Game Analysis of ChatGPT in University Education Applications

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Abstract. Purpose – The purpose of this research paper is to study the measures taken by eight universities (e.g., the University of Hong Kong, Chinese University of Hong Kong, Lingnan University Hong Kong, Education University of Hong Kong, Hong Kong University of Science and Technology, City University of Hong Kong, Hong Kong Baptist University, and Hong Kong Polytechnic University) in Hong Kong after the emergence of ChatGPT (December 2022 to September 2023) and their impact on the education ecology of Hong Kong.

Design/Method/Approach - The study examines earlier publications, including governmental records and newspapers, and offers five sections of analysis. It starts by going over how ChatGPT is used in the classroom. Second, the paper designs a Game Model for the ChatGPT Educational Application. Third, the paper analyzes the condition of game behavior. Fourth, it analyzes the application of AI software in college classrooms for teaching from the perspective of information asymmetry. Fifth, the paper discusses the changes from ChatGPT to the traditional teaching mode.

Findings – First, eight universities in Hong Kong from December 2022 to August 2023 adopted various policies. These policies can be divided into three categories: the encouraged use policy, the restricted use policy, and the no use policy. Besides, the Education University of Hong Kong proposed a "6-P teaching orientation" policy (Plan, Prompt, Preview, Produce, Peer Review, and Portfolio Tracking). Second, the eight universities in Hong Kong lifted the ban on the use of ChatGPT in September 2023. But they limit the number of instructions and tokens in ChatGPT per month and require students to submit a "prompt list" of AI-generated content.

Originality/value – The research paper reviews the changes in policies about ChatGPT in the education sector of Hong Kong from December 2022 to September 2023. In addition, the paper analyzes how the government, schools, and students' interests change depending on the different situations. Besides, the paper designs the Nash equilibrium solution in ChatGPT Education Application and conducts ChatGPT model-based education policy recommendations for dilemmas.

Keywords: ChatGPT, Game Analysis, Educational Application, Information Asymmetry

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1 Introduction

After ChatGPT impacted Hong Kong's education ecology, the policies adopted by eight universities in Hong Kong can be divided into three categories: encouraged use policies, restricted use policies, and prohibited use policies. However, since September 2023, universities in Hong Kong have lifted the prohibition on using ChatGPT.

Encouraging usage policy: City University of Hong Kong launched CityU GPT Chatbot in the new academic year 2023/24 to provide teachers, students, and start-ups with the most advanced artificial intelligence tools. It promises extra points in their midterm reports. Students are limited to using 20 instructions and up to 500,000 tokens/scepters per month.

Restricted use policies: The Education University of Hong Kong allowed students to use AI-assisted tools such as ChatGPT in their homework and proposes a "6-P teaching orientation". These include Plan, Prompt, Preview, Produce, Peer Review and Portfolio Tracking. Duan Chongzhi who is the president of the Chinese University of Hong Kong, stated that students will not be prohibited from using ChatGPT, but they must report and notify the relevant teachers when using it. The University of Hong Kong announced the integration of next-generation artificial intelligence technology GenAI into its teaching environment. GenAI is included as the fifth core competency that students must develop. The first four core competencies are oral, written, visual and digital communication. Students are limited to 20 instructions per month. Lingnan University provide teaching staff and students with training on the application of ChatGPT, and is exploring new ways to assess students' work and support learning. One of the challenges is redesigning the tools for exams and testing to assess each student’s true progress. Students are required to submit a "hint checklist" listing AI-generated content. Hong Kong Polytechnic University provide ChatGPT and Microsoft Bing Chat for teachers and students for free, with a monthly quota of 500,000 tokens per person; teaching and clinical staff can also use up to 100,000 tokens per person per month for text to image and image to text GPT-4 application. Hong Kong Baptist University allows students to use ChatGPT, each student is allocated 600,000 tokens per calendar month for consumption.

In the field of education, when educational subjects face the innovation of educational technology, they will engage in a game of interests at different levels. The application of ChatGPT in education is highly related to the interests of the government, schools and students. Based on static game analysis and information asymmetry, this paper builds a model to analyze the interests of the government, schools, and students in different situations, finds the Nash equilibrium solution of "ChatGPT education application", and conducts ChatGPT education according to the model Policy recommendations for dilemmas.

2 Literature Review

2.1 Application of ChatGPT in Teaching

The core of school education is always teaching to students, and classroom teaching is one of the most important teaching methods in education[1]. Classroom teaching can effectively manage educational activities, and the main promoters of teaching activities are teachers in the school. ChatGPT can improve students' learning conditions in specific teaching environments and provides more possibilities for students' development. However, ChatGPT technology is a general technology, and its design and development did not fully consider the special needs of education. Although ChatGPT has weakened the role of traditional teachers to a certain extent, it still cannot replace teachers' role in classroom teaching. Teaching is not just about teachers imparting knowledge to students, but more importantly, it is about cultivating students' understanding of the meaning of life and regulating students' behavioral habits[2]. These are teachers' teaching activities to cultivate students in classroom teaching. The kind of teaching behavior uses the teacher's body as the teaching medium and combines the teacher's verbal behavior with physical behavior to achieve the best educational effect [3].

When ChatGPT first appeared, some experts and scholars were negative about whether it could be used in classroom teaching. For example, American linguist Noam Chomsky said in an interview that ChatGPT would only make it easier for students to plagiarize[4]. Many educational institutions, scholars, and educators have expressed strong concerns about whether students will abuse ChatGPT. Therefore, at the beginning, many countries, local governments, and educational institutions prohibited students from using ChatGPT to write homework or papers[5]. However, more and more scholars have seen the potential and application prospects of ChatGPT in the field of education. Some studies have pointed out that ChatGPT will bring major breakthroughs to teachers' teaching level. ChatGPT can adopt the "Socratic teaching method" to guide students to learn independently through discussions, questions and answers, debates, etc.[6], and, ChatGPT It shortens the time and space distance between students' traditional learning and allows them to receive timely feedback and help. The famous psychology professor Mayer once pointed out that "instant feedback" is very useful for students' learning[7]. ChatGPT instant feedback improves students' learning experience and addresses their emotional, self-esteem, and self-expression needs[8]. Therefore, teachers can assist students in providing detailed step-by-step answers to questions after students use ChatGPT to assist learning. Some studies have also pointed out that ChatGPT, a new human-computer interaction education model, gives ChatGPT the identity of a digital tutor, improves teachers' teaching effectiveness, and promotes the intelligence of teaching strategies and methods. ChatGPT also provides students with personalized intelligent virtual tutoring. For example, supporting students' personalized learning, adaptive learning, and helping them write academic papers, etc[9].

The current educational subject is based on teachers and students as the core of education. However, in the future, conversational robots such as ChatGPT will become one of the cores of the educational subject, reconstructing the relationship between the educational subject and forming a "teacher-AI robot-student" relationship. A new type

of triangular relationship[10]. This will speed up the process of transforming the traditional binary structure of "teacher-student" into the three-dimensional structure of "teacher-student machine"[11]. Thus, ChatGPT will also reshape the abilities and qualities of teachers and students, which also indicates that “composite educators” will be born with the emergence of ChatGPT[10]. However, it is worth noting that digital tools such as ChatGPT only provide students with a "value system" and do not understand the real situation of the questioner when giving instructions. They only give answers based on different probabilities. Teachers have also changed from the role of imparting knowledge to students to how to enhance students' critical thinking, creative potential, and how to help students avoid dependence on ChatGPT. With the support of ChatGPT, teachers can conduct adaptive learning research according to the learning situation of students, ask students to submit a list of instructions for using ChatGPT, and track students' learning behaviors, so as to develop targeted teaching design, teaching strategies and learning programs for students[11].

3 Method

3.1 Game Model About ChatGPT Educational Application

Game theory was first applied in the field of economics, and many game theory scholars have won the Nobel Prize in Economics. Then, game theory has also attracted the attention of scholars in the field of education, and there have been more applied researches on educational governance in colleges and universities. Game theory is an important tool that can be used to analyze and explain the relationship between different things on the basis of building a game model. It can also be used to reflect the relationship between stakeholders. Its research paradigm can also be used to illustrate the relationship between interest groups within universities[12].

Entering the era of artificial intelligence-generated content, the emergence of ChatGPT has changed the pattern of the technological revolution, brought new hope to education, and also tested the relationship between education and ChatGPT: Researchers have put forward different views on whether to embrace or ban ChatGPT. This article is based on the analysis of game theory as follows: Under the guidance of the education department, students and universities are the main players in the game regarding whether or not to use AI-assisted tools (ChatGPT) in learning. As part of the education body, students and colleges and universities can choose whether to use the AI-assisted tool (ChatGPT) according to their basic situation, which is a prerequisite for gaming. After the teacher understands the learning outcomes of the students using the AI-assisted tool (ChatGPT), the teacher can decide whether the students can continue to use the AI-assisted tool (ChatGPT) for learning assistance based on the actual situation.

3.2 Condition Analysis of Game Behaviour

Research hypothesis

Whether students can freely use AI-assisted tools (ChatGPT) is closely related to the policies of local governments and universities. When the government and universities allow students to freely use AI-assisted tools (ChatGPT), they will make strategic choices according to the social environment and educational environment at that time. In view of this, build a game model before students can freely use the AI auxiliary tool (ChatGPT). The model is based on static game analysis[13], quantifies the benefits of both sides of the game through integers within 10, and constructs the "ChatGPT Educational Application" benefit matrix model.

Hypothesis 1: The policies of the local government and universities allow students to freely use the AI-aided tool (ChatGPT) under the permission of the social environment and educational environment, and students also actively use ChatGPT, and the strategy choice is (active use, active use);

Hypothesis 2: The policies of the local government and universities allow students to freely use the AI-assisted tool (ChatGPT) under the permission of the social environment and educational environment. Students do not actively use ChatGPT, and their strategy choices are (active use, passive use);

Hypothesis 3: The policies of the local government and universities do not allow students to freely use AI-assisted tools (ChatGPT) in the social environment and educational environment, and students also actively use ChatGPT, and their strategy choices are (prohibition, active use);

Hypothesis 4: The policies of the local government and universities do not allow students to freely use the AI-assisted tool (ChatGPT) in the social environment and the educational environment, and students do not use ChatGPT either, and their policy choices are (prohibited, not used).

According to the above assumptions, there are four ways to present:

1) If the policies of the local government and universities allow students to freely use AI-assisted tools (ChatGPT), and students actively use ChatGPT, both parties will benefit from 5 units;

2) If the policies of the local government and colleges and universities allow students to freely use AI-assisted tools (ChatGPT), and students do not actively use ChatGPT, the local government and colleges will affect the quality of education because students do not use AI-assisted tools, and students will not use AI If the auxiliary tools affect the learning effect, the local government and universities will benefit less by 1 unit, and the students will benefit less by 2 units;

3) If the policies of the local government and universities do not allow students to use AI-assisted tools (ChatGPT), the relationship between students and teachers will be affected by the private use of ChatGPT, and the fairness of learning will also be affected by the private use of ChatGPT by students. However, due to the In the private use of ChatGPT, the local government and universities will benefit by 3 units, and students will benefit by 2 units if learning resources that do not use ChatGPT are obtained;

4) If the local government and universities do not allow students to use AI-assisted tools (ChatGPT), and students do not use ChatGPT, neither party will benefit, and each will be assigned 0 units. The model construction is shown in Table 1.

Table 1. Model construction

	The government and universities allow	**The government and universities do not allow**
students actively use	(5，5)	(-3，-2)
student passive use	(3，4)	(0，0)

Analysis of application of AI software in teaching from information asymmetry perspective

The concept of information asymmetry originated from the old automobile market analysis model proposed by Akerlof in 1970, and was later introduced into the field of economic research by Western economists. The application of this theory to classroom teaching in colleges and universities refers to the asymmetric distribution of teaching information between teachers and students in terms of course objectives, teaching plans, teaching content, teaching requirements, etc. and its impact on classroom teaching effects.

There are two main aspects of the risk loss that information asymmetry brings to people, namely unfavorable choice and moral hazard.

Unfavorable choice refers to the fact that in classroom teaching, the teacher deliberately expands his knowledge set and highlights the information advantage by specifying textbooks and bibliographies that are inconsistent with his own teaching references. Moral hazard, also known as immoral behavior, is manifested in classroom teaching by teachers taking advantage of their own teaching experience and knowledge reserves, only teaching what they are best at in the teaching process, avoiding the "blind spots" of their knowledge, and not saying anything about it. Guiding students to explore is not conducive to students' comprehensive acquisition of knowledge.

4 Findings

Since ChatGPT entered the Hong Kong education ecosystem, the following changes have taken place in the Hong Kong education sector:

1. The policies adopted by eight universities in Hong Kong from December 2022 to August 2023 can be divided into three categories: Encouraged Use Policy, Restricted Use Policy, and No Use Policy.
2. The Education University of Hong Kong proposed a "6-P teaching orientation".
3. Starting from September 2023, all universities in Hong Kong lift the ban on ChatGPT.

Limit the number of instructions or tokens students can use in ChatGPT per month. Students must also submit a "prompt list" listing AI-generated content. Based on

research, this article puts forward the following policy suggestions to get out of the ChatGPT education dilemma.

5 Discussion

The differences between ChatGPT and traditional teaching models

First, without teachers, students cannot learn knowledge in traditional teaching models. The teacher's main task is to pass on the knowledge in the textbook to the students and, in the process of preaching, to solve the students' doubts and cultivate the students' moral character of "morality, intelligence, physique, and beauty." Second, the teaching mode mainly refers to narration; Third, the role of teachers and students is a one-way relationship, with teachers as the main; Fourth, teaching resources are mainly teaching materials (books); teaching tools mainly include textbooks, blackboards, and chalk; Fifth, the teaching assessment is a paper-and-pencil assessment with standard answers. Sixth, it is an unequal and undemocratic teacher-student relationship.

The advanced artificial intelligence technology of ChatGPT breaks the traditional teaching method in terms of people, physics, and space. Human means that learners can use artificial intelligence as a medium to learn new knowledge, such as:

- ChatGPT can understand learners' questions and answer them.
- Physics means that learners can quickly acquire knowledge from social media.
- Space means that learners can ignore the space environment for learning.

ChatGPT mainly breaks the medium of " teachers." Its beauty lies in the ability to personalize the learning experience for the learner. With the development of artificial intelligence, different AI teaching products continue to emerge, such as smart tutor systems, automatic scoring systems, teaching robots, classroom analysis systems, etc., breaking the differences between ChatGPT and traditional teaching models. However, when the AI+ teaching model is fully used in the education field, the government and relevant education departments or institutions should give priority to exploring the path of AI+ education, such as establishing a sound education mechanism, improving policies and regulations for AI+ education, establishing relevant departments for AI+ education supervision, building an interconnected and shared database, compiling and releasing AI+ education blue book, etc.

Some studies have analyzed the risks that ChatGPT may bring to future education, and concluded that ChatGPT mainly faces four challenges in teaching practice: the first is Cheating and plagiarism; the second is that some students will rely too much on ChatGPT to learn and miss some Learning opportunities with high participation are required; the third is that students are prone to receive some biased or harmful information; the fourth is that students are prone to receive inaccurate or even wrong information. The study also pointed out that teachers should consider the actual role of ChatGPT as a teaching practice tool; when using ChatGPT to implement teaching, promote teachers' innovation in educational objectives, teaching strategies, teaching evaluation, etc.; cultivate teachers and students' artificial intelligence application literacy; strengthen the educational application of ChatGPT Governance to ensure that the use of ChatGPT complies with legal rules and ethics[14].

Based on research, this article proposes to improve the AI + education system, improve artificial intelligence + education policies and regulations, build an interconnected and shared database, and supervise the content generated by artificial intelligence in the education field (such as ChatGPT) to get rid of the risks and challenges that ChatGPT may bring to education.

- Improve the AI+ education system

Cultivate the artificial intelligence thinking of primary school students, middle school students, and college students, including cultivating students to pay attention to network security and privacy issues; clearly establish the basic educational goals of artificial intelligence education, and establish a general understanding of artificial intelligence among the whole people. For example, the government will The learning framework clarifies that teachers should teach students to gradually cultivate students' artificial intelligence literacy and awareness of the correct use of artificial intelligence software tools during the learning process in junior high schools and universities, such as: designing question instructions, searching for artificial intelligence texts, etc. Gradually cultivate teachers' artificial intelligence literacy: train teachers to use artificial intelligence teaching aids for professional course design and daily teaching work; create an artificial intelligence education-friendly environment and explore the future of smart education and career development.

- Improve artificial intelligence + education policies and regulations

The government should pay attention to the impact of artificial intelligence on morality, ethics, law and society; improve regulations related to artificial intelligence; improve personal data protection laws and improve the intellectual property rights management system. The government should monitor the teaching quality of schools. Therefore, the government can build a database to analyze teachers' daily teaching behaviors and students' learning outcomes. Schools should prevent students from overrelying on AI software for learning, and set up relevant departments to monitor students for academic misconduct.

- Construct an interconnected and shared database

Establish a national artificial intelligence teaching database, including PPT teaching materials, teaching videos, teaching software, test papers, etc.; Establish a big data platform for Macao student development, using data to integrate data from the Education and Youth Development Bureau, the Labor Secretariat and social media. The data includes Macao's basic education, university education, employment, economy, demographic characteristics, social contribution, etc. Through these data, the Macau government can comprehensively study and summarize the growth characteristics and patterns of college students. Discuss the advantages and disadvantages of higher education in Macao, analyze the fairness of higher education and the impact of higher education on social and economic development, as well as the impact of higher education and the value and contribution of graduates to society. Therefore, this platform can provide a basis for the Macau government to formulate basic education and higher education policies, and can also become one of the main basis for the Macau government to formulate basic education budget and higher education budget. Establish a framework for the development of education quality in Macao, analyze the teaching advantages of different schools, formulate a mechanism for complementing advantages, formulate a

framework for teachers' teaching literacy, formulate a framework for core knowledge of different disciplines, formulate students' learning literacy, explore paths for AI campus construction, and explore the impact of AI on future society. Influence and so on.

- Supervision of content generated by artificial intelligence in education (e.g. ChatGPT)

Students who use AI-generated content (such as ChatGPT) for assignments or papers are required to submit a list of "AI-generated content prompts" explaining which content in their coursework and papers was AI-generated, in accordance with eight requirements The same goes for the University of Hong Kong.

6 Conclusion

The research paper reviews the changes of policies about ChatGPT to the education sector of Hong Kong from December 2022 to September 2023. In addition, the paper analyzes how the government, schools, and students' interests change depending on the different situation. Besides, the paper designs the Nash equilibrium solution in ChatGPT Education Application and conducts ChatGPT model-based education Policy recommendations for dilemmas. Besides, the Education University of Hong Kong proposed a "6-P teaching orientation" policy (Plan, Prompt, Preview, Produce, Peer Review and Portfolion Tracking). Second, the said eight universities in Hong Kong lift the ban on the use of ChatGPT after September 2023. But they limit the number of instructions/tokens in ChatGPT per month and require students to submit a "prompt list" of AI-generated content.

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