and Guide the Adaptive Development of Educational Technology

With the continuous advancement of educational digital transformation and the iterative upgrading of generative artificial intelligence technology, human-machine collaborative learning has become the new normal of future learning, which requires us to pay attention to the game and balance between human and machine, strengthen the identification of human-machine roles and the dynamic adjustment between them, and strengthen the flexible conversion of human and machine autonomy. It can be said that human-machine symbiosis is the advanced stage of the harmonious development of the relationship between human and machine. It also means that human beings can communicate with machines and learn from each other. For human beings, machines are no longer simply responsible for some simple auxiliary functions, but to play a more far-reaching integration function.In the future, human-computer interaction will achieve virtual and real integration at the technical level, value co-creation at the social level, and human-computer symbiosis at the communication level. [6] In the field of education, generative artificial intelligence leads the transformation of the relationship between educational subjects from " teacher-student " to " teacher-student-machine. " The continuous improvement of the autonomy and intelligence level of artificial intelligence makes the original binary subject relationship between " teacher-student " gradually collapse, and then constructs the complex structure of " teacher-student-machine. "(As shown in Figure 5).
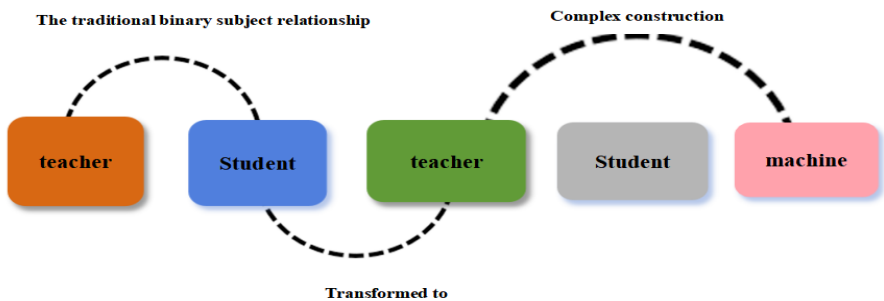

Fig. 5. The transformation of traditional teacher-student relationship

In this way, generative artificial intelligence has a strong enabling effect on both teachers and students. For example, it can help teachers carry out teaching work by playing intelligent assistants, experts and scholars, problem-solving experts, data analysts and so on. Not only that, through the contact with generative artificial intelligence, teachers and students gradually understand its working principle and application method, improve learning motivation and efficiency, but also realize scientific empowering learning mode, improve the dual tasks of teaching and learning, guide the adaptive development of technology, and finally realize the improvement of value through man-machine combination.

4   Conclusions

At present, the rapid development of generative artificial intelligence has brought unprecedented new impetus to the digital and intelligent transformation and development of education. However, this process also brings a series of challenges. For example, in terms of educational goals, the requirements for the accuracy of knowledge and the controllability of educational quality are constantly increasing, which makes the construction of educational big models more urgent ; at the same time, how to use the powerful text generation, language understanding and logical processing capabilities of generative artificial intelligence to more effectively introduce interactive and conversational teaching methods to cultivate students ' innovative ability has also become an urgent problem to be solved. In addition, with the rapid development of generative artificial intelligence, ethical risks and legal issues have become increasingly prominent. How to ensure the healthy development of science and technology is also a challenge we need to face. The solution of the above problems has yet to be technical experts, education experts, legal experts, psychological experts and the majority of front-line teachers and students to jointly study and discuss, in order to create a new model of future education new forms.

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