

Research on motivation and behavior of ChatGPT use in middle school students

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Abstract: In recent years, the field of large language models of artificial intelligence has garnered significant attention. Nonetheless, most relevant studies focus on the macro-level impact of artificial intelligence on various areas, while there is a lack of research that caters to the needs of individuals. This study draws upon a summer camp on AIGC organized by a university in Beijing in 2023. It employs the research method of combining a questionnaire survey and interview to explore the behaviors, motivations, and attitudes of students participating in the camp, their parents, and other middle school students. This paper aims to examine the behavioral patterns and underlying motives of middle school students in their utilization of ChatGPT, analyze the impact of educational activities on students, and investigate the differences in perspective between parents and students concerning the AI Grand Linguistic Model. The findings indicate that educational activities have a pronounced and positive impact on the utilization of ChatGPT by middle school students; they use ChatGPT for a short duration, at a low frequency, and with limited dependency, often utilizing it for English learning and Chinese writing. The primary motivations for middle school students to utilize ChatGPT are to aid in learning, broaden their interests, foster sociality, and enhance their mental well-being. Parents and students hold similar attitudes toward using ChatGPT in secondary school. Yet, parents demonstrate significantly more favorable perspectives towards applying ChatGPT in school education than their children.

Keywords: Middle school students; ChatGPT; Use motivation; Use behavior

1. Introduction

Since the end of 2022, the emergence of the new generation of Artificial Intelligence (AI) applications spearheaded by ChatGPT has garnered extensive attention. The application of ChatGPT has been widely debated and investigated within the realm of education research, yielding a comprehensive range of outcomes. For instance, several scholars have proposed that educators may employ ChatGPT to develop teaching methodologies, deliver personalized education programs, and broaden students' intellectual interests and extracurricular activities^[1]. However, most of these studies are based on limited attempts, and the ideas presented remain hypothetical and lack substantiation to support the claims.

Several universities in New York City and beyond have implemented a ban on ChatGPT due to concerns that it may disrupt the teaching process. Nonetheless, this blanket restriction has been regarded by many as an inappropriate and excessive response.

There is a lack of empirical research on the student population, especially in basic education. In China's basic education, teachers are pivotal in determining whether students can freely utilize technology to enhance their learning. Nevertheless, most teachers are reluctant to endorse students' unfettered use of technology in the classroom, leading education researchers to neglect the behavioral patterns of students' utilization of technology for learning during the basic education phase. By contrast, the situation abroad is considerably more favorable. Due to the lack of findings from local practices as a foundation, the Chinese education system has long relied on foreign expertise to guide its practices, resulting in numerous educational practices that are not aligned with the national context and subpar

teaching outcomes. This issue has long been a distress for China's educational practice.

To comprehend the willingness, motivation, and behavioral traits of Chinese middle school students to utilize ChatGPT, and how they can use ChatGPT flexibly and reasonably without compromising social ethics, the researchers have selected middle school students as the subject of their research and examined their motivation and behavior patterns associated with the use of ChatGPT for learning. Through this study, researchers will have a more comprehensive understanding of the characteristics of middle school students in using ChatGPT, thereby providing sound recommendations for guiding and standardizing the utilization of ChatGPT among middle school students. The findings of this research will help to broaden understanding of the utilization of ChatGPT in the student population and provide them with reasonable suggestions and approaches for its utilization.

2. Literature Review

Through a comprehensive literature review, the researchers have identified that certain scholars have begun to explore the novel benefits, challenges, and opportunities that using AI within the classroom will entail for education^[2], including its significance for students. Nonetheless, the current research on the application of chatbots in education is still developing, with minimal empirical studies investigating the effective learning design or utilization of learning strategies^[3], specifically in primary and secondary education.

As regards the motivation for students to employ ChatGPT, no empirical research has been conducted thus far. Motivation drives most human actions and is influenced by many internal and external factors^[4]. Numerous scholars have concluded that the intrinsic motivation driving middle school students to engage with Chat GPT lies within their desire to utilize Chat GPT to enhance their reading and writing proficiency, summarize the literature, and generate practice examinations^[5]. The primary external incentive for students to engage in AI-enabled learning is that it can provide prompt and insightful feedback and recommendations, thereby catering to their diverse learning requirements^[6]. Moreover, a minority of scholars have expressed concerns regarding the potential for a small proportion of students to utilize Chat GPT in the learning process for purposes such as plagiarism and academic dishonesty^[7].

Several studies have been conducted to assess the performance of ChatGPT users when they are employed to assist with academic tasks. Studies have revealed that ChatGPT users, including college students, notably depend on ChatGPT during its utilization^[8]. Nevertheless, ensuring that AI can have the maximum positive impact on education is imperative. However, this does not consider the data privacy concerns and technology dependency issues that are associated with artificial intelligence, which necessitates the utilization of large volumes of student data for personalized learning and assessment, but may pose a risk to student privacy, particularly in the areas of data collection, storage, and sharing, warranting the necessity of heightened protection. Furthermore, this may adversely impact students' autonomous learning abilities and teachers' teaching judgment and interpersonal communication skills.

3. Research Design

3.1. Research Problems

This summer camp aims to enhance middle school student's understanding of AIGC and improve their information literacy through hands-on experience with ChatGPT. The activities encompass utilizing and applying large language models, critical analysis of challenges and debates surrounding AI applications, AI voice imitation training, and AI-assisted academic writing. The summer camp guides students to thoroughly comprehend ChatGPT, express personal perspectives and insights, and formulate their own beliefs regarding the potential utilization of ChatGPT in the future through in-depth exposure and discourse. Nevertheless, parents play a pivotal role in determining whether secondary school students can utilize ChatGPT beyond the classroom. One of the primary concerns of this research is whether these two groups possess similar attitudes toward ChatGPT. To this end, the study has identified the following research questions:

- (1) Does the summer camp intervention have a notable impact on the utilization of ChatGPT by middle school students?
- (2) What motivates and influences the behavior of middle school students utilizing ChatGPT?
- (3) What are the attitudes of parents and students towards the utilization of ChatGPT at the secondary

level?

3.2. Research object

The research subjects of this study are middle school students and their parents who participated in the AIGC summer camp organized by a university in Beijing in 2023, as well as domestic middle school students who did not participate in the camp. Of these, summer camp participants accounted for 44.74% of the participants.

3.3. Research methods and tools

3.3.1. Questionnaire Survey Method

In light of the research objectives and technology acceptance theory, this study developed a questionnaire on ChatGPT Usage Behavior and Motivation of Middle School Students, encompassing five domains: information, practicality, sociality, technical characteristics, and adoption attitude. The questionnaire consisted of 21 items. Additionally, to facilitate subsequent statistical analysis and further investigation and discussion, we incorporated three questions about essential demographic variables, summer camp participation, and information literacy. The questionnaire's dimensions and composition are depicted in Table 1.

Table 1: Questionnaire structure.

First-order dimension	Second-level dimension
Basic information	Identity, gender, learning stage, summer camp participation, information literacy
Information class	Purpose, Duration frequency and experience of use, degree of dependence
Practicability	Required competence, applicable discipline
Sociality	Identity construction
Technical characteristics	Explicit advantage, ease of use, usefulness
Adopting attitude	It is used for students' independent learning and for school classroom education

The questionnaire survey is designed for middle school students and their parents. The implementation of the questionnaire employs the format of an electronic questionnaire. Relevant WeChat groups are disseminated through the questionnaire platform, and data are recovered through the platform. Based on the reasonable response time, several invalid questionnaires were excluded, resulting in a total of 76 valid questionnaires being recovered.

Excluding questions in the essential information section, the reliability and validity assessment is conducted for questions in the five dimensions of the questionnaire. The reliability analysis outcome demonstrates that $\alpha=0.896$ attesting to the questionnaire's high reliability. The validity analysis results indicate that $KMO=0.897$, affirming the questionnaire's high validity.

3.3.2. Interview Method

Based on relevant literature and questionnaire survey results, this study designed an interview outline to investigate the behavior and motivation of middle school students in using ChatGPT for learning, as well as the attitude of middle school students and their parents towards ChatGPT for learning and education. The interview outline is shown in Table 2.

Table 2: Interview outline.

Content	Dimensionality
Basic information of the interviewee	Learning period and information literacy
The effect of educational activities	Participation in summer camp
Motivation and attitude of middle school students to use ChatGPT	How to use ChatGPT
	The social impact of ChatGPT
	Usage scenario of ChatGPT
	ChatGPT for learning attitudes and principles of use

This study adopts semi-structured interviews. 7 middle school students and their parents who

participated in this AIGC summer camp are randomly selected to conduct online interviews, and the interview content is recorded by video and text.

4. Data Analysis

A total of 76 individuals participated in this study, consisting of 57 students and 19 parents; including 28 male participants and 48 female participants. Of the student population, 34 were enrolled in middle school and 42 in high school. The researchers selected three male students, four female students, and seven parents to participate in individual interviews.

The study employed descriptive statistics and statistical analysis (including t-test and variance analysis) to analyze the behavioral characteristics and attitudes of the sample group towards the utilization of ChatGPT for learning, with a particular focus on exploring the motivations underlying middle school students' engagement with ChatGPT for learning, as illuminated by the interview data.

4.1. Questionnaire data analysis

4.1.1. Information class

Of the respondents in this study, 82.46% of students have utilized artificial intelligence to assist in their learning processes. The primary purpose of using AI learning tools or platforms is to enhance academic performance, receive personalized learning support, locate additional learning resources, and cultivate interests, albeit with diverse opinions regarding the utilization of emotional catharsis. These students utilize ChatGPT and similar AI tools for a limited period, with the majority concentrated within the 0-3-month range and used less frequently. They are also less reliant on artificial intelligence, with survey results significantly below the average of 3. When experiencing ChatGPT for the first time, 84.21% of students were surprised by it, with a small proportion expressing concerns.

From the output of an independent sample T-test in SPSS, students who participated in the summer camp exhibited a significantly higher sense of novelty when utilizing ChatGPT for the first time than those who did not participate in the camp. On average, students with high self-rated information literacy spent significantly more time operating ChatGPT than those with low self-rated information literacy. Similarly, students with high self-rated information literacy rated the difficulty of using ChatGPT considerably higher than those with low self-rated information literacy.

4.1.2. Practicality

Conform to the data obtained through the questionnaire, the respondents of this study acknowledge the existence of a specific auxiliary effect of ChatGPT in all the subjects studied at middle school, with English being the most effective and mathematics being relatively limited. Additionally, regarding the utilization of ChatGPT in students' learning, it is noted that all the respondents consider critical thinking, diverse learning, and independent thinking as crucial.

Concomitantly, the output results of the independent sample T-test performed in SPSS indicate that, with respect to the gender of students, male students scored significantly higher than female students in comprehending and utilizing ChatGPT in learning subjects such as Chinese, politics, history, and geography. Moreover, students who participated in the summer camp expressed their agreement that the ability to undertake diverse learning activities enables them to utilize ChatGPT for their learning better, and ChatGPT's effectiveness in assisting in learning Chinese, physics, chemistry, and biology was significantly higher for those who participated in the camp as compared to those who did not. Students who participated in the camp also demonstrated significantly higher scores than those who did not. As regards the age group of students, ChatGPT's impact on middle school students was found to be significantly higher than that on high school students.

4.1.3. Sociality

This study aims to investigate the association between ChatGPT and students' sociality regarding personal identity construction. According to the questionnaire data, the mean M of the three aggregated matrix scale questions, namely, the usage of ChatGPT aligns more closely with their identities, the utilization of ChatGPT facilitates socialization, and the utilization of ChatGPT contributes to group integration, was 3.48, which was significantly higher than the median value of 3. Consequently, it can be deemed that ChatGPT serves as an asset in the construction of personal identity and the fostering of social development among middle school students.

Moreover, the output results of independent sample T-test in SPSS reveal that junior high school students exhibit a significantly higher degree of agreement that ChatGPT aligns more closely with their identities than senior high school students, and students who participate in summer camp express a significantly higher degree of agreement than those who do not. Furthermore, the degree of agreement that the utilization of ChatGPT can contribute to better group integration is significantly higher among students with high information literacy self-ratings than students with low information literacy self-ratings.

4.1.4. Technical Features

According to the survey findings, 38.16% of the respondents believe that compared to traditional learning methods, the most notable advantage of utilizing ChatGPT for collaborative learning lies in the expansion of the accessibility scope of learning resources; meanwhile, 34.21% of the respondents acknowledge that ChatGPT provides more flexible and convenient learning channels in comparison to traditional learning methods.

In terms of students' ease of utilization to ChatGPT, the overall score attained a score of 4.1, which is significantly higher than the median value of 3, suggesting that middle school students find ChatGPT to be straightforward and user-friendly; in terms of students' perceived usefulness to ChatGPT, the overall score achieved a score of 3.95, which was significantly higher than the median value of 3, suggesting that middle school students perceive ChatGPT to be practical and effective.

Based on the output results of the independent sample T-test in SPSS, concerning the usability of ChatGPT, male students significantly agree that ChatGPT is simple to use, intuitive in its interface, and easy to navigate, compared to female students. The students who participated in the summer camp expressed their agreement that ChatGPT was simple to use and its interface was intuitive and easy to navigate, significantly higher than the students who did not participate in the summer camp. Concerning the perceived usefulness of ChatGPT, male students greatly agree that ChatGPT can help improve academic performance, compared to female students, and students who participate in the summer camp express their agreement that ChatGPT can enhance learning efficiency, provide answers to questions, and simplify the writing process, compared to students who do not participate in the summer camp.

4.1.5. Adopting attitude

The respondents generally concurred in adopting the ChatGPT attitudes in various fields (student self-directed learning, school teaching applications). Of these, 51.32% of the respondents expressed a favorable attitude towards using ChatGPT in independent learning, while 46.05% held a neutral stance. Regarding using ChatGPT in school teaching, 52.63% of the respondents had a positive attitude, while the remaining 47.37% held an unbiased perspective.

Based on the output of the independent sample T-test in SPSS, parents demonstrated a significantly higher attitude than students regarding using ChatGPT in school teaching, indicating that parents have a more positive outlook than students.

4.2. Analysis of interview data

4.2.1. Impact of summer camp on students

The findings of the interviews indicate that students who attended the summer camp found ChatGPT to be a highly effective tool. To properly utilize ChatGPT, which involves providing accurate instructions to obtain more precise information and maximum benefits from AIGC technology, they must learn how to use it correctly.

ChatGPT is viewed as a convenient search engine tool that can broaden students' interests and subject knowledge. It stimulates students' interest in learning the subject, enables them to deeply comprehend the content of the knowledge point of the issue, and provides them with a more abundant knowledge content. Furthermore, after realizing the powerful function of ChatGPT, students have initiated thoughts on social ethics and morality. The sound and video generated by ChatGPT can easily lead to social problems such as fraud and crime.

ChatGPT can assist students in gaining a deeper understanding of the capabilities of large language models that can be utilized, which has sparked their keen interest (S3 and S7), but it can also potentially cause chaos in the social security order (S1).

Therefore, students are advised to utilize ChatGPT as an effective tool for learning and creation, while

being mindful of adhering to social norms and laws.

4.2.2. Students' cognition of using ChatGPT

The students' exposure to ChatGPT through this summer camp has demonstrated that the capabilities of ChatGPT are still substantially different from the realm of personal imagination. Nevertheless, while employing ChatGPT, students can generate ideas through continuous communication and feedback.

The content information furnished by ChatGPT is frequently fictitious and is not accurately answered, with inquiries that necessitate accurate responses often being delineated as frameworks lacking any meaningful information, necessitating eventual human intervention. Conversely, when other students utilize ChatGPT, they can seamlessly communicate and provide precise directives regarding the same topic or issue, even igniting students' interest with novel ideas and inspiration.

For instance, for a student with an interest in programming, ChatGPT only generates code frameworks, failing actually to execute the code, and can only be operationalized through manual enrichment of its specific information, which is far from the role of ChatGPT's "universal man" in their imagination (S1). Additionally, during the writing process of a paper, ChatGPT can fabricate documents that have no relevance to the paper (S1). However, ChatGPT can be employed to query questions that are not covered by other search engines or lack clear answer information, and communication with ChatGPT can establish coherence and generate thinking during its utilization (S2).

When employing ChatGPT, students should be cognizant of its limitations and adept at capitalizing on its advantages. Simultaneously, efforts should be made to improve students' judgment and critical thinking skills in order to better cope with potential problems.

4.2.3. Impact of ChatGPT on students' sociality

In the context of ChatGPT usage, students have appraised it as a valuable resource for facilitating the establishment of friendships. At the same time, the utilization of ChatGPT can stimulate an interest in independent learning, but it can also foster a tendency to rely on ChatGPT for subject assignments.

ChatGPT can effectively provide students with prompt information guidance, facilitating the establishment of interpersonal communication and enabling two strangers to swiftly engage in meaningful discussions on a shared topic, fostering camaraderie. However, given the expedited and accurate information offered by ChatGPT and its myriad functions, students have also shown a willingness to utilize ChatGPT to complete their homework and participate in competitions, thereby raising concerns about their future academic development.

Drawing from the information provided by ChatGPT, students have successfully established meaningful connections with others (S2). While ChatGPT can swiftly provide users with information, students have shown a propensity to utilize ChatGPT to complete their homework, yet they are also apprehensive about receiving criticism (S6). Conversely, students are also concerned about their future academic progress, and their academic pressure has been heightened, leading them to fear that they will be replaced by ChatGPT and lose their social value (S1, S2, and S5). Even if ChatGPT is utilized as a supplement or substitute for a player in a student competition, the true essence of the competition will be lost (S6).

Students have expressed diverse expectations and concerns regarding ChatGPT, necessitating appropriate cognitive guidance and the identification of a balance point, enabling them to utilize ChatGPT's advantages without being wholly dependent on it, thereby preserving their learning value and personal development.

4.2.4. Future Scenarios for Using ChatGPT

Students believe that ChatGPT can play a role in deepening subject learning, developing interest and promoting interpersonal communication in future use.

Students want to expand their areas of interest through ChatGPT, which can provide them with relevant information and advice, as well as better understanding and in-depth research (S1). Students also use ChatGPT to help them in in-depth learning in terms of subject cognition, because ChatGPT provides students with fast and accurate information and answers, helps students better grasp subject knowledge, and promotes academic growth and curiosity (S2, S3, S4, S6 and S7). On the other hand, students mentioned using ChatGPT to conduct psychological interviews to understand their inner world better. They also hoped it could provide suggestions for psychological adjustment and making friends (S5).

Overall, participants agreed that, under the right circumstances, they would use ChatGPT to expand

their interests, deepen their knowledge of the subject, or improve their mental health and interpersonal relationships. However, they also mentioned the importance of using ChatGPT cautiously to avoid negative effects on personal development.

4.2.5. Attitude towards the use of ChatGPT in secondary education

ChatGPT presents low credibility and inaccurate information, which is not suitable for indiscriminately adopting as a basis for personal advancement and planning. Simultaneously, it can lead to students' excessive reliance on it, diminishing their ability to self-reflect. Furthermore, it can erode students' will to strive and learn. However, ChatGPT has had a significant impact in alleviating the burden on teachers and students.

Concerning the current technical proficiency and development of ChatGPT, as well as the challenges encountered during the implementation of this summer camp, the information provided by ChatGPT possesses limited value, is often inaccurate, and can be prone to logical inconsistencies. Therefore, middle school students cannot use it without appropriate guidance and full confidence in the information provided by ChatGPT. Although ChatGPT can solve most of the problems, its convenience and efficiency can easily mislead middle school students into believing that mastering knowledge is effortless, discouraging them from cultivating their spirit and perseverance in exploring knowledge. In contrast to a small number of middle school students, they will utilize ChatGPT depending on the specific circumstances, as it is more akin to an anthropomorphic tool than other artificial intelligence products, with a greater degree of flexibility, which can save students' time and reduce the workload of teachers.

At present, the cognitive capacity of middle school students is relatively limited, and the technological advancement of ChatGPT is not fully mature, leading to their inability to accurately assess the information generated by ChatGPT, thereby facilitating their tendency to overlook the objective existence and potentially mislead them (P1). While utilizing ChatGPT, students often perceive it as efficient and easy, potentially leading to a decline in their diligence in completing homework, resorting to cheating during exams, and other undesirable behaviors (P6). On the contrary, the ease of operation and utilization of ChatGPT can significantly reduce students' learning time and the administrative burden of teaching work for teachers (P2). However, students themselves need to exercise critical thinking while utilizing ChatGPT (S2), as appropriate.

When utilizing ChatGPT, it is imperative to rationalize its advantages under appropriate guidance and fundamentally cultivate students' learning independence and critical thinking abilities, thereby ensuring the proper utilization of ChatGPT and fostering students' all-round development and in-depth learning.

5. Conclusion And Discussion

5.1. Research Conclusions

Summarizing the principal findings of this study, the researchers conclude that the following results merit careful consideration:

(1) Educational activities substantially impact the utilization of ChatGPT among middle school students, which is primarily manifested in the comprehension of ChatGPT and other artificial intelligence large language models, social development, and acceptance of novel technologies. In these respects, the students who participated in this summer camp demonstrated significantly enhanced outcomes compared to their peers who did not partake in this summer camp;

(2) The utilization of ChatGPT by middle school students exhibits the following characteristics: a brief duration, infrequent utilization, minimal reliance, and frequent utilization to aid English and Chinese writing. The primary motivations for middle school students to employ ChatGPT are to facilitate learning, enhance identity construction, promote interpersonal communication, cultivate interests, broaden knowledge, and improve mental well-being.

(3) Parents and students have similar attitudes towards using ChatGPT within middle school. The vast majority of respondents hold a neutral or favorable stance towards adopting ChatGPT in diverse fields (student independent learning, school teaching application). However, parents exhibit a more positive outlook than students in applying ChatGPT within school education. At the same time, parents and students are capable of treating ChatGPT and related large language models with critical thinking, highlighting its beneficial impact on middle school students' learning and lives while also expressing concern over the potential decline in students' self-reflection abilities and independent learning abilities

when utilizing ChatGPT in middle school learning.

5.2. Discussion

In light of the findings of this investigation, this paper aims to examine the management framework for the implementation of ChatGPT in Chinese secondary school settings, as well as provide recommendations for the development and application of ChatGPT-based products for secondary school students, emphasizing the significance of enhancing educational content on the utilization of ChatGPT in schools.

5.2.1. Management Policy

In China, policies governing the use of ChatGPT by secondary school students are of paramount importance. Despite initial concerns regarding the suitability of middle school students for ChatGPT, the study has uncovered that such matters were not entirely justified. Firstly, it is imperative for governing policies to ensure that the utilization of ChatGPT does not harm students' academic performance and health. This necessitates ensuring that students do not develop an addiction to using ChatGPT and protecting their privacy and personal information. Secondly, given their increased level of maturity, students can identify the potential problems that may arise from their actions while concurrently exercising independent judgment when utilizing ChatGPT to avoid academic misconduct. Simultaneously, it is imperative for policies to foster a culture of vigilance among schools and families when it comes to monitoring the behavior of secondary school students when using ChatGPT, ensuring that they fully comprehend and capitalize on the potential of this tool.

5.2.2. Product design and application

There exists immense potential for applying artificial intelligence (namely, large language models like ChatGPT) to the lives of middle school students. Firstly, ChatGPT can be utilized as an academic aid to aid middle school students in answering questions, providing elucidations, and offering guidance. The product should possess an excellent educational nature, enabling students to improve their academic proficiency and tackle learning obstacles. Students can pose questions to ChatGPT concerning mathematics, science, history, and other disciplines to obtain instantaneous answers and explanations that will enhance their knowledge comprehension. Simultaneously, the product should be engaging and interactive to captivate the attention of middle school students, and students can engage in simulated conversations with ChatGPT to improve their listening and speaking skills and proficiency in grammar. They can also attempt to communicate with ChatGPT in a foreign language to gain practice and receive feedback.

Furthermore, product design should consider the psychological and cognitive characteristics of secondary school students, ensuring that its content and functions are appropriate to their age and developmental stage. Moreover, through simulated conversations with ChatGPT, students can hone social skills such as expressing their opinions, asking questions, listening to others, etc. Of course, before utilizing these products and methodologies, they should be meticulously studied and evaluated to ensure that they align with the needs and educational objectives of middle school students.

5.2.3. Contents of school education

At present, the utilization of ChatGPT in educational institutions remains relatively limited. Nevertheless, it is recommended that institutions of learning modestly enhance the academic content concerning ChatGPT applications. This can be accomplished by incorporating ChatGPT into lesson plans, instructing students on the appropriate utilization of the tool, and educating them on assessing the authenticity and reliability of information. Upon acquiring proficiency in using ChatGPT, students can adopt a multifaceted perspective when examining problems, thereby gradually cultivating critical thinking skills, which can subsequently be applied to their daily lives and careers in the future, resulting in time-saving benefits. Additionally, educational institutions can foster student engagement in discussions and research on artificial intelligence and natural language processing, thereby fostering their technological literacy.

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