

# Research on ChatGPT-Driven Advanced Mathematics Course

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**Abstract:** ChatGPT can provide a personalized learning experience based on students' learning styles, needs and interests. By identifying students' learning level and knowledge background, it can automatically adjust course content and difficulty to help students better grasp knowledge. ChatGPT can help teachers automatically grade homework and exams, saving a lot of time and energy, and devote more energy to teaching. At the same time, ChatGPT can answer students' questions, provide detailed explanations and support to help students better understand the course content and improve learning efficiency. By using ChatGPT, educational services can be delivered online, eliminating geographical and time constraints and providing learning opportunities to more people. Through the augmented reality technology combined with ChatGPT, it can provide students with a more vivid and vivid learning experience and enhance their learning interest. In general, ChatGPT can provide more technical support for education and promote the intelligence and modernization of education. This paper explores the impact of ChatGPT on the higher mathematics curriculum.

**Keywords:** ChatGPT; Education; UGC education model; Mathematics courses

## 1. Introduction

ChatGPT is also doing well in the field of education. It can provide various educational services for students and teachers through natural language processing technology. First, ChatGPT can provide students with a personalized, self-directed learning experience.<sup>[1][2]</sup> By interacting with ChatGPT, students can get more precise learning content and suggestions, so that they can arrange their time and pace freely and choose their learning content freely. At the same time, ChatGPT can also help students learn different languages, provide authentic language expression and cultural background knowledge, so that students can better understand and master the target language. Secondly, ChatGPT can also help teachers assess students' abilities and enrich teaching content. It can analyze students' responses and questions through natural language processing techniques, thus helping teachers better assess students' abilities. At the same time, ChatGPT can provide rich teaching content, including a variety of knowledge points and case studies, so as to help students more deeply understand the course content and better grasp the knowledge. In addition, ChatGPT facilitates the integration of students' interdisciplinary knowledge. Through ChatGPT's dialogue and autonomous learning ability, students can not only learn the field of knowledge that they are interested in, but also learn more diversified knowledge through the integration of knowledge in different fields. At the same time, ChatGPT can also help students conduct self-assessment and feedback during the learning process, and stimulate students' learning interest and creativity.<sup>[3]</sup>

## 2. Overview of basic concepts

### 2.1. Concept of ChatGPT

ChatGPT (full name: Chat Generative Pre-trained Transformer), a chatbot program developed by OpenAI in the United States, was released on November 30, 2022. ChatGPT is a natural language processing tool driven by artificial intelligence technology, it can understand and learn human language to talk, but also according to the context of the chat interaction, really like human chat communication, and even complete the writing of emails, video scripts, copywriting, translation, code, writing papers and other tasks. ChatGPT is a very popular conversation bot that is currently doing very well. Since its launch on November 30, 2022, ChatGPT has reached 100 million monthly active users in just two months, making it the fastest growing consumer app in history. By comparison, TikTok took nine

months to reach 100 million monthly active users and Instagram took two and a half years. ChatGPT continues to evolve through continuous online learning, such as conversations with humans. In addition, ChatGPT is widely used in various industries and has become a hot topic around the world.

ChatGPT is based on the GPT3 model to improve, it inherits the GPT3 article writing ability, but also in the dialog field, writing code, BUG modification, search and other areas have powerful functions. In addition, ChatGPT has a human-like cultural background and behavior pattern, is able to interact with users in natural language, and learns and evolves itself based on user feedback.

## **2.2. Concept of UGC education model**

UGC education model refers to the education model of User-generated Content. This model focuses on students' subjectivity and participation. By guiding students to actively participate in the creation, evaluation and sharing of course content, it can achieve effective knowledge learning and personal ability improvement. In general, UGC education model is a student-centered education model that pays attention to students' subjectivity and participation. By guiding students to actively participate in the creation, evaluation and sharing of course content, it can better promote the effective learning of knowledge and the improvement of personal ability.

## **2.3. Connection between ChatGPT and UGC education mode**

There is a close relationship between ChatGPT and UGC education models. First, ChatGPT is a natural language processing technology that can be used to intelligently generate text content, while the UGC education model focuses on students' active participation in the creation, evaluation, and sharing of course content. In the UGC education model, ChatGPT can be used as a tool to help students better participate in the creation of course content. For example, students can use ChatGPT to generate text content, including articles, reports, speeches, etc., to present their ideas and research results. At the same time, ChatGPT can also be used to evaluate and share the work of other students, thus facilitating the exchange and sharing of knowledge. In addition, ChatGPT can be combined with the UGC education model to enable further development of personalized learning. By analyzing students' learning behaviors and interests, ChatGPT can automatically adjust the content and difficulty of learning to meet the individual needs of students, and provide students with more flexible and diversified learning paths.

## **3. ChatCPT introduces advanced mathematics courses**

### **3.1. Impact of ChatCPT on advanced mathematics courses before class**

First, improve the efficiency of preview: ChatGPT can provide some background knowledge and basic concepts related to mathematical knowledge points to help students enter the learning state faster and improve the efficiency of preview. For example, ChatGPT can help students understand the meaning and application of some mathematical symbols and formulas, as well as their importance and application scenarios in higher mathematics.

Second, assist teachers in lesson preparation: ChatGPT can assist teachers in searching and sorting out literature materials and generating complete course materials, such as syllabuses, lesson plans and reading materials, so as to help teachers better prepare for lessons.

Third, stimulate learning interest: ChatGPT provides some interesting and practical content related to mathematics knowledge points, which can stimulate students' learning interest and motivation, so as to better invest in the study of higher mathematics.

Fourth, strengthen independent learning ability: ChatGPT can provide students with personalized learning methods and timely feedback, so as to help students better grasp mathematical knowledge, but also can cultivate students' independent learning ability and independent thinking ability<sup>[4][5][6]</sup>.

### **3.2. The impact of ChatCPT on the content of higher mathematics courses**

First, answer questions in real time: ChatGPT can answer questions and doubts encountered by students in the learning process in real time, so that students can understand and master mathematical knowledge in time.

Second, assist teachers in teaching: ChatGPT can assist teachers in teaching and provide some information and examples related to mathematical knowledge points, so as to better assist teachers in completing teaching tasks.

Third, promote classroom interaction: ChatGPT can interact with students to make classroom teaching more lively and interesting, but also can attract students' attention and improve learning results.

Fourth, provide personalized learning experience: ChatGPT can provide personalized learning methods and content according to students' learning styles and needs, so as to better meet students' learning needs and improve learning results.

### ***3.3. Establish higher mathematics curriculum with UGC education model as the core***

First, create a learning community: establish an open and collaborative learning platform to encourage students to share their experience and experience in learning higher mathematics, as well as their ideas and skills in solving mathematical problems. Students can communicate, discuss and answer questions with each other on this platform, so as to better understand and master math knowledge.

Second, guide students to participate in the creation of course content: Encourage students to actively participate in the creation of course content, for example, you can guide students to write math textbooks or make math courseware, and share and exchange with classmates in class. This can make students more active in learning math knowledge, and better understand and master math knowledge.

Third, carry out practical activities: Through practical activities, such as mathematical contest in modeling, mathematical experiments, etc., let students use mathematical knowledge to solve practical problems, so as to better understand and master mathematical knowledge, and cultivate students' innovation ability and practical ability.

Fourth, personalized learning: according to the different needs and learning styles of students, provide students with personalized learning methods and content, for example, you can customize personalized learning plans and math problem solving solutions for students, so as to better meet the learning needs of students and improve learning results.

### ***3.4. The influence of ChatCPT on the after-class of higher mathematics courses***

First, improve the efficiency of problem solving: students can use ChatGPT to search and solve mathematical problems quickly, improve the efficiency and accuracy of problem solving, and also reduce the burden and pressure of students.

Second, assist teachers to correct homework: ChatGPT can assist teachers to correct homework and tests, improve the efficiency and accuracy of correction, and also help teachers to better understand students' learning situation and problems, so as to better guide students' learning.

Third, promote the improvement of teaching quality: Through the assistance of ChatGPT, teachers can more accurately understand the learning situation and problems of students, so as to better adjust the teaching content and methods, and improve the teaching quality and effect.

Fourth, enhance students' independent learning ability: ChatGPT can provide students with personalized learning methods and timely feedback, so as to help students better grasp mathematical knowledge, and also cultivate students' independent learning ability and independent thinking ability<sup>[7]</sup>.

It should be noted that although ChatGPT can improve students' problem-solving efficiency, assist teachers in correcting homework and promote the improvement of teaching quality, it also needs to be regulated and managed in the use process to prevent students from over-relying on ChatGPT to complete homework and tests, which will affect their independent thinking ability and learning effect.

### ***3.5. The impact of ChatGPT on the evaluation and supervision of higher mathematics***

First, changes in evaluation methods: The traditional teaching evaluation methods are usually based on students' test scores and homework performance, but the emergence of ChatGPT can better understand students' learning situation and problems, so the evaluation methods can pay more attention to students' practical application ability and innovative thinking ability, rather than simple memory and test-taking ability<sup>[8]</sup>.

Second, changes in supervision methods: ChatGPT can monitor and predict students' learning behavior and test results in real time through technical means such as data analysis and algorithm model, so as to better grasp students' learning situation and problems, timely find students' learning difficulties and deficiencies, and predict students' learning development trend and future performance.

Third, personalized evaluation: ChatGPT can conduct personalized teaching and evaluation according to the learning progress and interests of students, so as to better meet the learning needs of students and improve the learning effect and quality.

Fourth, the change of feedback mechanism: ChatGPT can provide timely feedback and guidance for students, thus helping students to better master math knowledge; at the same time, it can also provide better teaching feedback for teachers, help teachers better understand students' learning situation and problems, adjust teaching content and methods, and improve teaching quality and effect<sup>[9]</sup>.

#### **4. Positive effects and limitations of ChatGPT on higher mathematics curriculum**

##### ***4.1. There is a significant difference between ChatGPT and ordinary intelligent tools in the impact of advanced mathematics courses***

ChatGPT and common intelligent tools have a significant difference in the impact of higher mathematics courses, mainly reflected in the teaching efficiency, learning effect, and educational resources.

Teaching efficiency: ChatGPT can automatically generate a large number of topics according to the learning stage of students, so that students can better grasp the knowledge point, so as to improve the teaching efficiency. However, ordinary intelligent tools often can only provide limited teaching auxiliary functions, and can not automatically generate topics.

Learning effect: ChatGPT can help students understand complex knowledge points through natural language understanding, so that they can learn better. In addition, ChatGPT can also meet the individual needs of students and improve learning efficiency through personalized teaching and other ways. Ordinary intelligent tools often provide only limited learning support.

Educational resources: ChatGPT can integrate a large number of educational resources to provide personalized learning resources for each student, such as translation functions, integration of various language learning resources, etc. However, ordinary intelligent tools often can only provide limited educational resource support functions.

In general, ChatGPT has a broader and deeper impact on higher mathematics courses, not only helping to improve teaching efficiency and student learning effect, but also integrating more educational resources to promote educational equity and development. However, ordinary intelligent tools have relatively little impact on advanced mathematics courses.

##### ***4.2. ChatGPT's positive impact on the higher mathematics curriculum***

Enhanced learning efficiency: ChatGPT is able to use natural language processing and machine learning technology to quickly answer students' questions and give detailed steps and analysis. This helps students to understand knowledge points faster and improve learning efficiency.

Improve self-directed learning: ChatGPT can provide students with the opportunity to study independently. Through dialogue with ChatGPT, students can explore mathematical concepts and solve mathematical problems independently, thereby developing the ability to learn independently.

Adapt to different learning styles: ChatGPT can present math content in a variety of forms such as text, images, and audio to adapt to different learning styles. For example, students can gain a better understanding of mathematics by talking to ChatGPT and obtaining detailed explanations and derivation processes of mathematical formulas.

Stimulate interest in learning: ChatGPT can stimulate interest in higher mathematics by interacting with students and providing interesting application scenarios and examples. This helps to increase students' motivation and engagement.

ChatGPT can be used as an aid in advanced mathematics courses to help teachers better organize their teaching. For example, ChatGPT can provide teachers with teaching suggestions, problem solving

skills and other references to improve the quality of teaching<sup>[10][11]</sup>.

#### 4.3. Limitations of ChatGPT for advanced mathematics courses

**Lack of real-time:** ChatGPT's training materials are mainly from before 2022, and it is not possible to analyze current higher mathematics course content and educational trends in real time, so there may be a lack of understanding of certain knowledge points and issues.

**Lack of discrimination:** ChatGPT is essentially integrated and answered based on the basic materials provided in advance, it lacks critical thinking and discrimination, and can not analyze and explain the knowledge points of advanced mathematics courses in depth like human teachers.

**Lack of expertise:** Although ChatGPT can perform natural language processing and machine learning, its training materials are mostly generalised and lack specialized training in advanced mathematics. As a result, ChatGPT may not be able to provide accurate answers or in-depth analysis to some specialized questions.

**Unable to communicate emotionally:** Although ChatGPT can communicate with words, it cannot sense the emotional changes and needs of students in the same way as a human teacher, nor can it provide personalized teaching guidance and emotional support.

**Additional resources required:** Using ChatGPT requires certain computing resources and network bandwidth that may be unavailable or limited for some users<sup>[12][13]</sup>.

## 5. Conclusions

ChatGPT's impact on the future of higher mathematics education is two-sided. First, ChatGPT's generative model enables it to perform a variety of math-related tasks, such as solving problems, providing ideas, and writing papers. This can help improve the efficiency and quality of higher mathematics education, especially in guiding and assisting students in their learning. On the other hand, however, ChatGPT's limitations suggest that it is not a complete substitute for traditional higher mathematics education. For example, ChatGPT's inability to provide emotional support, lack of critical thinking and discrimination, among other things, makes it unable to provide comprehensive educational services like human teachers in some cases. At the same time, the rapid progress and widespread use of ChatGPT may pose challenges to some aspects of higher mathematics education. For example, if ChatGPT can quickly solve various math problems, students may rely more on the tool than on their own math development and exercise. In addition, the application of ChatGPT may also have an impact on the content and way of teaching higher mathematics, for example, focusing more on the teaching of theory and application, and neglecting the teaching of basic knowledge. In summary, ChatGPT's impact on the future of higher mathematics education is complex, with both opportunities and challenges. Therefore, educators need to deal with this change carefully, both to make full use of the advantages of ChatGPT to improve the quality of teaching, and to prevent its possible negative effects. For example, educators can guide students to the proper use of ChatGPT to develop their independent thinking and problem-solving skills, while also addressing the challenges that ChatGPT may bring by changing the teaching methods and content.

## References

- [1] Pitzer M .ChatGPT[J].*Nervenheilkunde*[2023-11-27].DOI:10.1055/a-1948-8785.
- [2] Goto A , Katanoda K .Should we acknowledge ChatGPT as an author?[J].*Journal of Epidemiology*, 2023:JE20230078.DOI:10.2188/jea.JE20230078.
- [3] Owens B .How Nature readers are using ChatGPT[J].*Nature*, 2023.
- [4] LAN Shunzheng. While enjoying the convenience of ChatGPT, we should also see its challenges [J]. *World Knowledge*. 2023, (06):72-73
- [5] Wang Hongcai, LongBaixin,MaoJu.Challenges and Opportunities brought by ChatGPT to education (PEN)[J]. *Journal of Soochow University: Educational Science Edition*, 2023, 11(2):11-24.
- [6] Yang Haiyan, Li Tao.ChatGPT teaching Application: Scenarios, Limitations and Breakthrough strategies [J]. *Chinese Educational Informatization*, 2023, 29(6):26-34.
- [7] Zheng Yanlin, Ren Weiwu. Path selection of ChatGPT teaching application from the perspective of Practice [J]. *Modern Distance Education*, 2023(2):3-10.
- [8] Biever C .ChatGPT broke the Turing test — the race is on for new ways to assess AI[J].*Nature*,

2023, 619(7971):686-689.

[9] Feng Jianjun. *How we view the challenge of ChatGPT to education* [J]. *China Audio-Visual Education*, 2023(7):1-6.

[10] Zhang Kezhong. *ChatGPT, Subject Teaching and Others* [J]. *Educational Research and Review: Teaching and Learning in Secondary Education*, 2023(6):1-1.

[11] Zhang Hai-bo, Yang Zhao-shan. *The educational challenge and response of ChatGPT* [J]. *Journal of Sichuan Normal University: Social Science Edition*, 2023, 50(4):107-114.

[12] Zhou Yingping. *Application and challenge of ChatGPT technology in Personalized education* [J]. *Journal of Shazhou Polytechnic College*, 2023, 26(1):32-35.

[13] Liu Sumiao, Fang Fang. *ChatGPT Empowering Higher education: Opportunities, Challenges and Effective responses* [J]. *Education and Examinations*, 2023(3):74-81.