Satisfaction with MOOCs platforms and the need for intelligence: Voices from Chinese university undergraduates

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Abstract: This study explores the user experience of MOOC platforms, especially the SPOC mode, among Chinese undergraduates. It finds that students in their second and third years commonly use these platforms for learning. While users appreciate the basic features, they are only moderately satisfied and seek improvements to enhance their learning interest and efficiency. They desire smoother and more efficient platform operations. Users want diverse course offerings, better presentation, and assured quality from the MOOC platforms. Intelligent features like course recommendations and question-answering receive positive feedback. The study suggests that MOOC platforms should enhance personalization, interactivity, and resource quality and collaborate with universities to develop a blended teaching model using new technologies. The discussion proposes leveraging user data and feedback to improve functions, offer personalized experiences, and achieve better learning outcomes.

Keywords: MOOCs; Chinese undergraduates; satisfaction; intelligence

1. Introduction

Since the Open Courseware Movement (OCW) proposed by MIT and the Open Educational Resources Movement (OER) proposed by UNESCO in 2002, online learning and blended classrooms have been further developed [1-2]. Subsequently, massive open online courses (MOOCs) rapidly gained popularity, but the sharp increase in quantity led to a quality crisis, such as students' weak learning continuity, high dropout rates, difficulties in testing learning effectiveness, and other problems [3-4]. The Small-scale Restricted Online Course (SPOC) proposed by Professor Armando Fox applies MOOC resources to the small-scale teaching environment [5] to better ensure the learning effect and deep learning of students. Despite the improvements of SPOC based on MOOC, there are still a series of challenges and problems in platform development, such as low platform operation efficiency and lack of competitiveness[3].

In recent years, SPOC has been widely used in MOOC platforms and college education. Most of the existing research discusses the application of MOOC and SPOC from the perspective of designers, involving intelligence, discipline characteristics, teaching depth, etc. Some research also focuses on the construction of MOOC platforms and user experience [4]. However, most of these studies focus on user experience and needs from the perspective of the architect. Based on user experience and needs, this paper analyzes the usage experience of MOOC platforms for Chinese undergraduates in the era of intelligence and discusses the development direction of MOOC platforms.

2. Literature Review

Since the concept of massive open online courses (MOOCs) was first proposed by US professor Dave Cormier in 2008, many top universities and their professors have chosen to democratize higher education in this way, and these attempts have given birth to the first MOOC platforms. In October 2011, Andrew Ng, a computer science professor at Stanford University, offered a free online course on coding that attracted hundreds of thousands of learners to sign up. This success spawned Coursera, a world-renowned for-profit MOOC platform. Another popular for-profit MOOC platform, Udacity, was built on the impact of Sebastian Thrun's free, shared courses. EdX, another not-for-profit MOOC often studied by

researchers, is funded by MIT and Harvard. Under the leadership of these pioneers, many countries' top universities and companies have invested in the construction of MOOC platforms, such as Khan Academy, FutureLearn, NetEase Open Courses, and XuetangX Online.

The popularity of MOOCs has triggered a boom in learning and studying through MOOCs. Yonggu Wang et al. (2014) summarized the characteristics of MOOCs, arguing that, compared with traditional teaching modes, MOOCs encompass core learning processes such as online learning, partner collaboration, and multiple management, and are characterized by large scale, openness, networking, and personalization[6]. With the huge growth of MOOC platforms, online courses, and student registrations, the rapid acceleration in quantity has led to a quality crisis. Students in online education face issues such as weak learning continuity, high dropout rates, difficulties in meeting practical needs through online teaching, challenges in testing learning effects, difficulties in certifying credits, and generally insufficient depth of learning. Researchers have paid more attention to the shortcomings and inadequacies of MOOCs. At the same time, the search for changes based on the MOOC model is also ongoing, with Professor Armando Fox proposing the Small Private Online Course (SPOC), which has had the most far-reaching impact [7]. As Bo Qin et al. (2021) point out, this model (SPOC) applies MOOC teaching resources to a small-scale teaching environment, emphasizes overall course planning and flipped classroom design, and strives to better ensure the learning effect of students and promote deeper learning and continuous communication through small-scale teaching for specific groups[8].

Although SPOC goes further than traditional MOOC courses and overcomes problems such as insufficient learning depth, disjointed learning needs, and difficulties in authenticating learning results to a certain extent, SPOC still has some common shortcomings with MOOC. Xue Yun et al. (2016) pointed out that, The SPOC model also has some problems, such as the richness and practicality of course resources to be improved, the scientific design of teaching links to be insufficient, especially the interaction, evaluation and incentive mechanism to be improved[9].

In recent years, there has been extensive exploration regarding the application of MOOCs and SPOCs in college teaching and platform construction. Most researchers discuss the structural design from the perspective of designers, focusing on dimensions such as intelligence, subject characteristics, teaching depth, and teaching mode. Yantong Chen (2023) takes the SPOC model in college English teaching as a starting point, where the SPOC foreign language teaching model has been constructed from the perspective of deep learning [10]. Some scholars have also explored the integration of the SPOC model into the construction of sports courses and applied the flipped classroom teaching model of SPOC to the table tennis elective course in colleges and universities, conducting experiments and comparing it with traditional teaching methods.

Furthermore, some scholars have conducted research from the perspective of MOOC platforms construction and user experience. Ting Shen (2023) selected four widely used MOOC platforms, namely Coursera, edX, Chinese University MOOC and Chinese Alliance, to conduct in-depth discussions on their renewal, interactivity, and co-creation of new forms of textbooks supporting international Chinese education MOOCs[11]. Chongyang He (2022), based on user acceptance models TAM and TTF, proposed corresponding management suggestions for SPOC platforms from the perspective of user acceptance[12].

As the scale of course resources and learners on the MOOC platform continues to grow, a single interaction and feedback method is no longer sufficient to cater to a large and diverse audience. Therefore, the research and application of intelligent MOOC teaching modes have become imperative. With the proliferation of artificial intelligence, big data, and other technologies, leveraging intelligent technology for empowerment has emerged as a pivotal proposition in the development direction of MOOC platforms.

After summarizing the literature research related to MOOCs and SPOCs, it is found that the current research on SPOCs focuses on feature connotation, application modes, practical exploration, user experience, and intelligence, and has reached a relatively mature conclusion. However, in the areas of user experience and intelligence, although many scholars have conducted research from various dimensions, most of them adopt the designer's perspective and emphasize the construction of theoretical models. Therefore, research in related fields generally lacks cross-disciplinary insights based on the user's perspective, and the research system requires further improvement.

3. Research Design

3.1. Research Questions

In the current teaching of undergraduate universities in China, SPOC mode hybrid teaching based on MOOC platform has been widely used in the teaching practice of major public courses and some professional courses. This study aims to explore and answer the following three questions from the dimension of user experience and intelligent demand by drawing a portrait of undergraduate users in Chinese universities:

(1) What is the user profile of today's SPOC-compatible MOOC platforms?

(2) College undergraduates' attitude (satisfaction) on existing platform.

(3) College undergraduate users' understanding and attitude toward the core functions of MOOC platform and platform intelligence?

3.2. Research object

At present, SPOC-compatible MOOC platform users primarily fall into two categories: one is college students, who utilize MOOC online videos to achieve blended online and offline teaching in campus classes; the other is online students. Colleges and universities offering SPOCs impose certain application conditions on online students who meet these criteria. Due to the limitations of the author's research tools and methods, this paper intends to focus primarily on undergraduate users from colleges and universities with high platform popularity and deep usage as the main research subject.

3.3. Research Tools

This study uses structured questionnaire as the main tool, including four dimensions: basic information, usage, satisfaction and functional needs. The questionnaire was designed to collect college students' usage frequency, functional preferences, satisfaction, and views on intelligent improvement of the MOOC (including SPOC) platforms they use daily (Table 1).

Table 1: Dimensions of the questionnaire

Dimensions	Content
Basic information	Gender, grade, major, ability self-assessment
Usage	Common platform, reason, frequency, use effect
Influencing factors of satisfaction	Appearance, form, additional functions, response speed, resource richness, course quality, professional fit
Functional requirements	Basic improvement, introduction of artificial intelligence, intelligent development needs and rationality

3.4. Research Methods

Based on the research content, this study primarily employs investigation research and content analysis methods. Firstly, a questionnaire is designed based on the research question dimensions, and data is collected through a questionnaire survey. Subsequently, statistical software such as SPSS is utilized to analyze the collected questionnaire data, uncovering the relationship between college students' usage of MOOC platforms, their satisfaction, and their demands and expectations for intelligent functions. Finally, relevant teaching and research opinions and prospects are presented.

4. Data analysis

A total of 45 questionnaires were distributed in this survey, and 39 valid questionnaires were recovered. In terms of the gender and grade of the respondents, there were 15 males, accounting for 38.46%, and 24 females, accounting for 61.54%. In this survey, the female respondents were significantly more than the male respondents, accounting for the majority. In addition, among the respondents, there was one freshman, accounting for 2.56%; 19 college sophomores, accounting for 48.72%; 15 college juniors, accounting for 38.46%; college seniors, accounting for 10.26%; And 0 college fifth-year students (five-year majors), accounting for 0%. Overall, the cumulative proportion of sophomore and junior

college students is 87.18%, which is much higher than that of students in other grades. This "MOOCs platform" is the most widely used among sophomore and junior students, because of the emphasis on user feedback research on this part of students.

In terms of the subject background and information literacy of the respondents, 19 of them were humanities and social sciences majors, accounting for 48.72%; 18 were from science and technology majors, accounting for 46.15%; And 2 were from art majors, accounting for 5.13 percent. At the same time, when asked to self-evaluate their ability to use network resources for learning (out of 5), the average score of the respondents reached 3.79, which can be said that the respondents generally have a good ability to learn online.

Through the cluster analysis, it can be found that although the groups who think they have strong network learning ability and use MOOCs platform more often have a higher overall satisfaction with the current MOOCs platform functions, they also hold a more positive attitude toward the intelligent improvement of MOOCS platform. While the other group has weaker ability to use the Internet for learning, relatively speaking, they use the MOOCs platform for learning, or pay less attention to the further development of MOOCs platform.

4.1. Usage of MOOC users

According to the survey, regarding the frequency of learning through MOOCs per week, the average score of the respondents was 2.69, which indicates that MOOCs have become an important, but not indispensable, learning medium in the overall learning of today's college students. Platform preferences are generally diversified, and some respondents mentioned non-comprehensive video platforms such as BiliBili in the remarks. With the popular development of video streaming platforms, the original functions belonging to MOOCs have also been absorbed, and MOOCs are facing certain competitive pressure.

As far as the use effect is concerned, most respondents believe that MOOCs are helpful to learning to some extent, but the overall evaluation is moderate, with an average score of 3.13. When asked about the specific performance of the help, 78.57% of the respondents generally believe that MOOCs are beneficial in "promoting the facilitation of knowledge acquisition", while 42.86% of the respondents believe that MOOCs improve the interaction between teachers and students. However, only 13.51% and 29.73% of respondents believe that MOOCs can greatly help in the aspects of "improving learning interest" and "strengthening learning efficiency", which indicates that MOOCs have indeed promoted the facilitation of knowledge acquisition on the one hand, and greatly improved the teacher-student interaction through new structures such as SPOC flipped classroom. However, the user experience and efficiency of the platform itself have not been recognized by most users.

A survey was conducted on the platform interface appearance, course presentation form and basic functions commonly used by the respondents, and it was found that the average feedback score of the respondents was 3.79, indicating that users have a high overall recognition of the basic functions of the MOOCs platform. However, it should be noted that in terms of course presentation form and additional functions, there are still a few individual cases that express dissatisfaction.

When analyzing the reasons why users choose to use MOOCs, the independent sample T-test reveals significant gender differences ($p=0.005$), indicating that there is significant preference heterogeneity between male and female users in terms of functional needs. Furthermore, the gender demand difference of additional functions was also significantly confirmed by the T-test ($p=.004$), which provided data support for gender differentiation of platform functional design.

In terms of students' satisfaction with the course quality of MOOCs platform, ANOVA analysis showed significant grade differences ($p=0.025$), suggesting that grade may be an important factor affecting users' evaluation of course quality. In addition, the satisfaction of response speed also showed significant difference among different grades ($p=0.050$), indicating the different impact of grade on user experience.

In terms of intelligent function requirements, the difference in gender preference for the question-answering function of MOOCs platform was significant through T-test ($p=0.005$), while the difference in demand for other intelligent functions was also significant ($p=0.030$). These findings provide a basis for gender customization of intelligent functions of the platform. The difference in the demand for learning assistance functions ($p=0.015$) further emphasizes the importance of gender in the functional requirements of MOOCs platform and points out the direction for the platform to provide more

personalized learning assistance functions.

In the analysis of the frequency of use of MOOCs, ANOVA test showed a significance level of 0.045, revealing significant differences in the frequency of use among students of different grades, and providing key clues for understanding the influence of grades on use behavior. As for the perception of the degree of learning assistance, the ANOVA test result (significance level 0.003) clearly points out that grade difference is significant in students' perception of the teaching effect of MOOCs platform, providing a basis for further exploring the influence of grade level on students' evaluation of the teaching effect of MOOCs platform. In terms of course quality satisfaction, inter-group ANOVA analysis (significance level 0.050) found that students of different grades had significant differences in their satisfaction with the course quality of MOOCs platform, which provided a direction for optimizing course quality. As for the satisfaction of intelligent course recommendation, inter-group ANOVA analysis (significance level 0.025) shows that students of different grades have significant differences in their satisfaction with the recommendation system, which provides an important basis for understanding how grade affects the evaluation of the course recommendation system. Finally, the analysis of the satisfaction of the intelligent question-answering function (significance level 0.019) shows that students of different grades also have significant differences in their satisfaction with the question- answering function, which provides guidance for optimizing the question-answering function according to grade differences.

Through ANOVA test, we found that students of different majors have significant differences in their perception of the degree of learning assistance of MOOCs platform ($p=0.010$), which provides an important perspective for understanding students' cognition of the educational value of the platform. Further inter-group ANOVA analysis revealed that students of different majors also have significant differences in the frequency of using MOOCs platform ($p=0.027$), which provides an empirical basis for exploring the impact of professional background on online learning behavior. In addition, the satisfaction analysis on the interface appearance of MOOCs platform shows that students of different majors also show significantly different satisfaction ($p=0.036$), which helps us to grasp students' specific preferences and expectations for interface design.

4.2. User Attitude

4.2.1. Basic Requirements

According to the user survey, the core needs of the users of the MOOCs platform focus on the presentation form of courses, the richness of course resources and the quality of courses. More than half of the respondents (56.41%) asked to improve the presentation of courses, 58.97% expected the platform to have more abundant course resources, and 56.41% paid attention to the quality of courses. These data highlight the urgent need for users to improve teaching quality and learning experience.

In terms of the operational experience of the platform, ANOVA analysis revealed significant differences in user satisfaction with the response speed of the platform ($F(3, 35) = 2.871$, $p = 0.050$), indicating that users have further expectations for the fluency of the platform.

4.2.2. Intelligent demand

Respondents generally hold a positive attitude towards the intelligent development of MOOCs. In the questionnaire, regarding the question "Do you pay more attention to the intelligent development of the platform than the optimization of basic functions", the respondents gave a high average score of 3.92, which shows the strong interest and recognition of users in the introduction and optimization of intelligent functions.

Regarding the rationality of intelligent improvement, the average score of respondents reached 3.82, which reflects that users generally believe that intelligent development is the key direction to improve the experience of MOOCS platform. Especially for the satisfaction of intelligent course recommendation and Q&A functions, inter-group ANOVA analysis found that students of different grades had significant differences in their evaluation of these functions (intelligent course recommendation: $F(3, 35) = 3.511$, $p = 0.025$; Intelligent question- answering: $F(3, 35) = 3.756$, $p = 0.019$), which provides a clear user base and development direction for the optimization of intelligent function of MOOCs platform.

In general, users have clear expectations and confidence in the basic needs and intelligent development of MOOCs platform. The platform needs to pay attention to these needs and meet users' expectations and enhance user satisfaction by improving course presentation quality, enriching course resources, improving course quality and strengthening intelligent functions.

5. Research conclusion and discussion

5.1. Research Conclusions

Based on the investigation and analysis of the use of MOOCs by undergraduate students in Chinese universities, this study draws the following conclusions:

(1) In the current context of educational technology development, MOOC platforms compatible with the SPOC model are gradually becoming an essential component in the field of higher education. According to the user survey data, it can be observed that the primary users of these platforms are undergraduate students, particularly sophomores and juniors. Their frequent use of MOOCs indicates that students in these grades have more profound online learning needs, primarily driven by the requirements of their schools and professional courses.

(2) Undergraduate students' satisfaction with the existing MOOC platforms shows an above average attitude. Although most users believe that MOOCs are helpful to their learning, the overall evaluation is moderate, with an average score of 3.13. Users generally believe that the platform is beneficial in promoting the facilitation of knowledge acquisition, but its performance in improving learning interest and reinforcement learning efficiency is not outstanding. In addition, users also show certain expectations for the response speed and operational experience of the platform, hoping that the platform can provide a smoother and more efficient user experience, and there is a relatively obvious disciplinary background gap in these aspects, which may be related to the different needs of professional courses. It should be noted that in terms of overall satisfaction with MOOCs, there is little difference between humanities and social science students and science and engineering students, while some art students have a lower satisfaction. However, since the sample size of the latter is smaller than that of the former two in this study, there may still be room for independent research.

(3) Undergraduate users have clear expectations for the functional improvement of the MOOC platform. They hope that the platform can provide rich and diverse course resources, improve the presentation of courses, and ensure the quality of courses. The user survey shows that more than half of the users particularly emphasize the improvement of course presentation forms, as well as the richness of course resources. In addition, users held a positive attitude toward the intelligent development of the platform, and they showed obvious interest in and recognition of the introduction and optimization of intelligent functions. But at the same time, the cluster analysis results show that the optimization of MOOCs' functions, whether in basic aspects or intelligent improvement, should consider the needs of different learning stages and different learning levels.

These results show that although undergraduate users in colleges and universities recognize the basic functions of the existing MOOC platform to a certain extent, it does not represent the solution of the problem, especially in terms of improving user experience and meeting individual needs, and the more core users expect the improvement and intelligence of the platform functions.

5.2. Discussion

Combined with the research results, we can find that the future optimization direction of MOOC platform mainly lies in improving the personalization, interactivity and resource quality. Based on these three issues, the following discussion is made:

(1) Deepen the cooperation between the platform and universities, and build a mixed teaching model

From the above survey, it can be found that the choice of Chinese college students for MOOCs is greatly influenced by the choice of university authorities. Meanwhile, streaming media platforms such as BiliBili are also impacting the status of traditional MOOCs. Therefore, how to carry out in-depth cooperation with universities and develop their own advantages of mixed teaching will become the main topic of content optimization of MOOCs platform.

On the one hand, focus on user groups and teach students according to their aptitude. In terms of the current development trend of MOOCs, the differentiated competition among MOOCs is becoming increasingly fierce, and more help from universities is needed in the future development [13]. While deeply cooperating with colleges and universities to launch featured courses, it is also necessary to focus on the needs of college students for course design. Since 2013, "higher education" has been one of the most influential keywords in the field of MOOCs research [14], which reflects that the mainstream audience of China's MOOCs is most college students. The teaching needs of college courses and the

actual needs of college students should become an important vane for the construction of MOOCs platform.

On the one hand, multi-party cooperation should be established to establish a perfect evaluation and feedback mechanism. While the relevant education departments carry out the system construction, university teachers and students, as specific practitioners, should be encouraged to give feedback based on their own experience, especially students who occupy most users. As Yonghe Zheng et al. (2023) pointed out, in the promotion process of MOOCs, universities should focus on stimulating students' enthusiasm to participate in the construction of MOOCs, giving full play to the initiative of the builders, clarifying the specific needs of learners, and implementing the evaluation of MOOCs [14].

(2) Adopt new technologies such as big data and artificial intelligence to improve learning experience

For users, the current MOOCs platform has a problem of convenience but difficulty in improving efficiency in terms of user experience, which reflects that although the current MOOCs platform has many learning resources, it cannot effectively push them and provide them to users. In terms of solving this problem, the big data learning technology supported by artificial intelligence has significant advantages. Judy Kay, an expert on educational artificial intelligence in Australia, once talked about building an open learner model with artificial intelligence technology combined with learning data. Learners can self-perceive and self-regulate by viewing their own learning data, to learn more actively [15]. At present, MOOCs platform has accumulated a large amount of learning data. Based on this condition, the main direction of further optimization and development of MOOCs platform should be how to make reasonable use of big data technology to carry out in-depth analysis and learning of these data, sketch users' needs, and provide more accurate and personalized teaching information and suggestions for learners and teaching staff.

Of course, if the platform's learning system interface is too cumbersome or insufficient guidance, it will reduce the user's learning efficiency and satisfaction. Therefore, an auxiliary system that can listen to the specific needs of users and provide relevant guidance to users according to the needs is also a good solution. At present, a research team in China has used the big data accumulated on XuetangX to make an intelligent learning assistance system "Xuetang Xiaomu", which can not only provide corresponding incentive words according to different learning motivations, but also help improve the retention rate of course learners [16]. Through intelligent robot assistance system like "Xuetang Xiaomu", artificial intelligence technology is further combined with learning path planning, learning interaction and other functions to provide learners with more personalized real-time learning assistance, connecting an isolated function point in MOOCs platform, further improving the fluency of the platform and improving user learning experience at the same time. It can also call platform resources more fully and pertinently and build an overall career learning experience. As Zhizhen Zhang et al. (2023) pointed out, the educational technology thinking of large-scale language model artificial intelligence represented by ChatGPT and its derivative applications should not only stop at the level of basic help functions such as providing users such as teachers and students with suggestions and guidance but should go deep into the overall impact on the structure of school teaching system[17].

In general, the future application of new technologies in MOOCs should focus more on how to effectively utilize user learning data and feedback to enhance and adjust functionalities, thereby providing users with a more personalized and efficient experience, leading to improved learning outcomes.

References

[1] OCW, M. (2008). MIT OpenCourseWare. Retrieved July 10, 2024, from http://en.wikipedia. org/wiki/MIT_OpenCourseWare
[2] Butcher, N., Kanwar, A., & Uvalic-Trumbic, S. (2015). A Basic Guide to Open Educational Resources (OER). Commonwealth of Learning, UNESCO.
[3] Chen, X. D., Cao, A. Q. (2014). Why Didn't Persist—Analysis of a MOOC Learning Case. Modern Distance Education, (2), 9-14.
[4] Gao, D. (2014). Cold Thinking on the Heat of MOOCs. Journal of Distance Education, 2, 39-47.
[5] Fox, A. (2013). From MOOCs to SPOCs. Communications of the ACM, 56(12), 38-40.
[6] Wang, Y. G. , Zhang, Q. (2014). Characteristics and Learning Mechanisms of MOOCs. Educational Research, (9), 112-120.
[7] Kang, Y. Q. (2014). The "Post-MOOC Era" of Online Education—Analysis of SPOC. Tsinghua Journal of Education, 35(01), 85-93.

[8] Qin, B., Yang, J. (2021). Exploring the SPOC Teaching Model in Course Construction. Chinese University Teaching, (3), 32-37.

[9] Xue, Y., Zheng, L. (2016). Exploration and Reflection on the SPOC Flipped Classroowwm Teaching Model. Chinese Journal of Educational Technology, (05), 132-137.

[10] Chen, Y. T. (2023). Research on the Application of SPOC Foreign Language Teaching Model under the Perspective of Deep Learning. Foreign Language World, (04), 91-96.

[11] Shen, T. (2023). Research on New Forms of Teaching Materials for International Chinese MOOCs [Doctoral dissertation]. Zhejiang University.

[12] He, C. Y. (2022). Research on the User's Intention to Use SPOC Platform Based on the Integrated Perspective of TAM and TTF [Doctoral dissertation]. Zhongnan University of Economics and Law.

[13] Ji, J. M., Wang, Y., Ouyang, J. Y., et al. (2019). A Summary and Future Trends of MOOC Development in 2018—Taking Coursera, edX, XuetangX, Udacity, and FutureLearn as Examples. Chinese Journal of Distance Education, (09), 16-25.

[14] Zheng, Y. H., Yang, S. H., Wang, J. Y. (2023). Current Status, Research Directions, and Prospective Reflections on MOOCs in China. Chinese Journal of Educational Informatization, 29(4), 26-34.

[15] Yi, W., Hu, M. H., Hu, Y. L., et al. (2018). Open Learner Models: Engaging Learners in Construction—An Interview with Internationally Renowned Educational AI Expert Professor Judy Kay. Open Education Research, 24(03), 4-11.

[16] Feng, W., Tang, J., Liu, T. X.(2019). Understanding dropouts in MOOCs. Proceedings of the AAAI Conference on Artificial Intelligence, 33(01), 517-524.

[17] Zhang, Z., Zhang, L. L., Mi, T. Y., et al. (2023). Will Large Language Models Catalyze Structural Changes in Schools? —A Prospective Analysis Based on ChatGPT. Chinese Journal of Distance Education, 43(04), 32-41.