

The Research about the Innovative Application in Education Field Based on ChatGPT Foundation Model

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Abstract: In 2022, generative artificial intelligence (i.e., generative AI) was included and highlighted in the Gartner Hype Cycle™ for Artificial Intelligence (AI) section. The journal indicated that the generative AI would be a significant trend in AI field in the future. Among them, ChatGPT, the representative of generative AI, can generate various modes of content, which has attracted wide discussion. From the earliest GPT-1 proposed by OpenAI to the latest GPT-4, ChatGPT has played diverse roles in life scenarios, especially in the field of education, where its innovative value has received widespread attention. The interactivity and extensibility of ChatGPT enable it to create educational aids, build independent learning platforms, and simulate learning scenarios. ChatGPT has offered promising prospect and new ideas for education innovation and development. However, since the algorithm kernel of ChatGPT is still Large Language Model (LLM) that relies on volume and differences of training data and material, using ChatGPT is likely to bring disadvantages such as academic abuse, knowledge plagiarism and intelligence discrimination. Therefore, this work will focus on the followings to illustrate innovative applications of ChatGPT technology in education and discuss how to better embrace the opportunities ChatGPT brings. The main work of this paper is as follows: (1) Using international Chinese education to illustrate the innovative application of ChatGPT large model; (2) To demonstrate how ChatGPT empowers higher education; (3) To synthesize the education innovation driven by ChatGPT, and also to present thoughts on the challenges triggered by current ChatGPT application.

1. Introduction

The application of educational technology is undoubtedly indispensable in the education field today. According to statistics from the Ministry of Education, educational information technology has been used to carry out teaching activities by more than 80% of primary and secondary school teachers, covering as many as 1.6 million classrooms with according equipment [1]. Among them, educational technologies based on artificial intelligence attract amounts of attention, such as releasing and correcting assignments through cloud platforms and using data analysis to assess learning behavior. "Artificial Intelligence plus Education" has become a hot educational trend nowadays, driving the reform of education ecology. Thus, the artificial intelligence products represented by

ChatGPT become important targets for research nowadays.

The development of ChatGPT mainly contains the following five phases differing in features, data participants, pretraining data, as shown in Table 1. GPT1.0 is the earliest GPT model, which mainly performs unsupervised learning and implements a large language model by unsupervised training and supervised fine-tuning of the model according to a specific task. The auxiliary objective function also plays an important role in the training process. GPT2.0 is concentrated on multi-task learning, using unsupervised training model to achieve a supervised task. Practically speaking, it uses known text data to infer subsequent text content [2]. GPT3.0 adds a little example information to make the model more easily capture different information and adapt to various tasks. After that, GPT3.5 adds a feedback reinforcement model to GPT3.0 by evaluating GPT3.5's performance and giving rewards and punishments to make the task performance close to human level. GPT4.0, proposed a few months ago, has more powerful features which makes image input and the application of image data a reality, enabling the connectivity from language to multimodal[3]

Table 1: ChatGPT Development Phases [2]

Stage	Features	DataParticipants	PretraingData
GPT1.0	Unsupervised Learning	117 Million	Approx. 5GB
GPT2.0	Multitasking Learning	1.5 Billion	40GB
GPT3.0	Large Number of Parameters	175 Billion	45TB
GPT3.5	Feedback-Reinforced Learning	-	-
GPT4.0	Multimodal Connectivity	100 Rillion	-

It is based on the development of ChatGPT that related technologies have also been innovatively applied in the field of education. In the international Chinese language education field, ChatGPT, as a language interaction-based tool has been widely researched in the field due to the cross-regional and multicultural nature of the subject. With its powerful language generation capability and generative data output method, ChatGPT has received much research in the field [4]. In 2023, Hua Liu et al. proposed the application of using ChatGPT for intelligent teaching reading and writing Chinese, and constructed a human-computer collaborative teaching model in which the instructor set the tasks and requirements first, and then ChatGPT generated the task material [5]. However, since the current AI technology cannot ensure the accuracy of the generated materials, the content output using ChatGPT may be distorted, incorrect, or even meaningless. In response, Xiaobing Zhou et al. introduced multimodal supply and full feedback for ChatGPT large model technology to achieve continuous optimization of interactive platform functions[6].

The introduction of ChatGPT technology has also contributed to the revolution of higher education. Feng Zhang et al. offered the possibility regarding "triple substitution" of artificial intelligence for graduate education, such as artificial intelligence technology embedding[7]. In 2021, Wollny proposed a multimodal large model based on ChatGPT to automate learning tasks in an interactive way between teachers and students. Subsequently, Langworthy proposed that ChatGPT large model technology enabled the shift from decentralized education focusing on quality assessment to centralized education with a focus on skills[8]. However, since the underlying logic of content generated by ChatGPT is still generalized from user-given datasets, it causes problems of quality, authenticity, and reliability. In this regard, Feng Zhang et al. identified the service boundaries that ChatGPT should have in higher education and also the protection of digital resource information[9].

The purpose of this study is to examine the innovative application of ChatGPT in international Chinese language education and higher education, and then present the pros and cons of the innovation in education based on the former two examples. The remaining sections of the paper are structured as

follows. I will introduce the technological innovation of ChatGPT in Chinese international education in section 2. Then, the related application in higher education will be discussed in section 3. The fourth section will illustrate my views on the opportunities and challenges brought by the innovative application of ChatGPT large model technology in education based on the above examples. Finally, section 5 will summarize the paper and draw conclusions from the discussion of innovative application of ChatGPT.

2. International Chinese Language Education Field

2.1 Human-Computer Interaction Function Application

International Chinese language education is an important educational discipline and also the way to spread Chinese culture. Since ChatGPT was introduced, many experts have conducted concerning researches on the application of ChatGPT in this field. That is because the subject itself requires interactivity, and one of the important features of ChatGPT is the powerful intelligent human-computer interaction. In 2023, the team of Xiaobing Zhou found that ChatGPT incorrectly classified words such as classifying intermediate level 6 words as elementary level. In addition, ChatGPT achieved moderate error correction, but still could not elaborate the causes of errors and the error acquisition mechanism. In response, Zhou et al. proposed multimodal provisioning at input and timely feedback during use. Multimodal supply is based on personalized resource integration, using ChatGPT to provide a complete set of learning chain from word learning to testing, as well as providing explanations of language skills and knowledge in different scenarios. Timely feedback, on the other hand, is used to continuously improve ChatGPT output content by constantly providing content including instructional focus changes and error acquisition [6].

2.2 Knowledge Service Side and Demand Side Reform

The supply side and demand side of knowledge service are two core subjects in international Chinese language education, and revolutionizing both is also the focus of the work oriented to generative AI models [12]. In this regard, Haifeng Pan thought that digital resources such as curriculum and textbook libraries that are already widely used nowadays should be integrated, and at the same time, resource mining and output of other related disciplines should be matched to create a dedicated database for ChatGPT in international Chinese language education. For the demand side, to make ChatGPT have more accurate demand mining functions, Haifeng Pan proposed that instructors should input different task descriptions and presentations into the prompt driver by topics and scenarios, so as to provide educational services based on actual application scenarios of ChatGPT[13]. As a strong interactive technology with high language generation capability, ChatGPT can provide language learners with uninterrupted and non-tiring language learning companion services. From this perspective, Gaoqi Rao considered that the key to the grounded application of ChatGPT large model technology is to capture prompts for learning. In summary, ChatGPT requires users to give guidance prompts continuously for outputting the most optimal answers. Therefore, setting reasonable and efficient prompts is the key point for ChatGPT to provide language learning companion services [4].

3. Higher Education Field

3.1 Resource Allocation Model Reform

Higher education plays an indispensable role in China's education system and is an important part of cultivating high-quality talents. The development of ChatGPT large model technology is bound to

have a profound impact on the field of higher education and will also have a wide range of applications. In the traditional education structure, resources like teaching materials and test questions required by universities are integrated and aggregated from various platforms, which can be scattered. Besides, when allocating educational resources, resources are often allocated directly based on the subject settings of different majors, which can lead to the solidification and waste of resources. In 2023, Chao Shen pointed out that using ChatGPT can promote the intelligent management of educational resources and personalize training of students. ChatGPT is essentially a natural language processing technology, based on which universities can iteratively output the required text resources by inputting diverse data such as subject characteristics and needs for training. When allocating, ChatGPT can also help solve the disadvantages of the traditional resource allocation model in higher education. Moreover, by analyzing students' learning behaviors and relevant generated reports, schools can reasonably allocate educational resources based on the content of the reports so that educational resources are no longer solidified in subject categories, but are truly distributed according to needs, achieving educational resources circulation[10].

3.2 Innovative Improvement Measures

However, ChatGPT technology still relies heavily on pre-trained data repositories and autoregressive model architecture based on prompting[11]. Getting the desired output from training input data may result in rigid results, which are far from the human mindset. Thus, over-reliance on ChatGPT technology for higher education is instead detrimental to students' development, leading to incorrect judgments about learning analysis. For this point, Feng Zhang et al. submitted effective methods. The first step is to establish the subject boundary between ChatGPT and students in the process of learning. This means that even though ChatGPT technology has the function of simulating human language forms, analyzing and summarizing functions, students still have to act as learning subjects to analyze the rationality of the results and make criticism or innovation of the results. At this level, ChatGPT technology can only be used as a supplement to students' intelligence and knowledge. Based on this, Feng Zhang et al. also requested to reconstruct the large model technology of ChatGPT. In the past, universities have usually focused on getting objective content such as student performance analysis and assignment correction results when using ChatGPT, neglecting the logical training of the technology. Hence, Feng Zhang et al. advised to improve the logical function of ChatGPT in terms of ethical and legal constraints [9]. Targetting at ChatGPT, Wu et al. also proposed to use ChatGPT as the core, supplemented by the use of other AI technologies. This approach aims to create an intelligent learning environment, i.e., to achieve "scenario-based" learning. This requires universities to expand the application chain of ChatGPT large model technology, which should not be limited to teachers and students as the main teaching subjects, but should build an intelligent structure covering the device side, user side, management side and service side[7]. In summary, the improvement methods focus on distinguishing the subject boundaries of AI use and education, resource integration, and improving model ethics code, as shown in Figure 1.

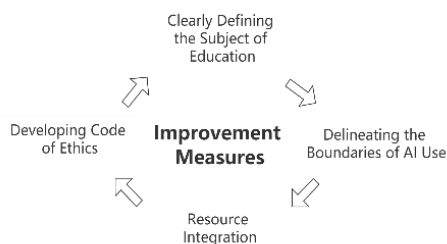


Figure 1: Improvement Measures for ChatGPT

4. Reflections on Education Reform Driven by ChatGPT

4.1 Educational Opportunities Brought by ChatGPT

A study of ChatGPT innovative applications in international Chinese language education and higher education reveals that ChatGPT is able to reduce a great deal of repetitive work in the teaching and learning process by completing the most basic learning tasks in a supportive role, allowing teachers and students to focus on teaching and learning tasks that require more human mindset thinking. In addition, ChatGPT can act as a digital tutor for students. Taking the role of a language partner in international Chinese language education as an example, ChatGPT enables interaction with students in a conversational format to support their language learning. Omar et al. in 2022 used ChatGPT's language model to educate students in their experiment. The team made ChatGPT perform chaperoning and material provision based on different subject. The experiment found that students' independent learning and participation increased under this model, and ChatGPT helped students to think more openly [14]. Adjustments based on timely feedback and evaluation enables ChatGPT to continuously optimize the output and eventually generate personalized instructional needs suitable for students. In 2023, Frieder et al. found that ChatGPT could achieve secondary feedback based on evaluation under the Reinforcement Learning from Human Feedback (RLHF) mechanism, iterating the output continuously. The team asked ChatGPT to offer suggestions for the improvement of input text, and then found that ChatGPT's responses were accurate, while it monitored all changes made by students[15].

4.2 Educational Challenges Posed by ChatGPT

The innovative application of ChatGPT in education is a major breakthrough of "AI plus Education", but it also brings many challenges to the education industry. Academic plagiarism and intelligent discrimination are two prominent problems [16]. In recent months, many universities at home and abroad have issued clear announcements to prohibit the use of ChatGPT in teaching activities, which essentially stems from the controversy over the ownership of ChatGPT-generated results. The results given by ChatGPT are essentially the integration of database resources. Although they can provide answers that meet the requirements, the output is still based on existing data results without innovation and independence. Consequently, the use of ChatGPT in teaching activities is likely to result in intentional or unintentional plagiarism of others' academic fruits and undermine knowledge protection [16]. Also, since the use of ChatGPT is based on certain databases, the differences in digital resources available in different regions will also inevitably affect the objectivity of ChatGPT answer generation, which has essentially become a resource divide that brings digital discrimination to regions lacking educational resources. Meanwhile, Zhuo et al. experimentally found that although ChatGPT itself was not discriminatory, ChatGPT answers could contain bias and discrimination [17] when users used training packets that contain discriminatory information (e.g., poverty, skin color, ethnicity). This is the problem that cannot be circumvented by using ChatGPT at present.

5. Conclusions

ChatGPT large model technology brings new momentum to the education ecology and is a positive response to the current trend of "Artificial Intelligence plus Education". ChatGPT undoubtedly brings new empowerment to the education industry from a technical perspective, and may be used as a breakthrough to achieve ecological innovation changes in the "Society-Technology-Education" chain. It can not only act as intelligent interactive education characters for specific disciplines such as international Chinese education, but also offer innovative reforms to the educational resources

allocation and students cultivation. At the same time, despite the great development potential of ChatGPT technology, its inherent application security and ethical flaws still cause concerns. (See in Figure 2) Thus, how to improve ChatGPT technology, avoiding the academic ethical and moral problems brought by it, and how to balance the traditional teachers' role with ChatGPT are still the directions that should be considered and solved when implementing ChatGPT in education.

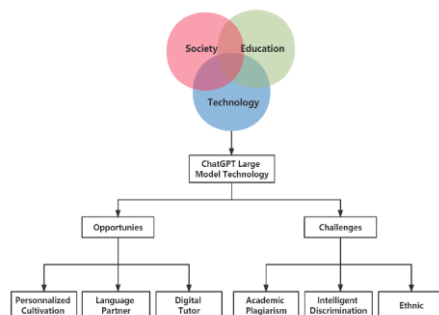


Figure 2: Opportunities and Challenges for ChatGPT

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