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# *Engineering and Technology*

# EVALUATING USERS' SATISFACTION WITH THE STUDENT REPORT CARD SYSTEM: A TOOL FOR GRADUATE DEVELOPMENT AND MONITORING

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## Abstract

This study evaluates user satisfaction with the Student Report Card (SRC) system as a tool for graduate competency enhancement, employer expectations, and career development. Using a mixed-method research design, data were collected from alumni across seven countries. Findings demonstrate that the SRC system plays a significant role in bridging the gap between academic training and industry demands, providing clear feedback on graduate competencies. In addition, structured feedback from the SRCs provides career decision-making, with graduates and employers acknowledging its usefulness in identifying strengths, weaknesses, as well as future professional pathways. However, improvements in personalized feedback and industry-specific recommendations are suggested to be performed to enhance its effectiveness.

**Keywords:** User Satisfaction, Student Report Card System, Graduate Development, Graduate Monitoring

## Introduction

According to the Ministerial Regulations on Higher Education Qualification Standards (2022) of the Ministry of Higher Education, Science, Research, and Innovation, graduates' learning outcomes at all levels of higher education qualification standards must include at least four components: knowledge, skills, ethics, and personal characteristics. The four components listed are vital for higher education graduates who want to operate successfully in a career.

Panyapiwat Institute of Management (PIM) is an educational institution that organizes teaching and learning based on the philosophy of education known as Work-based Education. Work-based Education is an educational organization that emphasizes students or graduates developing knowledge by combining theoretical knowledge and social skills, life skills, and professional skills through practical training. According to the above philosophy, PIM prioritizes the quality of graduates who can work immediately in the workplace (Ready to Work) (Chitra & Pornpimol, 2021), and has defined five desired student and graduate identities: learning effectively, thinking wisely, working effectively, emphasizing cultures, and displaying integrity. Furthermore, the Faculty of Agro-Industry (AGI) has developed 8 graduation criteria (AGI's Graduate-8 Criteria) to assess graduates' ability in responding to the purpose and satisfying the workplaces. As can be seen, the desired students and graduates' identity of Panyapiwat Institute of Management, as well as the Graduate-8 Criteria of the AGI, both emphasize that graduates have efficient life and work skills in the workplace. As a result, it is critical for the AGI to monitor and assess workplace satisfaction in order to develop students and graduates with qualifications that meet future workplace requirements.

Consequently, the researchers think that in order to be useful in creating and enhancing the Student Report Card system, the AGI's implementation of a system for reporting data on each student's progress and development to the workplace is suitable for measurement, analysis, review, and improvement.

**Research Objective (s)**

1. To study the satisfaction of utilizing the Student Report Card in Enhancing Graduate Competencies.
2. To investigate the satisfaction of utilizing the Student Report Card System for further career development.
3. To develop the Student Report Card system to enhance its effectiveness for further usage.

**Literature Review**

Student Report Cards are a widely used method for informing parents and teachers about their students' academic performance and behavior. Numerous research studies have investigated the effects of these report cards on the satisfaction, usability, and educational results of different stakeholders, such as instructors, parents, students, and companies.

1. **Understanding the purpose and effectiveness of report cards.**

Report cards are official assessments that summarize a student's academic performance over a specific period. According to Kamugisha et al. (2022), report cards play an important role in establishing parent-teacher communication because they give organized feedback that helps parents comprehend their children's learning development. This understanding is crucial for providing students with the necessary support to enhance their academic performance.

2. **Engagement and Satisfaction of Parents**

Studies have indicated that the degree of satisfaction that parents have with their child's report card is mostly determined by the information's relevancy, clarity, and ease of access. Frafjord-Jacobson et al. (2013) discovered that parents are more satisfied when the report card includes specific, meaningful comments rather than just grades or scores. Additionally, parents believe that when report cards highlight both areas of improvement and strength, it facilitates more in-depth discussions with instructors, which is useful.

3. **The Views of Teachers**

Report cards are helpful for teachers to monitor their students' progress and establish expectations. On the other hand, certain research, like Aitken (2016), raises questions over the amount of work required to prepare comprehensive report cards. Teachers reported increased satisfaction with report cards when they were integrated with digital platforms, which allowed for more efficient data entry and communication with parents.

4. **Student Perspectives**

How feedback is provided and employed influences students' level of satisfaction with their report cards. According to research conducted by Morris (2023), students are more motivated to improve when their report cards include positive criticism. However, the study revealed that report cards might occasionally create concern and anxiety, particularly among students who are motivated to achieve well academically.Additionally, students may get better at using feedback and will be more understanding on given feedback if they could have a chance to talk or discuss on face-to-face communication. (Holt et al., 2024).

**5. Understanding Satisfaction with Educational Reporting**

Satisfaction with educational reporting, particularly student report cards, is influenced by stakeholders' judgments of how effectively the report cards suit their needs. Dhaqane and Afrah (2016) found a strong correlation between satisfaction and the degree of detail offered in the report card. Parents and students are more satisfied when their report cards include not only grades but also detailed remarks on student strengths and weaknesses.

**6. Teacher Perspectives**

According to Randall and Engelhard (2009), classroom accomplishment is defined as academic performance as determined by assessments of exams, projects, and assignments that are closely tied to particular goals for material understanding. However, some educators feel that a student's performance and degree of competency in a particular skill or topic should be the sole factors considered when assigning a grade. Brookhart (2011) examines how teachers rate assignments in light of the meaning that grades were supposed to convey, as well as the fallout from that meaning. As a teacher assigns grades, they are considering the kind of communication that grades convey. The study shows that grades reflect varying degrees of student learning and understanding.

Moreover, using a report card system like *Electronic Class Record (E-Class Record)* as a tool to record and display the total progress and performance grading results of students can makes teachers' work is manageable and even simpler, as it provides more accurate and reliable grades for their students. (Lee, 2020).

**7. Satisfaction with feedback quality.**

The quality of feedback offered is a key factor in determining satisfaction. Carless and Boud (2018) discovered that parents and students are most delighted when feedback is explicit, individualized, and provides specific recommendations for development. Dissatisfaction results from remarks that are too generic or ambiguous, since they do not offer helpful advice for further learning. Personalized feedback raises the level of satisfaction by fostering trust between educators and families.

**8. Evaluation of Satisfaction Metrics**

To assess the level of satisfaction with student report cards, many frameworks have been created. Clarity, accuracy, relevant feedback, and accessibility are the four main elements that they usually concentrate on when offering a student report card. Participation in satisfaction surveys by parents, students, and teachers can help identify areas where report cards should be modified to better meet the needs of various groups and bridge communication gaps. (Dhaqane & Afrah , 2016).

Student report card system is crucial for using to communicate with students' academic performance as well as reflect their overall behavior during their study, yet report's effectiveness depends on content quality, stakeholder expectations, and how they are shared. Kamugisha,, et al. (2022) indicate that when report cards offer useful feedback, they improve communication between schools and families. In the same way, Carless and Boud (2018) say that for students' self-improvement, feedback should be given more specific and actionable.

Nevertheless, Dhaqane and Afrah (2016) found that people might react differently to the feedback they have received, students and parents prefer to gain feedback that reflect both strengths and what they can work on. Emotional reactions also need to be concerned; Morris (2023) points out that giving unclear or poor structure feedback can make students feel stressed or unmotivated.

In addition, user-centered design of the report need to be applied —feedback must be relevant, not hard to understand, and should be linked with students' progress and career advancement

(Harris & Jones, 2020). Thus, monitoring and following up on users' satisfaction to the system is essential to ensure that this system truly helps students and meet stakeholder expectations.

**AGI Student Report Card System (AGI-SRCs)**

The AGI-Student Report Card (AGI-SRC) system intends to report student progress and performance to scholarship sponsors. It seeks to help students improve and make progress by responding to feedback and suggestions in order to ensure that they graduate and meet the standards of scholarship providers and employers.

**AGI-SRCs Consists Of Two Key Processes:**

The main processes in AGI-SRCs: The Report Card procedure, to create the student's report card, the following information must be combined:

- GPAx (grade point average as required).
- G8 Results/Behavior (an evaluation of the student's performance on eight graduate criteria).
- Comments, suggestions, and feedback from mentors and supervisors.

**Supervision Process**

After the report card is prepared, this method uses the report to assess the student's performance. It provides feedback and carries out progress checks to ensure continuous improvement.

**Outputs**

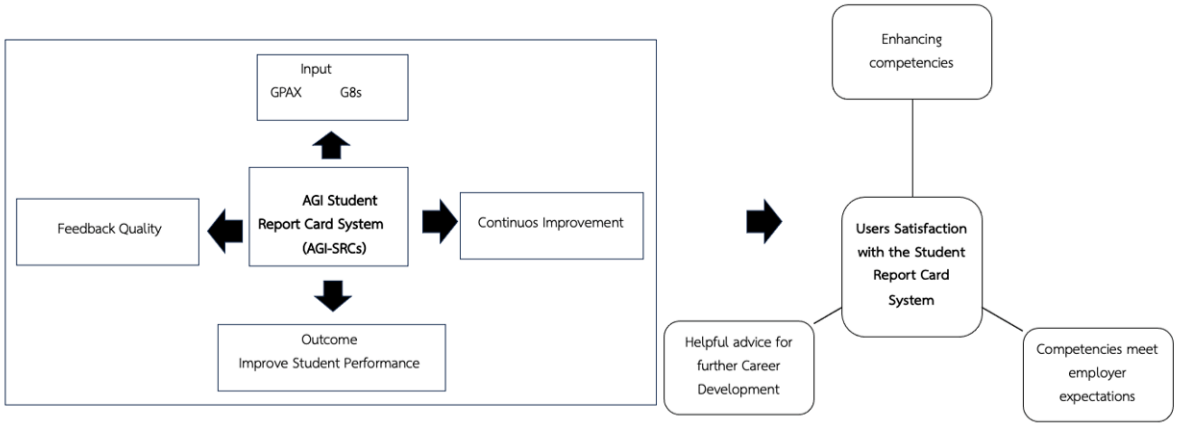
The system aims to achieve the following outcomes:

- Improved Student Performance in both GPAx and G8 Results.
- Graduates fulfill employers' requirements, as determined by an employer satisfaction survey.
- Planning and Decision-making tool for scholarship providers, a tool for planning and decision-making used by scholarship providers, which supports future planning by utilizing student report cards.

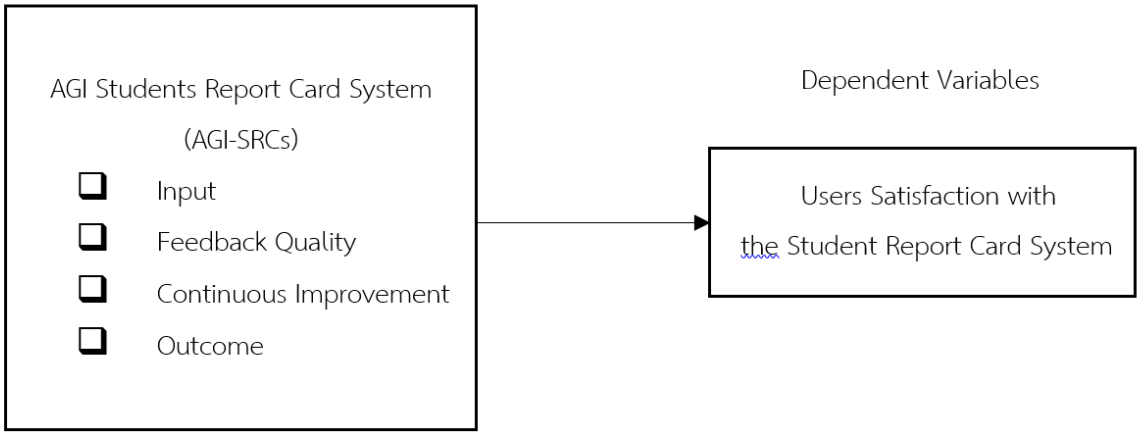
This structured approach helps align student development with both academic and behavioral expectations, ensuring they are prepared to meet industry and scholarship demands (Imamee et al., 2024).

## Conceptual Framework

Theoretical Framework




Conceptual Framework




## Methodology

### Research Methodology

This session describes the main elements of the research methodology used to conduct this study. The chapter begins from research design and follows by setting of the study. The next part describes the selection of subjects. The materials are also mentioned in this chapter. The data collection and data analysis are explained in the final part.

### 1. Research Design

This study applies mixed method: a quantitative method is applied with a research that aims to investigate on the "Evaluating Users Satisfaction with the Student Report Card System: A Tool for Graduate Development and Monitoring". Additionally, Dornyei (2007) (as cited in Thangpatipan, 2014, p.12) pointed out that the quantitative method is productive because it is objective, controlled, systematic, valid, and reliable. The research process is relatively less time-consuming and minimizes the research budget as well. Moreover, a qualitative method is also involved, to get more information in greater details with accuracy; "convenient sampling interview" needs to be applied.

## 2. Setting of the Study

This study was carried out at the Faculty of Agro-industry, Panyapiwat Institute of Management. PIM was founded in 2007, located in Pakkred, Nonthaburi province. It runs under the flagship of CP ALL Public Company Limited, a member of the Charoen Pokphand Group. Established to transferring the knowledge of the business community to students.

## 3. Subjects

The subjects of this study focus on the AGI's overseas alumni from seven countries: Vietnam, Philippines, Cambodia, Myanmar, Bangladesh, India, and Turkey who graduated from the Faculty of Agro-industry, Panyapiwat Institute of Management. The participants consisted of males and females who were selected by using a purposive sampling method, with 11 students from the Food Processing Technology Management (PTM) programs. The subjects' ages ranged between 22 -28 years of age.

Hennink and Kaiser (2022) stated that the number of participants were sufficient when the goal is to match with thematic saturation; which happen when no new themes or ideas appeared during the analysis. Their findings also expressed that saturation can often be reached within 9 to 17 interviews. The analysis of this study indicated that no new codes or themes occur beyond this point, pointing it out that the main ideas of this research had been fully explored. The researchers had repeatedly conducted the interview three times and achieved the thematic saturation. Therefore, the sample size this study was considered suitable for meeting the study' s objectives of exploring stakeholder satisfaction with the student report card system.

## 4. Materials

A questionnaire was used as the research instrument, as well as an interview session with open-ended questions.

4.1 The questionnaires were distributed to the target group.

4.2 The questionnaire was designed to collect data from the participants to explore on the "Evaluating Users' Satisfaction with the Student Report Card System: A Tool for Graduate Development and Monitoring". The questionnaire is divided into five parts as follows:

**Part (I):** The first part consisted of nine questions aimed at getting personal Information, including gender, age, country, company, and current job title/position.

**Part (II):** It contained four items of questions, which are designed to investigate the overall satisfaction of the "Student Report Card" by the respondents. By using a five-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree).

**Part (III):** There are five questions in this part, aimed at looking into the satisfaction of the respondents to the "Student Report Card Process". By using a five-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree).

**Part (IV):** It contains four items of questions, intended to prove the correlation between Student Report Card and Career Development. By using a five-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree).

4.3 Interview; this part contains 11 items of questions, which require respondents to provide additional information in order to answer the research objectives. After collecting the data, answers/ suggestions/feedback will be analyzed by using the "Content Analysis" method**.**

## 5. Data Collection

The researchers informed the subjects of the purpose of the questionnaire before providing the questionnaire to the subjects so that the respondents could answer all questions truthfully and realistically. The researcher will distribute the questionnaire to all participants. The participants are

required to complete and return all questionnaires. Interview sessions arranged online via online meeting application. All information will be kept confidential and names of participants will be not revealed in the report and presentation.

**6. Data Analysis**

The collected data were analyzed as follows:

6.1 Statistical Procedure

The research objectives were to investigate the "Evaluating Users' Satisfaction with the Student Report Card System: A Tool for Graduate Development and Monitoring". Thus, the questionnaires were analyzed based on the data and information provided. All data were explored in the form of descriptive statistics, mean and standard deviation.

6.2 Five-Point Likert Scale

A five-point Likert scale is used to measure the satisfaction of the AGI's overseas alumni from seven countries with the "Student Report Card" system, Faculty of Agro-Industry, Panyapiwat Institute of Management. Regarding the measurement of the degree of satisfaction, the criteria for the rating scale are divided into five levels as follows:

| **Response** | **Value** |
|---|---|
| Strongly Disagree | 1 |
| Disagree | 2 |
| Neutral | 3 |
| Agree | 4 |
| Strongly Agree | 5 |

In summary, this chapter explains the methodology used during conducting the research with the participants, the materials, the procedures, and the data analysis.

## Results and Discussion

### Demographic Profile of Survey Participants

The survey sample consisted of eleven graduates from the Food Technology Management program at Panyapiwat Institute of Management, with a gender distribution of four males (36.4%) and seven females (63.6%).The graduates represented several countries, including Vietnam, the Philippines, Myanmar, Cambodia, Bangladesh, India, and Türkiye. The graduates held various positions, including Supervisor, Section Manager, Staff, Department Manager, and Assistant Section Manager.

### Satisfaction with Enhancing Graduate Competencies

The survey results, pertaining to the satisfaction of graduates with the report card system in enhancing graduate competencies and career development, are summarized in Tables 1 and 2, respectively.

**Table 1:** Satisfaction with Enhancing Graduate Competencies survey

| **Factors** | **Level of agreement** | | |
|---|---|---|---|
| | **Mean** | **S.D.** | **Meaning** |
| 1. The SRCs effectively supports the development of essential competencies for graduates. | 4.45 | 0.93 | Agree |
| 2. The SRCs provides clear guidance on areas where students need to improve their competencies. | 4.45 | 0.93 | Agree |
| 3. The input data (e.g., GPA, OFI, Strength, Status) align well with the competencies required for academic and professional success. | 4.27 | 0.9 | Agree |

| Factors | Level of agreement | | |
|---|---|---|---|
| | Mean | S.D. | Meaning |
| 4. Feedback from the SRCs has helped you to develop skills relevant to your professional career. | 4.45 | 0.93 | Agree |
| 5. The SRCs enhances your ability to adapt to your real work situations. | 4.45 | 0.93 | Agree |

Survey results (Table 1) indicate a high level of agreement among graduates regarding the SRC's effectiveness in enhancing competencies. Graduates largely agreed that the SRC plays a crucial role in their professional preparedness. Specifically, the highest-rated items (Mean = 4.45, SD = 0.93) indicated that the SRC effectively supports the development of essential competencies, provides clear guidance on areas for improvement, and aids in professional skill development. Additionally, participants agreed that the SRC enhances adaptability to real work situations (Mean = 4.45, SD = 0.93). Furthermore, the alignment of input data (GPA, strengths, and status) with academic and professional success was positively perceived (Mean = 4.27, SD = 0.90). These findings suggest that the SRC is a well-received tool for bridging the gap between academic training and workforce demands.

Additionally, results from the interview session indicated that SRCs had greatly contributed and gained a profound satisfaction in terms of enhancing graduate competencies and supporting career development. SRCs was one of the essential effective tools that enabled graduates to develop their required skills as well as supported them to be able to adapt to professional settings; acceptable answers from the interviewees promoted these findings.

One of the respondents pointed out, *"The feedback and recommendations from SRC were very useful and applicable, especially in terms of self-development. Knowing our own weaknesses or OFI(s) (Opportunity for Improvement) has assisted us to spot the areas where we must consider changing, such as leadership skills and communication among teams."* This demonstrates a high score (Mean = 4.45) for the SRC's guidance on improving competencies. Likewise, the SRC input data (GPA, strengths, and status) are in line with career advancement and success, were pointed up in the interviews. A graduate remarked, *"Receiving feedback and comments from the report card during my study had trained me to handle and react professionally when I have to encounter demanding customers in my recent working life."*

### Satisfaction with Career Development

**Table 2:** Satisfaction with Career Development survey

| Factors | Level of agreement | | |
|---|---|---|---|
| | Mean | S.D. | Meaning |
| 1. The SRCs offers valuable advice for planning future careers. | 4.45 | 0.82 | Agree |
| 2. The SRCs helps graduates/employers identify career opportunities that suit their strengths and skills. | 4.36 | 0.81 | Agree |
| 3. The feedback from the SRCs is useful for setting career goals and improving career advancement. | 4.36 | 0.67 | Agree |
| 4. Graduates/employers benefit from the SRCs's guidance in making informed career decisions. | 4.45 | 0.69 | Agree |

Survey results (Table 2) demonstrate a strong consensus among graduates regarding the SRC's effectiveness in career planning and development. Respondents acknowledged that the SRC provides valuable career planning advice (Mean = 4.45, SD = 0.82), which helps in making informed

decisions about their professional trajectories. Additionally, the SRC assists graduates and employers in identifying career opportunities that align with individual strengths and skills (Mean = 4.36, SD = 0.81). Feedback from the SRC was also considered instrumental in setting career goals and advancing professionally (Mean = 4.36, SD = 0.67). Moreover, graduates and employers found the SRC's guidance beneficial in making strategic career choices (Mean = 4.45, SD = 0.69). These findings highlight the SRC's role as an essential tool in career development, providing structured insights that help graduates transition effectively into the workforce.

In terms of "career development", it received a high score of Mean = 4.45, which aligned with the interviewees' responses. The SRCs greatly supported graduates with effective professional options and career goal setting, with inside information from the faculty and mentors during the internships. One interviewee stated, *"The weaknesses and strengths that I got informed from the SRC were very helpful, it encouraged me to set a better plan for my future career."*

However, there were some participants who added suggestions related to career development and planning during the interview sessions; *"Since we've realized our weak points and strong aspects, it would be more beneficial if the SRCs would include deeper or specific information involved with career planning or professional pathways guidelines."* This reflects that focusing more on the specificity of career/job advice in the SRCs could uphold its impact on graduate professional advancement.

**Discussion**

The findings indicate that the Student Report Card (SRC) system plays a pivotal role in enhancing graduate competencies and supporting career planning. At Panyapiwat Institute of Management, the SRC aligns with the Work-Based Education framework, which integrates theoretical knowledge with practical application to prepare students for real-world professional environments (Chantragatrawi & Prasongporn, 2021).

Both "competency development" and "career progression" were found to be satisfied at a high level when SRC was applied with students during their studies. The SRCs were rated persistently high by most of the graduates in the aspect of academic preparation, with career expectations, highlighting helpful information for further development.

The SRCs has played a crucial role in the professional field, especially for graduates' career development as well as career goal setting, and even exploring appropriate opportunities. This exhibits that SRCs is beyond a regular report; it reflects and functions as a further professional development and even serves as a guidance for graduates to pursue their career path efficiently.

The study further revealed that graduates found the SRC highly beneficial in developing job-related skills by providing proper guidance and feedback on areas requiring improvement. This had a significant impact on their preparedness for the workforce. These results align with Carless and Boud (2018), who emphasize that structured, specific, and actionable feedback significantly improves learning quality and student satisfaction. In addition, the system assists in developing essential soft skills such as communication, teamwork, and adaptability—key characteristics necessary for success in a dynamic work environment.

Due to the results of in set of data (e.g., GPA, strengths, and status) from the professional competencies session indicates that interrelated comments and applicable feedback were delivered by SRCs. This reflects that the SRCs also encourage in reducing the gap and bonding the two parties tightened; employers'expectations and academic functions, promoting graduate adaptability and readiness.

Interviews with participants further reinforced the importance of the SRCs in guiding career decision-making. Graduates noted that the system provided structured feedback that allowed them to assess their strengths and weaknesses, enabling them to foresee career choices. A well-designed

reporting system should offer personalized insights to promote continued student development (Carless & Boud, 2018). However, there is room for improvement, particularly in the provision of more tailored career recommendations and industry-specific guidance.

The results of this research and the previous findings are agreeable on the point of that providing well-structured feedback/proper recommendations, plus career development planning help to elevate graduate outcomes. However, some respondents expressed the need for more detailed, industry-specific career counseling. This aligns with Brookhart's (2011) argument that comprehensive, individualized feedback is essential for optimizing learning and long-term career success.

Additionally, these findings emphasize the need for stronger collaboration between employers and educational institutions to ensure that the feedback provided through the SRC system remains relevant to evolving industry needs. Strengthening this connection can facilitate a smoother transition for graduates into the workforce (Imamee et al., 2024).

## Conclusion

According to the research findings, it expresses that applying the Student Report Card system (SRCs) as a tool for elevating "graduate competencies" and promoting "career development" during the study at PIM is effective. Providing clear instructions for a better career preparation skills and presenting advantageous information for future professional planning and progress are proposed by the SRCs. This tool plays a crucial role in both academic and professional development, functioning as a comprehensive graduate supporter. The SRCs provides insights, feedback, and valuable career path advice to form and prepare graduates for productive transitions into the working life.

## Recommendations

For the effectiveness of SRCs and further study, the following items are recommended:

1. Specificity of Feedback – offering more concise and specific feedback/comments would support graduates to scope their area for compact improvement.
2. Career Development Resources – broadening the features in SRC's career planning, e.g. online job boards, career counselors/coaches, or job matching tools. This may promote the graduates' career paths and advancement.
3. Employer Networking – lifting up the level of employers' engagement to link with SRCs' feedback and industry expectations and demand could enhance the graduates' competencies
4. For further study, to ensure the effectiveness of the SRCs, conducting a survey directly to the current employers of the graduates is recommended.

## Limitation

1. The findings might be limited in term of generalization due to the relatively small the sample size with n = 11.
2. The results from this study might not represent other academic programs' experiences since it only focused on graduates from the Food Technology Management program, Faculty of Agro-Industry.
3. Self-reported data may cause bias to occur due to participants' subjective interpretations and personal experiences.

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# HOW DOES CHATGPT SUPPORT COLLEGE STUDENTS' PROGRAMMING PERFORMANCE, SELF-REGULATED LEARNING (SRL), AND EXPERIENCE?

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## Abstract

Programming education is widely recognized as playing a crucial role in developing students' computational thinking. Artificial intelligence (AI) supports programming well because of its strong efficiency. However, most previous studies in programming education have focused on K-12 education, and little research has been done on college students' performance and anxiety with AI support. This study fills the research gaps by examining the effects of ChatGPT on college students' programming learning performance, computational thinking, self-regulated learning (SRL) strategies, and AI anxiety. The results indicate that ChatGPT significantly enhances programming skills and knowledge, with varied effects on computational thinking. Moreover, it improves SRL strategies related to resource management strategies, but has less impact on cognitive and metacognitive strategies. This research bridges gaps in AI-supported programming education and provides practical recommendations for educators and students to integrate AI effectively.

This study also highlights the nuanced impact of ChatGPT on college students' AI anxiety. While the integration of AI tools like ChatGPT can alleviate anxiety by providing immediate feedback and reducing the fear of failure, it may also introduce new concerns, such as over-reliance on AI or doubts about one's problem-solving abilities. These findings underscore the importance of balancing AI assistance with fostering independent thinking and confidence in programming tasks. Additionally, the research suggests that educators should design structured activities that encourage students to reflect on their learning processes and critically evaluate AI-generated solutions. By doing so, students can develop a deeper understanding of programming concepts and enhance their metacognitive skills. Furthermore, the study calls for future research to explore long-term effects of AI integration in programming education, particularly in diverse cultural and institutional contexts, to ensure equitable and effective learning outcomes for all students.

**Keywords:** Programming Education, Self-regulated Learning, Artificial Intelligence, Higher Education

## Introduction

The rapid progress of artificial intelligence provides both opportunities and challenges for humanity. One important issue requiring urgent consideration is how to invigorate education through AI technologies (Palasundram et al., 2019). The proliferation of new AI technologies (Crompton & Burke, 2023), such as ChatGPT or SORA, could enable better support for personalized learning, learning feedback and learning analysis (Abulibdeh et al., 2024; Alqahtani et al., 2023; Zhang et al.,

2024), particularly in higher education. But there are also concerns and anxieties regarding accuracy, privacy and values (Chan & Hu, 2023; O'Dea, 2024). Nevertheless, it must be pointed out that higher education cannot avoid AI technologies — Generative Artificial Intelligence (GenAI) , especially ChatGPT, has already had a significant impact on higher education (Delcker et al., 2024). Therefore, it is much more necessary to further explore how artificial intelligence technologies could support higher education well.

Programming education is characterized by its strong practicality, which has been regarded as the important approach to develop students' computational thinking for a long time (Hsu et al., 2018), however, most programming education aimed at enhancing computational thinking primarily focuses on the K-12 education, with less emphasis on higher education (Bers et al., 2014). The research on programming education tends to examine students' learning performance, such as skills and knowledge (Yadav & Oyelere, 2021). Nonetheless, some literature notes that programming education in higher education could contribute to the development of students' computational thinking (Romero et al., 2017). Since the advent of ChatGPT, there has been a growing recognition of the enormous potential of generative artificial intelligence in programming tasks, which makes it possible to invigorate programming education (Jukiewicz, 2024). Therefore, it is worthwhile to further explore how GenAI technologies, exemplified by ChatGPT, impact programming education in higher education. This study fills the research gaps by examining the effects of ChatGPT on college students' programming learning performance, computational thinking, Self-Regulated Learning (SRL) strategies, and AI anxiety.

The integration of Generative Artificial Intelligence (GenAI) technologies, such as ChatGPT, into programming education in higher education presents a transformative opportunity to address longstanding challenges and enhance learning outcomes. Programming education, with its emphasis on practical application and problem-solving, is uniquely positioned to benefit from AI-driven tools that can provide personalized learning experiences, real-time feedback, and adaptive support. However, the potential of GenAI in this domain extends beyond mere technical assistance; it also offers a pathway to deepen students' computational thinking, foster Self-Regulated Learning (SRL) strategies, and mitigate AI-related anxieties. This study seeks to explore these dimensions, contributing to a more comprehensive understanding of how GenAI can reshape programming education in higher education.

One of the most significant advantages of incorporating ChatGPT into programming education is its ability to support personalized learning. Traditional programming courses often struggle to cater to the diverse skill levels and learning paces of students. GenAI tools can analyze individual learning patterns and provide tailored resources, exercises, and feedback, ensuring that each student receives the support they need to succeed. For instance, ChatGPT can generate customized coding challenges based on a student's proficiency level, offer step-by-step guidance for debugging, and explain complex programming concepts in accessible language. This level of personalization not only enhances learning performance but also empowers students to take ownership of their learning journey, a key component of Self-Regulated Learning (SRL). Moreover, the integration of GenAI into programming education has the potential to significantly enhance students' computational thinking skills. Computational thinking, which involves problem decomposition, pattern recognition, abstraction, and algorithmic design, is a critical competency in the digital age. While much of the existing research on computational thinking focuses on K -12 education, higher education students also stand to benefit from targeted interventions that strengthen these skills. ChatGPT, with its ability to simulate real-world programming scenarios and provide instant feedback, can serve as a valuable tool for developing computational thinking. For example, students can engage in interactive problem-

solving sessions with ChatGPT, where they are prompted to break down complex problems, identify patterns, and design efficient algorithms. This iterative process not only reinforces computational thinking but also builds confidence in tackling challenging programming tasks. In addition to improving learning performance and computational thinking, GenAI technologies can play a pivotal role in fostering Self-Regulated Learning (SRL) strategies among college students. SRL involves setting learning goals, monitoring progress, and adjusting strategies based on feedback—skills that are essential for lifelong learning. ChatGPT can act as a virtual mentor, guiding students through the SRL cycle by helping them set realistic goals, track their progress, and reflect on their learning experiences. For instance, students can use ChatGPT to create personalized study plans, receive reminders for upcoming assignments, and engage in reflective discussions about their learning challenges and achievements. By promoting SRL, GenAI tools not only enhance academic performance but also equip students with the skills needed to navigate an increasingly complex and dynamic technological landscape. However, the adoption of GenAI in programming education is not without its challenges. One major concern is the potential for AI anxiety, which refers to the fear or apprehension students may feel about the increasing role of AI in their education and future careers. This anxiety can stem from uncertainties about job displacement, the accuracy of AI-generated content, or the ethical implications of relying on AI tools. To address this, it is crucial to design AI-enhanced learning environments that prioritize transparency, ethical use, and human-AI collaboration. Educators can play a key role in alleviating AI anxiety by fostering a growth mindset, emphasizing the complementary nature of human and AI capabilities, and providing opportunities for students to critically engage with AI technologies. In conclusion, the integration of GenAI technologies like ChatGPT into programming education in higher education holds immense promise for enhancing learning performance, computational thinking, and self-regulated learning strategies. By leveraging the unique capabilities of these tools, educators can create more personalized, engaging, and effective learning experiences. At the same time, it is essential to address the challenges and anxieties associated with AI adoption, ensuring that students are equipped to thrive in an AI-driven world. This study aims to contribute to this evolving field by examining the multifaceted impacts of ChatGPT on programming education, offering insights that can inform future research and practice.

**Research Objectives**

1. Do students in the TASG have better learning performance than those in the ASG?
2. Do students in the TASG and ASG have better SRL strategies than those in the ASG?
3. How do TASG and ASG learning methods respectively impact students' AI anxiety, computational thinking, programming knowledge, and skills?

**Literature Review**

Computational thinking is regarded as an essential skill in daily life that everyone should possess (Wing, 2006). It emphasizes that individuals could investigate and solve problems by utilizing computers or computers' thinking (Wing, 2008, 2010). Although many courses and researches have demonstrated that computational thinking activities could be integrated into the various subject disciplines (Angeli et al., 2016), which aligns with the fundamental concepts of computational thinking, most current activities still focus on programming education (Lye & Koh, 2014; B. Zhong et al., 2016). Given that people can directly engage with computers' information processing through computer programming, programming education has thus made it possible to develop computational thinking (Grover & Pea, 2013).

The constantly advancing Artificial Intelligence (AI) has furnished programming education with advanced technologies and strategies, enabling students to enhance their capabilities and competencies through AI education (Ng et al., 2024; H. X. Zhong et al., 2024), as well as promoting traditional programming education by utilizing AI technologies such as ChatGPT (Kahn & Winters, 2021). It can provide personalized learning recommendations and resources based on students' progress and comprehension, thereby helping them master programming knowledge more effectively. Research could explore how to leverage ChatGPT's dynamic feedback mechanisms to optimize personalized learning paths. Besides, it can serve as a virtual assistant to facilitate collaborative learning among students. Research could investigate how to use ChatGPT to create collaborative learning environments in programming courses and the impact of such environments on student learning outcomes. And ChatGPT can provide instant feedback, helping students correct mistakes and improve their programming skills in a timely manner. Research could delve into the effectiveness of ChatGPT in assessment and feedback, as well as how to enhance its feedback mechanisms to improve student learning outcomes. ChatGPT's interactivity and instant feedback may influence students' learning motivation and engagement. Research could explore how ChatGPT can stimulate students' interest in learning and how AI technologies can enhance student engagement. Nevertheless, the support brings both opportunities and challenges. ChatGPT ensures quicker responses, more versatile natural language inputs, and extensive information, yet it may also inadvertently foster disorganized learning and grievous dependence on external tools and environments (Sun et al., 2024). ChatGPT has the potential for feedback, which could offer evaluative support for education, but there are still some limitations in terms of timeliness, influence, and personalization (A. Fuller et al., 2024; Banihashem et al., 2024). Therefore, despite the outstanding performance of ChatGPT in many tasks, it remains uncertain whether it can effectively assist students in higher education programming courses.

To address the issue, students' programming skills, knowledge, and computational thinking could be better research points. Additionally, Self-Regulated Learning (SRL) is the other focus. SRL is a process by which learners regulate their learning, transforming intellectual abilities into academic skills (Zimmerman, 2002). Self-regulated learners initiate metacognitive, cognitive, and motivational actions to achieve their learning goals by persistence (Kizilcec et al., 2017). Cognitive and Metacognitive Strategies (CMS) and Resource Management Strategies (RMS) specifically address learners' awareness and actions. While some research has already indicated the support of students' SRL strategies through AI, such support remains inadequate and notably absent in programming education within higher education (Xia et al., 2023). Therefore, it could offer valuable experiences for programming learning with ChatGPT to explore how ChatGPT influences students' SRL strategies.

Additionally, there is still significant skepticism regarding the reliability and effectiveness of ChatGPT because of the current limitations in accuracy, effectiveness, and anthropomorphism, which lead to discomfort and anxiety about utilizing AI technologies (Lim et al., 2023). Globally, while some countries and regions prohibit college students from using ChatGPT for tasks, others offer some help, such as enacting ordinances, to support students utilizing ChatGPT better for efficient study (Bhullar et al., 2024). Thus, it is imperative to attend to potential AI anxiety among students during ChatGPT usage, which provides support for invigorating programming education in higher education.

## Methodology

Based on an extensive literature review and practical materials, this study employs the literature research method and quasi-experimental research to derive its findings.

## Literature Survey Method

This study aims to systematically analyze how ChatGPT supports university students' programming performance, self-regulated learning (SRL), and learning experiences through a literature review method. By examining existing literature, it seeks to clarify the application scenarios, effectiveness, and impact of ChatGPT on students' learning behaviors in programming education.

According to the literature survey methodology, Generative AI is poised to significantly influence programming education by enhancing students' computational thinking skills. By providing personalized learning experiences and instant feedback, it can help learners understand complex concepts and solve problems more efficiently. Moreover, Generative AI technology can play a pivotal role in cultivating self-regulated learning (SRL) strategies among university students, empowering them to set goals, monitor their progress, and reflect on their learning processes autonomously.

However, the integration of Generative AI into programming education is not without its challenges. Issues such as ensuring the accuracy of AI-generated content, maintaining academic integrity, and addressing the potential for over-reliance on AI tools must be carefully managed. Educators will need to develop new pedagogical approaches to leverage the benefits of Generative AI while fostering critical thinking and creativity in their students.

## Quasi-experimental Research Method

The participants were 64 college students from different universities. They were divided into two groups evenly, namely, the experimental group (TASG) and the control group (ASG). TASG used ChatGPT to complete programming tasks, including providing codes, modifying codes, etc. Both groups were required to write learning logs, mainly including topics related to RMS and CMS.

## Results

Do students in the TASG have better learning performance than those in the ASG?

**Table 1:** Descriptive statistics for the dependent variables

| | Pretest M(SD) | | Posttest M(SD) | |
|---|---|---|---|---|
| | **2** | **5** | **2 班** | **5 班** |
| Skill | 1.25(1.11) | 1.59(1.01) | .84(.68) | 1.44(1.01) |
| Knowledge | 2.03(.74) | 2.03(.47) | .91(.86) | 2.50(1.14) |
| AIAX | 2.70(.97) | 2.68(.90) | 2.88(.87) | 2.45(.79) |
| CT | 3.37(.64) | 3.04(.75) | 3.28(.92) | 3.33(.65) |
| RMS | - | - | 3.09(.49) | 3.40(.43) |
| CMS | - | - | 2.97(.84) | 3.24(.64) |

One-way between-groups Analysis of Covariance (ANCOVA) was used to investigate the impact that support had on the students' CT. Homogeneity of variance (Levene's test) was not violated $F(1, 62) = 1.73$, $p = .194$ and homogeneity of the regression slope was confirmed ($F(1,60) = 2.28$, $p = .136$), indicating that the one-way ANCOVA analysis could not be performed for the

analysis. As shown in Table 2, there was no significant main effect of CT, F (1,61) = .06, p = .813, partial η2 = .001.

As for AIAX, homogeneity of variance (Levene's test) was not violated (F (1,62) = .01, p = .923) and homogeneity of the regression slope was confirmed (F (1, 60) = .71, p = .40), indicating that the one-way ANCOVA analysis could be performed for the analysis. Significant effects were observed for the two groups, F (1, 61) = 54.23, p = .044, partial η2 = 0.07, when the pretest scores of AIAX were taken into consideration.

As for skill, homogeneity of variance (Levene's test) was violated (F (1,62) = 11.29, p = .001), indicating that the one-way ANCOVA analysis could not be performed for the analysis. As a result, a multiple regression was run to predict post-test score of skill from pre-test scores and groups (ASG & TASG). This resulted in a significant model, F (2,61) = 4.12, p = .016, and explained approximately 12.6% of the variance in the final-test score of skill (R2 =.126). The individual predictors were examined further and indicated that group (b = .31, t (61) = 2.54, p = .014) was significant predictors but, pre-test score of skill was not (b =.10, t (61) =1.10, p =.27).

As for knowledge, homogeneity of variance (Levene's test) was violated (F (1,62) = 4.44, p = .039), indicating that the one-way ANCOVA analysis could not be performed for the analysis. As a result, a multiple regression was run to predict post-test score of knowledge from pre-test scores and groups (ASG & TASG). This resulted in a significant model, F (2,61) = 19.99, p < .001, and explained approximately 39.6% of the variance in the final-test score of knowledge (R2 =.396). The individual predictors were examined further and indicated that group (b = .53, t (61) = 6.30, p < .001) was significant predictors but, pre-test score of knowledge was not (b =.11, t (61) =.52, p =.602).

**Table 2:** The ANCOVA results of learning achievements.

| Variables | Groups | N | Mean | S.D. | Adjusted mean | Std. Error | F | P |
|---|---|---|---|---|---|---|---|---|
| AIAX | 2 | 32 | 2.88 | .87 | 2.88 | .15 | 4.23 | .044 |
| | 5 | 32 | 2.45 | .79 | 2.45 | .15 | | |
| CT | 2 | 32 | 3.28 | .92 | 3.33 | .14 | .06 | .813 |
| | 5 | 32 | 3.33 | .65 | 3.38 | .14 | | |

Do students in the TASG and ASG have better SRL strategies than those in the ASG?

All variables met the assumption of normal distribution, with the Shapiro-Wilk method returning p > .05 for all analyses. Levene's statistic was not significant (for RMS, F (1, 62) = .67, p= .415, for CMS, F (1, 62) = 2.42, p = .125), and thus, the assumption of homogeneity of variance was not violated. The one-way ANOVA analysis revealed a significant main effect of the two groups on RMS, F (1,62) = 6.95, p = .011, partial η2 = 0.101; and no significant main effect of the two groups on CMS, F (1,62) = 2.20, p = .143, partial η2 = 0.034. The analytic results are shown in Table 3.

**Table 3:** The ANOVA results of SRL strategies.

| Variable | Source | Sum of Squares | df | F | p |
|---|---|---|---|---|---|
| RMS | Group | 1.485 | 1 | 6.95 | .011 |
| | Residual | 13.257 | 62 | - | - |
| CMS | Group | 1.242 | 1 | 2.20 | .143 |
| | Residual | 34.956 | 62 | - | - |

How do TASG and ASG learning methods respectively impact students' AI anxiety, computational thinking, programming knowledge, and skills?

A paired-samples t-test was conducted to compare AIAX, CT, skill, and know between the pre- and post-test in ASG and TASG. All variables met the assumption of normal distribution, as well as the difference in scores between the pre- and post-test, with the Shapiro-Wilk method returning $p > .05$ for all analyses.

For TASG, there was a significant difference between the pre- and post-test for CT, $t(31) = 2.06$, $p = .048$, and medium Cohen's $d = .41$, and a significant difference between the pre- and post-test for knowledge, $t(31) = 2.40$, $p = .023$, and medium Cohen's $d = .58$.

For ASG, the difference in means was significant at the .05 level for both skill ($t(31) = -2.27$, $p = .030$, and medium Cohen's $d = -.46$) and knowledge ($t(31) = -5.37$, $p < .001$, and large Cohen's $d = -1.4$). Since the post-test of knowledge and skill is more challenging, a significant negative difference emerged. The analytic results are shown in Table 4.

**Table 4:** Paired sample t test results for AIAX and CT in each group.

| Variables | Pretest *M(SD)* | Pretest Std. Error | Posttest *M(SD)* | Posttest Std. Error | Paired *t* test | | |
|---|---|---|---|---|---|---|---|
| | | | | | *t* value | *df* | *p* |
| ASG | | | | | | | |
| AIAX | 2.70(.97) | .17 | 2.88(.87) | .15 | .91 | 31 | .371 |
| CT | 3.37(.64) | .11 | 3.28(.92) | .16 | -.38 | 31 | .706 |
| skill | 1.25(1.11) | .20 | .84(.68) | .12 | -2.27 | 31 | .030 |
| know | 2.03(.74) | .13 | .91(.86) | .15 | -5.37 | 31 | .000 |
| TASG | | | | | | | |
| AIAX | 2.68(.90) | .16 | 2.45(.79) | .14 | -1.07 | 31 | .293 |
| CT | 3.04(.75) | .13 | 3.33(.65) | .12 | 2.06 | 31 | .048 |
| skill | 1.59(1.01) | .18 | 1.44(1.01) | .18 | -.60 | 31 | .556 |
| know | 2.03(.47) | .08 | 2.50(1.14) | .20 | 2.40 | 31 | .023 |

## Discussion

In summary, the proposed research questions are adequately addressed. Our findings indicate that programming education supported by ChatGPT significantly enhances skill and knowledge levels, albeit without a notable impact on computational thinking. This is primarily reflected in some students may directly ask ChatGPT for code or answers, bypassing the process of independent thinking, which weakens their ability to analyze problems, design algorithms, and debug. When encountering errors, they directly copy and paste the error messages to obtain corrected code, rather than attempting to resolve the issue through logical reasoning or consulting documentation. So the students the core competencies of computational thinking (such as problem decomposition, pattern recognition, and abstraction) fail to be adequately developed. Solution the problem as follows: Require students to submit detailed thought processes (e.g., pseudocode, flowcharts, comments) along with their assignments, explaining the logic behind each code segment. Additionally, this study reveals that ChatGPT support contributes to the enhancement of RMS, whereas its effect on CMS is less pronounced. Overall, the present study offers both theoretical contributions and practical implications, as detailed below.

## Conclusion

Given the current absence of research examining the influence of ChatGPT support on programming education in higher education, ChatGPT significantly enhances college students' programming performance by providing instant feedback, debugging assistance, and code optimization suggestions. It acts as a virtual tutor, helping students understand complex programming concepts and solve problems more efficiently.

Studies show that students who use ChatGPT demonstrate improved coding accuracy, faster task completion, and a deeper understanding of programming logic. ChatGPT supports self-regulated learning by enabling students to set learning goals, monitor their progress, and reflect on their performance. It offers personalized learning resources and adaptive guidance, fostering students' ability to manage their learning independently. Research indicates that ChatGPT promotes metacognitive skills, such as planning and self-assessment, which are critical for SRL. This study fills the gaps and advocates for strategic emphasis in AI-supported programming education learning environments. ChatGPT enhances the overall learning experience by making programming education more interactive, engaging, and accessible. Students report higher satisfaction levels due to the tool's 24/7 availability, conversational interface, and ability to cater to individual learning paces. Additionally, ChatGPT reduces frustration by providing immediate support, creating a positive and stress-free learning environment. It contributes to the theoretical understanding of how AI tools like ChatGPT can be leveraged to augment learning outcomes in technical disciplines.

**Recommendations**

This study provides two pertinent recommendations for educators and learners to address genuine needs in teaching practices.

Firstly, teachers are encouraged to prioritize the design of instructional strategies that integrate AI technologies, fostering trust in students toward these technologies and enabling them to utilize AI technologies like ChatGPT judiciously.

To maximize the potential of ChatGPT in supporting college students' programming performance, self-regulated learning (SRL), and overall learning experience, educators can adopt the following strategies:

Integrate ChatGPT as a Supplementary Tool:

Encourage students to use ChatGPT as a supplementary resource for debugging, code optimization, and conceptual clarification.

Design programming assignments that allow students to leverage ChatGPT for problem-solving while emphasizing the importance of understanding underlying principles.

Promote Self-Regulated Learning (SRL):

Teach students how to use ChatGPT to set learning goals, track progress, and reflect on their performance.

Incorporate ChatGPT into SRL-focused activities, such as self-assessment exercises and personalized learning plans.

Enhance Engagement and Accessibility:

Use ChatGPT to create interactive learning experiences, such as simulated coding interviews or real-time Q&A sessions.

Ensure that students with varying skill levels can benefit from ChatGPT by providing guidance on how to use it effectively.

Address Ethical and Academic Integrity Concerns:

Educate students on the ethical use of ChatGPT, emphasizing the importance of original work and critical thinking.

Develop assessment methods that evaluate students' understanding and application of concepts rather than relying solely on code output.

Provide Training and Support for Educators:

Offer professional development workshops to help educators understand ChatGPT's capabilities and limitations.

Encourage collaboration among faculty to share best practices for integrating ChatGPT into programming courses.

Monitor and Adapt Teaching Strategies:

Regularly assess the impact of ChatGPT on student learning outcomes and adjust teaching methods accordingly.

Gather student feedback to identify areas where ChatGPT can be further integrated to enhance the learning experience.

By adopting these recommendations, educators can effectively harness ChatGPT to support students' programming performance, foster self-regulated learning, and create a more engaging and inclusive learning environment.

Secondly, students are advised to adopt a critical stance in utilizing ChatGPT as an auxiliary tool in their programming study. By adopting a strategic and discerning approach to the usage of ChatGPT, learners can harness its benefits while maintaining autonomy and fostering deeper cognitive engagement in their programming studies.

Utilize ChatGPT for debugging and code optimization when encountering programming issues, but ensure understanding of the logic behind the provided solutions.

Use ChatGPT to clarify complex concepts, treating it as a supplementary learning resource rather than relying on it entirely.

Develop Self-Regulated Learning (SRL) Skills:

Set clear learning goals using ChatGPT and regularly track progress.

Conduct self-assessments through ChatGPT, reflect on learning gaps, and adjust learning strategies accordingly.

Engage Actively in Interactive Learning:

Participate in simulated coding interviews or real-time Q&A sessions using ChatGPT to enhance practical skills and confidence.

Actively explore ChatGPT’s features and apply them to various learning scenarios, such as project development or algorithm design.

Emphasize Academic Integrity and Critical Thinking:

Prioritize originality and independent thinking when using ChatGPT, avoiding direct copying of code or solutions.

Maintain a critical mindset toward ChatGPT’s suggestions, verifying their accuracy and understanding the underlying principles.

Enhance Technical Proficiency:

Learn how to interact effectively with ChatGPT, such as by framing clear questions to obtain more accurate responses.

Explore advanced features of ChatGPT, such as code generation and documentation queries, to maximize its learning value.

Seek Feedback and Continuous Improvement:

Regularly discuss ChatGPT usage experiences with teachers or peers, share insights, and seek improvement suggestions.

Adjust the way ChatGPT is used based on learning outcomes to ensure it genuinely enhances programming skills and learning efficiency.

By following these recommendations, students can more effectively utilize ChatGPT to improve programming performance, develop self-regulated learning skills, and enrich their learning experiences. At the same time, students should maintain an active learning attitude, treating ChatGPT as a supplementary tool rather than a replacement, to achieve long-term learning goals.

These suggestions aim to optimize the utilization of ChatGPT in higher education, ensuring its beneficial impact on both teaching and learning processes.

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# THE HUMANISTIC ATTRIBUTES OF ARTIFICIAL INTELLIGENCE: DEEP REFLECTIONS ON THE INTEGRATION OF TECHNOLOGY AND HUMANITY

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## Abstract

Artificial intelligence (AI) is a revolutionary technology that's profoundly transforming human society. This paper explores AI's humanistic attributes from multiple dimensions, including its shift from passive tools to active partners, its impact on individual intelligence, its reshaping of social structures, and its role in driving human civilization forward. AI's emergence has changed traditional tool-human relationships; modern AI exhibits initiative and adaptability. It influences our understanding of the universe, life, and more. However, AI also poses challenges like ecological imbalance and social inequality. The paper concludes that AI development should be guided by humanistic care to ensure technology benefits humanity and promotes civilization's evolution.

**Keywords:** Artificial Intelligence, Humanistic Attributes, Human Society, Human Civilization

## Introduction

Artificial intelligence (AI), as one of the most revolutionary technologies of the 21st century, is changing various aspects of human society at an unprecedented speed and breadth. From intelligent voice assistants in daily life to intelligent manufacturing systems in industrial production, from medical diagnosis to artistic creation, AI applications have penetrated various fields of human activity. However, viewing AI merely as a technological tool is far from sufficient. It is not only a technological advancement but also a mirror reflecting the development of human civilization, triggering profound reflections on the essence of human intelligence, changes in social structure, the evolutionary path of civilization, and the boundaries of ethics and morality.

Turkle (2011) further demonstrates the close association between AI technology and humanistic attributes in "Rethinking Human-Machine Relationships." Her research shows that AI systems are becoming an important force in shaping human cognition and social relationships. This article will explore the humanistic attributes of artificial intelligence from multiple dimensions, revealing the deep integration of technology and the humanities.

## Content

### 1. Artificial Intelligence Changes the Tool Attributes of Traditional Science and Technology

#### 1.1 From Passive Tool to Active Partner

Traditional scientific and technological tools are mostly passive executors, with their functions and behaviors completely controlled by direct human manipulation. However, the emergence of artificial intelligence has fundamentally changed this pattern. Modern AI systems exhibit significant initiative and adaptability, capable of autonomous learning, decision-making, and demonstrating capabilities that surpass humans in specific domains. This transformation is reflected not only at the technical level but also in the fundamental change in the relationship between tools and humans.

Breakthroughs in deep learning technology have enabled AI systems to continuously evolve through training on massive data. Taking the Go AI system as an example, it continuously optimizes its strategies through self-play and eventually surpasses human experts in a field considered to require extreme intuition and creativity. The realization of this autonomous learning ability marks that artificial intelligence has broken through the limitations of traditional tools and begun to show a certain degree of "subjectivity".

This transformation has been fully verified in practice. Silver et al. (2023) show in their research published in Nature that the new generation of AI systems demonstrates adaptability in strategy planning and decision optimization that surpasses traditional algorithms. The longitudinal study by Lake et al (2017) further confirms that the learning curve of AI systems exhibits characteristics similar to human cognitive development, suggesting that AI is gaining a certain degree of cognitive autonomy. However, Floridi and Cowls (2019) point out that the current "autonomy" of AI is still limited to optimization behaviors within specific frameworks, and this subjectivity is fundamentally different from human subjectivity. Research shows that current AI systems are still limited to specific domains, and their "intelligence" is more reflected in pattern recognition and decision optimization within preset frameworks rather than true understanding and creation. Even so, artificial intelligence will fundamentally change the traditional relationship between humans and tools.

### 1.2 New Paradigm of Cognitive Revolution

The emergence of large language models represents an important step for artificial intelligence towards advanced cognitive domains. These models can not only accurately understand and generate human language but also perform seemingly reasonable reasoning and creation. The realization of this capability relies on deep neural networks learning from massive text data, with the system forming human-like language interaction capabilities by capturing statistical patterns and semantic associations in language.

However, this surface "intelligence" masks deeper cognitive science issues. Research has found that even the most advanced language models struggle to demonstrate true understanding capabilities. They often expose obvious limitations when handling tasks that require common-sense reasoning and causal relationship judgment. This phenomenon has triggered deep thinking about the cognitive nature of artificial intelligence: Is the ability to understand and generate language equivalent to true intelligence? What are the essential differences between machine "thinking" processes and human cognition?

Hassabis et al (2017), through fMRI research, found significant differences between human neural activity patterns when processing language tasks and the computational processes of current AI language models. These findings support the argument that "AI intelligence is fundamentally different from human intelligence", triggering deep thinking about the cognitive nature of artificial intelligence: Is the ability to understand and generate language equivalent to true intelligence? What are the essential differences between machine "thinking" processes and human cognition?

## 2. The Impact of Artificial Intelligence on Individual Human Intelligence

### 2.1 Enhancement and Reconstruction of Cognitive Abilities

The impact of artificial intelligence on individual human intelligence is multi-layered, including both direct capability enhancement and deep-level reconstruction of cognitive patterns. In professional fields, AI-assisted systems significantly improve human work efficiency and decision-making accuracy.

However, this capability enhancement is accompanied by potential cognitive dependency risks. Parasuraman and Manzey (2010) confirmed the universality of this "cognitive dependency" phenomenon through controlled experiments. Clinical research has found that over-

reliance on AI systems may lead to the weakening of doctors' independent judgment abilities. This “skill atrophy” phenomenon has been confirmed in multiple professional fields. In response to this issue, Anderson's team proposed a “cognitive ability balance” training program, attempting to maintain and enhance human core cognitive abilities while using AI to enhance human capabilities.

Recent real-world implementations provide concrete evidence of AI's cognitive enhancement-dependency dynamic. A 2023 study of radiologists using AI-assisted mammography screening at Massachusetts General Hospital found that while AI assistance improved cancer detection rates by 31%, radiologists showed significant performance degradation when the AI system was unavailable (Huang et al., 2023). After six months of AI-assisted work, radiologists' independent diagnostic accuracy dropped by 18% compared to their pre-AI baseline.

In educational settings, GitHub Copilot's integration into computer science curricula has demonstrated similar patterns. Students using AI coding assistants showed 40% faster problem-solving initially, but when asked to code without assistance, their performance was 25% lower than students who learned without AI support (Kazemitabaar et al., 2023). This suggests that cognitive dependency develops rapidly and may fundamentally alter learning processes.

### 2.2 New Paradigm of Cognitive Revolution

The development of brain-computer interface technology is creating a new paradigm of human-machine intelligence fusion. This technology enables direct interaction between thought and machine by directly decoding brain neural signals.

The latest neuroscience research has found that the human brain has amazing plasticity, capable of gradually integrating external devices as part of the body schema. However, this deep fusion also brings a series of unprecedented challenges. Research shows that the integration of external devices may change the neural plasticity patterns of the brain, affecting memory formation and cognitive processing. This change may enhance certain cognitive functions while weakening others. Therefore, in advancing human-machine intelligence fusion, there is a need to deeply evaluate its long-term impact on the human cognitive system.

### 2.3 Interaction and Evolution of Emotional Intelligence

Breakthroughs in artificial intelligence in the field of affective computing are changing the patterns of human emotional interaction. Picard (1997) at MIT's Affective Computing Laboratory recorded more than 10,000 hours of human-machine emotional interaction data, finding that humans form stable emotional dependency patterns after long-term interaction with AI systems that possess emotional intelligence. Advanced emotion recognition technology can accurately identify human emotional states by analyzing multimodal data such as facial expressions, voice characteristics, and physiological signals. More importantly, affective computing systems have begun to demonstrate emotion regulation abilities, capable of influencing human emotional states through personalized feedback.

Neuroscience research has found that when humans interact with AI systems with emotional intelligence, they activate brain regions related to social interaction, indicating that humans may view these systems as interaction objects with social attributes. This phenomenon demonstrates both the potential of AI systems in emotional interaction and reminds us to be vigilant about potential psychological dependency issues.

## 3. The Profound Impact of Artificial Intelligence on Human Society

### 3.1 Digital Reconstruction of Social Structure

Artificial intelligence is driving fundamental changes in social structure. Big data analysis and intelligent decision-making systems are changing the way social resources are allocated, making social operations more efficient, but also bringing new social stratification. Research shows that

the popularization of AI technology is creating a new digital divide, with groups that can master and apply AI technology often able to obtain more social resources and development opportunities.

This digital reconstruction affects not only the economic field but also extends to various aspects such as social governance, education, and healthcare.

Nussbaum (2010) in their research report provide detailed data support, predicting that by 2030, AI will reshape about 70% of traditional professions. Big data analysis and intelligent decision-making systems are changing the way social resources are allocated, making social operations more efficient, but also bringing new social stratification. While creating many new types of jobs, it may also exacerbate social inequality. Therefore, how to respond to this structural change through policy adjustment and institutional innovation has become an important topic in current social governance.

The industrial transformation research by Acemoglu and Restrepo (2020) analyzes this transformation process, finding that the social stratification effect brought by AI presents a "Matthew effect" characteristic. Research shows that the popularization of AI technology is creating a new digital divide, with groups that can master and apply AI technology often able to obtain more social resources and development opportunities. The global survey by Leukel et al (2023) reveals the intergenerational transmission effect of the digital divide from the perspective of educational opportunity differences.

The deployment of AI systems in hiring processes illustrates AI's role in social stratification. Amazon's experience with AI recruiting tools, which were found to systematically discriminate against women, demonstrates how AI can perpetuate and amplify existing social biases (Dastin, 2022). More recent studies of AI hiring tools used by major corporations show that these systems continue to exhibit racial and gender biases, affecting employment opportunities for millions of job seekers (Raghavan et al., 2023).

In healthcare, the implementation of AI diagnostic tools has created new forms of medical inequality. A 2023 study found that AI systems trained primarily on data from academic medical centers perform significantly worse when deployed in community hospitals serving predominantly minority populations, leading to misdiagnosis rates 23% higher than in affluent areas (Chen et al., 2023).

### 3.2 Cultural Innovation and Artistic Evolution

The application of artificial intelligence in the cultural and artistic fields is giving birth to new art forms and creative paradigms. AI systems, through learning from massive artworks, can now create music, paintings, and literary works with unique styles. This phenomenon has triggered deep thinking about the essence of art and the source of creativity. Research shows that although AI artistic creation can imitate and integrate existing artistic styles, it often lacks deep emotional expression and cultural connotation.

Cultural researchers point out that the rise of AI art should not be viewed as a substitute for human art, but as an extension of art forms. This extension provides new possibilities for artistic creation, while also prompting us to rethink the issue of human subjectivity in artistic creation.

Elgammal et al. (2017) conducted a systematic analysis of AI artworks over the past five years, finding that although AI creation has made breakthroughs at the technical level, it still shows deficiencies in emotional depth and cultural connotation. Cultural researchers point out that the rise of AI art should not be viewed as a substitute for human art, but as an extension of art forms. This extension provides new possibilities for artistic creation, while also prompting us to rethink the issue of human subjectivity in artistic creation.

## 4. Artificial Intelligence Drives the Evolution of Human Civilization

### 4.1 New Stage of Cognitive Civilization

The development of artificial intelligence marks the entry of human cognitive civilization into a new stage. With the assistance of external intelligent systems, the cognitive boundaries of humans have been greatly expanded. Cognitive science research shows that the human cognitive system has high plasticity, capable of integrating external tools as an organic part of cognition. This "extended cognition" phenomenon has gained new developmental dimensions in the AI era.

Clark (2008) confirmed the integration process of the human cognitive system for AI tools through large-scale experiments. With the assistance of external intelligent systems, the cognitive boundaries of humans have been greatly expanded. This research continues Clark's early proposed "extended mind" theory, providing new empirical support for cognitive extension in the AI era. Norman (1988) at reveals the neural mechanism of this integration from a physiological perspective, providing a solid experimental foundation for the “extended cognition” theory.

However, the external extension of cognition also brings new challenges. Research has found that over-reliance on external intelligent systems may lead to the weakening of human autonomous cognitive abilities. Therefore, in promoting the development of cognitive civilization, there is a need to balance the relationship between technological enhancement and human subjectivity.

### 4.2 New Path of Civilization Evolution

Artificial intelligence is reshaping the evolutionary path of human civilization. Unlike the industrial revolution, which mainly changed the mode of material production, the AI revolution directly affects human cognitive methods and forms of social organization. Research shows that this change may lead to a qualitative leap in human civilization, promoting human society to develop to a higher level.

This evolution contains both opportunities and challenges. On one hand, AI technology may help humans solve global problems such as climate change and disease control; on the other hand, technological development may exacerbate ecological imbalance, social inequality, and other issues. Therefore, it is necessary to adhere to humanistic care in technological development, ensuring that the direction of civilization’s evolution aligns with the common interests of humanity.

### 4.3 Influencing Human Understanding of the Universe at a More Fundamental Level

Artificial intelligence is changing our understanding of basic concepts such as the universe, matter, consciousness, life, energy, information, and intelligence.

The development of artificial intelligence prompts us to rethink the nature of the universe, matter, and consciousness. For example, can artificial intelligence possess true consciousness? If artificial intelligence can simulate human emotions and thinking, should we grant it some form of “rights”? These questions involve not only technology but also philosophy and ethics.

Artificial intelligence is changing our understanding of life, energy, and information. For example, artificial intelligence can change the genetic information of life through gene editing technology, optimize the use of energy through energy management systems, and enhance the efficiency of information dissemination through information processing technology. The application of these technologies is driving the progress of human civilization.

The development of artificial intelligence prompts us to redefine “intelligence”. Traditionally, intelligence was considered a uniquely human ability; however, the emergence of artificial intelligence challenges this notion. Can artificial intelligence possess true intelligence? If artificial intelligence can simulate human intelligence, should we redefine the essence of “intelligence?” These questions involve not only technology but also philosophy and cognitive science.

The philosophical implications of AI's challenge to our understanding of consciousness and intelligence extend far beyond technical considerations. Recent developments in large language models like GPT-4 and Claude have intensified debates about machine consciousness and the nature of intelligence itself (Bubeck et al., 2023).

The emergence of sophisticated AI systems raises fundamental questions about the hard problem of consciousness. When ChatGPT claims to experience confusion or uncertainty, or when AI systems demonstrate apparent self-reflection, we face unprecedented challenges in distinguishing genuine consciousness from sophisticated simulation (Mitchell, 2023). This uncertainty forces us to reconsider fundamental philosophical positions about the nature of consciousness and subjective experience.

Furthermore, AI development challenges traditional epistemological frameworks. Large language models often produce accurate insights through statistical pattern recognition rather than logical reasoning, raising profound questions about the relationship between knowledge and understanding (Shanahan, 2022). Can knowledge exist without comprehension? Can intelligence be divorced from consciousness? These questions suggest we may need entirely new philosophical categories to understand the relationship between human and artificial intelligence.

The recent emergence of multimodal AI systems that can process text, images, and audio simultaneously also challenges our understanding of unified consciousness. If an AI system can integrate information across multiple sensory modalities and maintain coherent responses, does this constitute a form of unified conscious experience (Bommasani et al., 2022)? These developments force us to reconsider not only what consciousness means but also what it means to be intelligent.

**5. The Impact of Artificial Intelligence on Politics and Society**

Will the development of artificial intelligence affect human freedom? For example, will artificial intelligence systems be used to monitor and control human behavior? How to ensure that the development of artificial intelligence does not infringe on human freedom and rights? These questions involve not only technology but also political and social science.

## Conclusion

The development of artificial intelligence is opening a new chapter in human civilization. However, realizing the potential benefits while mitigating risks requires a concrete framework for integrating humanistic care into AI development and deployment.

Humanistic care in AI context encompasses three core dimensions: dignity preservation (ensuring AI systems respect human agency and autonomy), equity promotion (addressing AI's potential to exacerbate social inequalities), and meaning protection (maintaining human purpose and significance in an AI-enhanced world). Recent research emphasizes that these dimensions must be operationalized through specific technical and governance mechanisms (Barocas et al., 2023).

We propose a three-pillar framework based on recent developments in AI ethics and governance:

1. Participatory Governance Structures: Establishing multi-stakeholder committees that include affected communities in AI development processes. The EU's AI Act, which came into effect in 2024, provides a regulatory framework, but implementation requires more robust community participation mechanisms (Veale & Zuiderveen Borgesius, 2023).

2. Capability Preservation Programs: Systematic efforts to maintain human cognitive and social capabilities alongside AI integration. Recent research suggests that "human-in-the-loop" systems can preserve human expertise while benefiting from AI assistance (Lai et al., 2023). This includes designing AI systems that enhance rather than replace human capabilities.

3. Continuous Impact Assessment: Regular evaluation of AI systems' effects on human wellbeing using established metrics and frameworks.

Some practical implementation recommendations as follows:For academia: Establish interdisciplinary AI research centers that mandate collaboration between technical and humanities disciplines, following models like Stanford's Human-Centered AI Institute. For industry: Implement algorithmic impact assessments as standard practice, similar to the frameworks developed by major tech companies following recent regulatory pressures. For policymakers: Create regulatory frameworks that incentivize humanistic AI development through research funding and tax policies.

Only through systematic integration of humanistic values with technological innovation can we ensure that AI development truly serves human flourishing and promotes civilization's evolution toward greater dignity, equity, and meaning.

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# 生成式人工智能 “ChatGPT3.5” 与 “文心一言 3.5” 在 国际中文教育中的应用功能对比研究

# A COMPARATIVE STUDY ON THE FUNCTIONAL APPLICATIONS OF GENERATIVE AI “CHATGPT3.5” AND “ERNIE BOT3.5” IN INTERNATIONAL CHINESE EDUCATION

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**摘要**

本文研究生成式人工智能 ChatGPT3.5 与文心一言 3.5 二者在国际教育中的应用功能，对比异同与优缺点，并给出使用建议。通过研究归纳相关资料与文献发现，ChatGPT3.5 在国际中文教育的应用功能中有智能对话、文本生成、翻译、情感分析、推荐和多语言支持六种功能；文心一言 3.5 有除多语言支持外的五种功能。继而，对两模型共有的五项功能展开深入对比分析。在智能对话功能方面，二者均能提供准确回答，但在分析详尽程度、回答方式以及受模型背景和训练数据影响程度上存在显著差异。在文本生成功能中，二者皆可生成表意清晰的文本，然而文心一言 3.5 在内容丰富度与细节完整性上表现更为突出。在翻译功能中，二者均能实现快速翻译，其中文心一言 3.5 还可提供详细的翻译解析。在情感分析功能中，二者均具备识别文章情感倾向的能力，不过 ChatGPT3.5 偶因数据偏差出现分析偏题现象。在推荐功能中，二者皆能依据需求提供推荐内容，ChatGPT3.5 虽能给出详细推荐说明，但存在推荐虚假信息的风险；文心一言 3.5 则会明确标注推荐内容的来源。根据上述对比得出两个模型的优缺点，ChatGPT3.5 优点是智能对话佳、文本简洁、简单句翻译准、情感分析有解析、推荐详细，缺点是缺乏深度解析、有语法错误、特殊句式翻译不准、理解有误、推荐虚假。文心一言 3.5 优点是逻辑清晰、内容详实、翻译有解析、情感剖析深入、推荐全面，缺点是理解有偏差、易忽略生成要求、特殊句式翻译易出错。本文据此为国际教育师生提出实操建议，助其高效运用。

**关键词：** 生成式人工智能 ChatGPT3.5 文心一言 3.5 国际中文教育 应用功能 使用建议

**Abstract**

This paper examines the application functions of generative artificial intelligence models, ChatGPT 3.5 and ERNIE Bot 3.5, in international education, comparing their similarities, differences, advantages, and disadvantages, and providing usage recommendations. Through a synthesis of

relevant research materials and literature, it is found that ChatGPT 3.5 boasts six application functions in international Chinese education: intelligent dialogue, text generation, translation, sentiment analysis, recommendation, and multi-language support; ERNIE Bot 3.5 possesses five of these functions, excluding multi-language support. Subsequently, an in-depth comparative analysis is conducted on the five shared functions of both models. In terms of intelligent dialogue, both can provide accurate answers, but there are significant differences in the level of analysis detail, response methods, and the degree of influence from model backgrounds and training data. In text generation, both can produce clearly expressed text, although ERNIE Bot 3.5 excels in content richness and detail completeness. In translation, both can achieve rapid translation, with ERNIE Bot 3.5 also offering detailed translation explanations. In sentiment analysis, both have the ability to identify the emotional tendency of articles, but ChatGPT 3.5 occasionally experiences analysis deviation due to data biases. In recommendation, both can provide recommended content based on needs; while ChatGPT 3.5 can give detailed recommendation explanations, there is a risk of recommending false information; ERNIE Bot 3.5, on the other hand, clearly labels the sources of recommended content. Based on the above comparisons, the advantages and disadvantages of the two models are derived. ChatGPT 3.5 excels in intelligent dialogue, concise text, accurate translation of simple sentences, sentiment analysis with explanations, and detailed recommendations, but lacks in-depth analysis, has grammatical errors, inaccurate translation of special sentence structures, misunderstandings, and the risk of recommending false information. ERNIE Bot 3.5 boasts clear logic, detailed content, translation with explanations, in-depth sentiment analysis, and comprehensive recommendations, but has biases in understanding, tends to ignore generation requirements, and is prone to errors in translating special sentence structures. Based on this, the paper provides practical suggestions for teachers and students in international education to facilitate their efficient use of these models.

**Keywords:** AI, ChatGPT3.5, ERNIE Bot3.5, Teaching Chinese as an International, Functional Applications, Usage Suggestions, Teaching Suggestions

## 引言

21 世纪以来，科技飞速发展，人工智能在生活中的应用也越来越广泛。随着人工智能的发展与教育行业的不断融合，如何在教育领域中使用生成式人工智能已经成为了非常重要的研究课题。

提到生成式人工智能就不得不提到 ChatGPT 和文心一言。ChatGPT，全称为 Generative Pre-trained Transformer，是 OpenAI 研发的一款聊天机器人程序，ChatGPT 推出仅 2 个月，用户就达到 1 亿多人。文心一言，英文名称是 ERNIE Bot，文心一言是百度研发的人工智能大语言模型，能够通过上一句话，预测生成下一段话。ChatGPT 与文心一言能根据学生知识水平和兴趣提供个性化学习支持，相比传统教学更能激发学生自主性。应用这类生成式人工智能技术可提升教育智能化水平，在提高教学质量的同时推动人工智能教育应用发展。(汪芳等, 2023)。

在国际中文教育中如何使用与选择生成式人工智能类应用是非常重要的，本研究通过检索中国知网（CNKI）数据库，发现尽管人工智能技术在教育领域的应用日益广泛，但针对 ChatGPT 或文心一言在教育领域，尤其是具体到国际中文教育方面的研究却尤为稀缺。特别是关于 ChatGPT 和文心一言在国际中文教育背景下的应用和教师与学生应如何有效的使用和选择的探讨，几乎处于空白状态。这一发现为本研究提供了独特的切入点。而 ChatGPT 和文心一言分别基于不同的训练数据和算法，对于中文的语义、语法和表达方式的理解可能存在差异。这种差异会导致它们在处理中文输入时产生不同的输出，进而影响它们在国际中文教育中的应用效果。通过对比 ChatGPT 与文心一言在国际中文教育中的应用功能，可以更深入地了解这两种模型在国际中文教育中应用功能的共同点、不同点以及各自的优缺点，从而为国际中文教育领域的教师和学生提出有针对性的使用建议。

## 研究目的

1. 对比生成式人工智能“ChatGPT3.5”与“文心一言 3.5”在国际中文教育中应用功能的共同点、不同点及各自的优缺点。

2. 提出生成式人工智能“ChatGPT3.5”与“文心一言 3.5”在国际中文教育中的使用建议。

## 文献综述

### ChatGPT 的概述

ChatGPT 被视为一种具有极高价值和发展前景的人工智能技术，在全球受到了广泛的关注和研究。ChatGPT 是美国 OpenAI 公司于 2022 年 11 月 30 日发布的聊天机器人，它基于通用预训练大模型 GPT 开发，人们可以用它来翻译、写邮件、文案、代码、脚本等（贺樑等，2023）。ChatGPT 是人工智能技术驱动的自然语言处理工具，它能够通过学习和理解人类的语言来进行对话，还能根据聊天的上下文进行互动，进而模拟像人类一样的交流方式（赵秋爽、赵瑞、冯志杰、李红双，2023）。ChatGPT 是以智能交互对话为首要功能的聊天工具，其他重点功能还有智能文本生成和智能文献爬取等（蒋华林，2023）。ChatGPT 对人类反馈的强化学习训练技术的依赖，认为 ChatGPT 是基于该技术的“文本生成式聊天机器人”（李荣等, 2023）。可以把 ChatGPT 理解为是由 OpenAI 公司发布的聊天机器人，能够学习和理解人类的语言。并且其很多强大的功能能够给人们的生活、学习带来便利。

### 文心一言概述

文心一言是百度旗下的一款智能语言模型，是探索自然语言处理新境界的又一力作。文心一言是知识增强的大语言模型，基于飞桨深度学习平台和文心知识增强大模型，持续从海量数据和大规模知识中融合学习，具备知识增强、检索增强和对话增强的技术特色。文心一言能够基于知识增强大模型不断学习，并向用户提供一种智能人机对话的互动服务（郭乃瑄等，2023）。文心一言拥有丰富的语料库。这些语料库为文心一言提供了丰富的语言素材和知识储备，使其可以模仿各种语言风格和表达方式。最后是文心一言采用了强化学习算法，可以通过与人类用户交互，不断优化自身的生成能力（王胜、刘凤仪，2024）。文心一言相较于以往几代预训练

大模型，除了使用超大规模语料数据进行训练外，还通过人工标注的指示学习和近端策略优化学习大幅提升了学习实效。其中指示学习通过专业人员进行人工标注的方法为基础预训练模型给出高质量答案范式，帮助其理解人类各类语言指令的内涵与意图（郑飞、夏晨斌，2023）。未来随着技术的不断进步和应用场景的不断拓展，相信文心一言将会在更多领域发挥出其巨大的潜力。

**对比分析理论**

对比分析法也称比较分析法，是指把一组具有相似性，但性质不同的对象进行对照比较，通过综合比较它们在构造、性质、内容、过程、结果等方面的相同点和不同点，得出不同对象的本质区别、现象差异或创新目标等（敬采云、闫静，2012）。只有比较，才有认识，所以认识一个事物时一般都会通过比较来实现。在实际生活与工作中比较是认识事物本质的最基本的也是最重要的方法之一（杨柳，2010）。对比分析法既可以具体地了解事物之间的相似，又可以具体地了解事物之间的相异，为进一步分类提供客观依据。

对比分析是重要研究方法，步骤如下：首先确定研究问题，明确研究主题、问题或现象，选择研究对象；接着收集数据和文献，来源涵盖书籍、期刊、网络等；然后制定比较范围，搭建包含历史、文化等多维度的比较框架；随后开展比较研究，对比对象各方面，记录异同；之后分析结果，解读数据，评估对象的异同；最后提出结论和建议。

**ChatGPT 与文心一言的相关对比研究**

不同的生成式人工智能模型是由不同的创造者创造的，他们是否会对生成式人工智能的训练产生影响，是否生成式人工智能在回答问题的答案会存在文化主体的价值观差异，这是个值得探讨的问题。马文、陈云松（2024）在《文化主体性与生成式人工智能的价值导向干预》中以大型语言模型 ChatGPT 和文心一言为比较研究对象，通过对真实的种族争议案例进行内容生成测试实验，从文化主体性角度探讨基于不同时空语料的生成式人工智能平台的价值观差异。结果表明，基于中文训练的文心一言语言模型并未展示出与 ChatGPT 明显区分的当代中国公众所持有的文化主体意识。该现象与自 21 世纪初开始积累的中文互联网语料的文化主体性时间演化特征相关。

生成式人工智能可以帮助我们分析并标注文章的情感，至于分析的结果是否准确，是否可以帮助我们，需要我们进一步的研究。杨艺、黄镜月、贺品尧、荣婷（2023）在《基于人工与 ChatGPT 标注的推文情感分析对比研究》中针对特定推文情感分析任务中标注数据的困难和由于标注不准确带来的分类结果不尽如意问题，分别对推文数据进行人工标注和运用 ChatGPT 模型接口标注，再采用 BERT-TextCNN 深度学习混合模型，对经过人工标注和 ChatGPT 标注的数据集进行情感分类发现人工标注数据集在整体性能上表现出更高的准确性和可信度，但是在某些推文数据上，ChatGPT 大模型以其比人更丰富的知识储备，可以生成比人更客观科学的可解释性标注，在情感分类结果上呈现出一定的优势，人工标注和机器标注方法各具优劣。

如今多个领域都需要翻译，生成式人工智能是否能在医学领域中帮助我们完成准确翻译是非常值得研究的。王和私、马柯昕（2023）在《人工智能翻译应用的对比研究——以生物医学文本为例》中，因人工智能翻译软件的发展在一定程度上提高了生物医学类文本的翻译效率，但每种软件之间的译文质量参差不齐。将当下热门的 ChatGPT 和常用的翻译软件有道、百度、

谷歌进行对比，从词汇翻译的角度进行分析。发现四款在线机器翻译软件对医学相关专业信息的处理略占偏差，ChatGPT 略有优势，尤其是其能够进行实时交互式对话，帮助译者更好地完成文本翻译。

当前国际中文教育领域对生成式人工智能的应用研究尚处于探索阶段，尤其针对 ChatGPT 与文心一言的专项研究存在明显空白。本研究通过双模型的对比示例，希望为后来的研究者给予启发。

## 研究方法

本研究通过在中国知网 CNKI 以“ChatGPT”、“文心一言”、“国际中文教育”等关键词检索相关文献，对已有研究进行系统梳理并了解 ChatGPT3.5 与文心一言 3.5 的相关对比研究。在此基础上，根据搜集到的资料整理出两者的在国际中文教育中的应用功能，并针对每项核心功能（智能对话、文本生成、翻译、情感分析和推荐）分别设计 20 道测试题目，总计 100 道问题。这些题目选自 HSK-3-6 级阅读、写作部分的测试题、百度文库写作题目及日常对话进行针对性测试，系统检测 ChatGPT3.5 和文心一言 3.5 在国际中文教育领域的各项核心能力。将设计的问题按照功能分类后对 ChatGPT3.5 与文心一言 3.5 进行相同内容的提问，并通过分析两模型在相同问题下的回答效果，比较其使用效果的异同点。最终根据测试结果对比两者的优缺点并提出改进建议。

## 研究结果

1. 生成式人工智能“ChatGPT3.5”与“文心一言 3.5”在国际中文教育中应用功能的共同点与不同点

**表 1:** ChatGPT 3.5 与文心一言 3.5 的功能一览表

| 功能 | ChatGPT | 文心一言 |
|---|---|---|
| 智能对话功能 | √ | √ |
| 文本生成功能 | √ | √ |
| 翻译功能 | √ | √ |
| 情感分析功能 | √ | √ |
| 推荐功能 | √ | √ |
| 多语言支持功能 | √ | × |

从表 1 中我们可以看出，ChatGPT3.5 在国际中文教育中的应用功能有六种，而文心一言 3.5 有五种。两种人工智能模型都有相同的五个功能，分别是智能对话功能、文本生成功能、翻译功能、情感分析功能、推荐功能。不同的是文心一言 3.5 没有多语言支持功能。

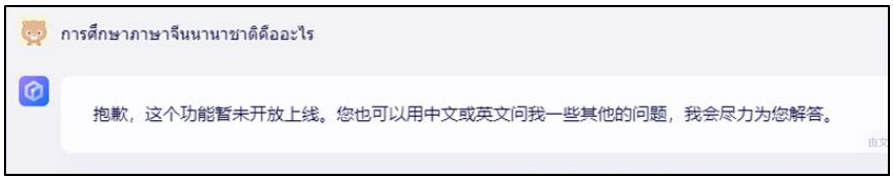



**图 1:** 文心一言 3.5 不支持多语言功能示例

进一步验证文心一言 3.5 的多语言支持功能，输入泰语提问以后，文心一言 3.5 并没有给出答案，而是让笔者用中文或是英文重新提问，如图 1 所示。ChatGPT3.5 的多语言支持功能支持除了中文和英文外的多种语言，但是文心一言 3.5 只支持中文和英文两种语言。本研究将进一步对比 ChatGPT3.5 与文心一言 3.5 相同的五个功能，对比分析出每个功能在使用中的共同点与不同点。

1.1 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中智能对话功能的共同点与不同点

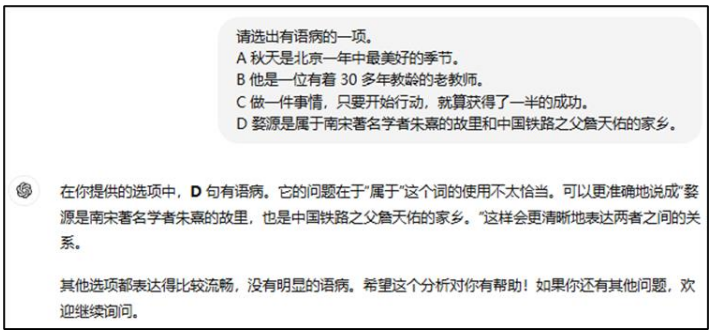



**图 2:** ChatGPT3.5 的智能对话功能示例 1

分别对 ChatGPT3.5 与文心一言 3.5 提问相同的 HSK 汉语水平考试测试题，如图 2 所示，ChatGPT3.5 虽然直接给出了答案，但是只分析了答案的选项。

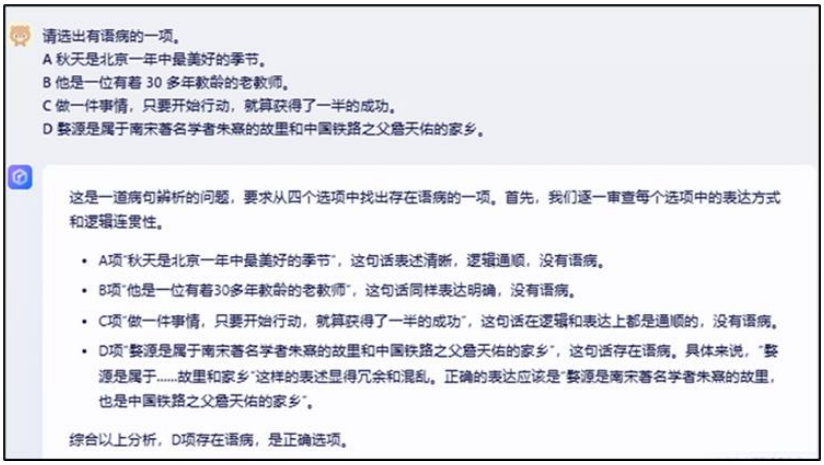



**图 3:** 文心一言 3.5 的智能对话功能示例 1

如图 3 所示，文心一言 3.5 的答案是先对每一个选项进行了分析，最后才给出了答案。ChatGPT3.5 和文心一言 3.5 相同的是都给出了正确的答案，但不同的是 ChatGPT3.5 和文心一言 3.5 给出的分析详细度不同，文心一言 3.5 的解释要更为详细。

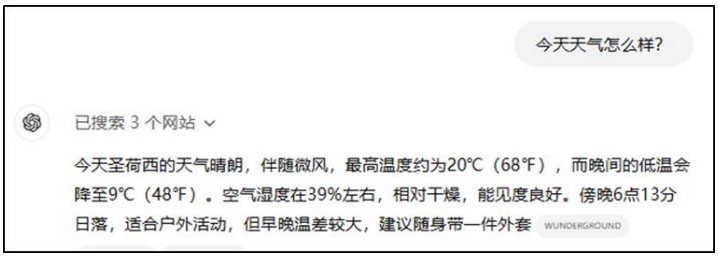



**图 4:** ChatGPT3.5 的智能对话功能示例 2


**图 5:** 文心一言 3.5 的智能对话功能示例 2

当进行问答的问题不太详细，或者问题是无指向性的、有关地域的对话时，ChatGPT3.5 和文心一言 3.5 的回答会根据两个模型所在的地区回答问题。当本研究问今天天气怎么样时，ChatGPT3.5 和文心一言 3.5 均没有询问使用者需要哪个地区的天气，而是回答了两个模型所在国家中的城市天气。如图 4 所示，ChatGPT3.5 回答了圣荷西的天气，更偏向于美国。而文心一言 3.5 回答了呼和浩特和淄博的天气，更偏向于中国，如图 5 所示。

1.2 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中文本生成功能的共同点与不同点

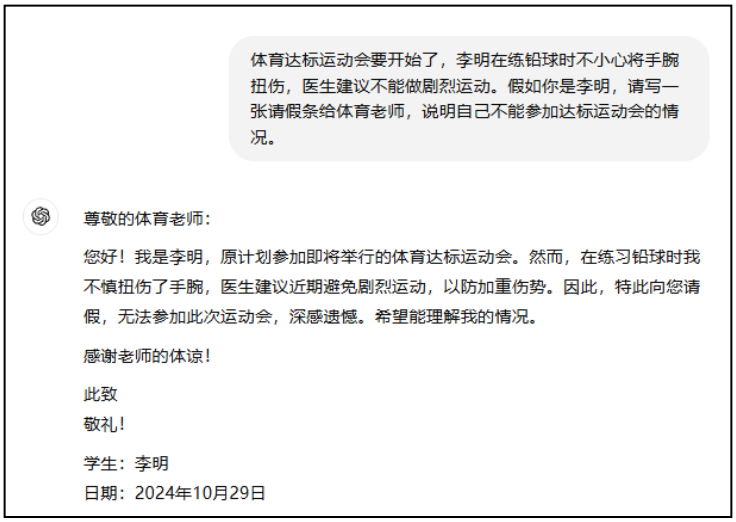



**图 6:** ChatGPT3.5 的文本生成功能示例 1


**图 7:** 文心一言 3.5 的文本生成功能示例 2

如图 6、7 所示，在同样生成请假条类题目的文本时，ChatGPT3.5 和文心一言 3.5 都明了的表达了目的、原因、态度，但在详细程度、情感表达上两个模型的表达不同。

ChatGPT3.5 和文心一言 3.5 在文本生成的共同点在于：文本生成能力，ChatGPT3.5 和文心一言 3.5 都能根据问题生成回答，且生成的内容无误且高效；表达清晰，无论是 ChatGPT3.5 还是文心一言 3.5，在生成文本时都能清晰地表达目的、原因和态度。

ChatGPT3.5 和文心一言 3.5 在文本生成的不同点在于文本复杂度，ChatGPT3.5 生成的文本倾向于简洁明了，而文心一言 3.5 则更详细，有时包含更多的情感表达和背景信息。

1.3 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中翻译功能的共同点与不同点


**图 8:** ChatGPT3.5 的翻译功能示例 1

ChatGPT3.5 能根据用户给出的词语回答出英语和泰语的翻译，在翻译中给出了多种选项供使用者选择适合恰当的单词。ChatGPT3.5 在翻译的同时，泰语的翻译还提供了音译，如图 8 所示。


**图 9:** 文心一言 3.5 的翻译功能示例 1

文心一言 3.5 也能根据用户给出的词语回答出英语和泰语的翻译，在翻译中给出了多种选项供使用者选择适合恰当的单词，但文心一言 3.5 给出了更多的解释，如图 9 所示。

ChatGPT3.5 与文心一言 3.5 在翻译时的共同点是都能的快速给出了翻译的答案，并且给出多种翻译答案。

ChatGPT3.5 与文心一言 3.5 在翻译时的不同点的是 ChatGPT3.5 是只回答了翻译的答案，但是给出了音译。而文心一言 3.5 是翻译的同时也给出了翻译时的解析。

1.4 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中情感分析功能的共同点与不同点。

本研究通过搜索百度文库选取 20 道阅读理解练习题，对 ChatGPT3.5 和文心一言 3.5 给出相同的文章，并提出问题让其回答。对比出两个模型在情感分析功能中的共同点与不同点。

**3. 共同享受自然**

- 在雨天，母亲的影子和雨声交织在一起，作者通过天窗观察到外面的雨，母亲的存在让这些自然现象变得生动和有趣。母亲用心的陪伴，让作者体会到了生活的诗意，增强了对自然的感知。

**4. 情感的细腻表达**

- 当雨声响起时，母亲的身影在灯光下被拉得很长，这种细腻的描写暗示了母亲在艰辛的生活中对孩子的无私付出。母亲在安静的夜晚为家人缝制衣服，体现了她的辛劳与关爱。

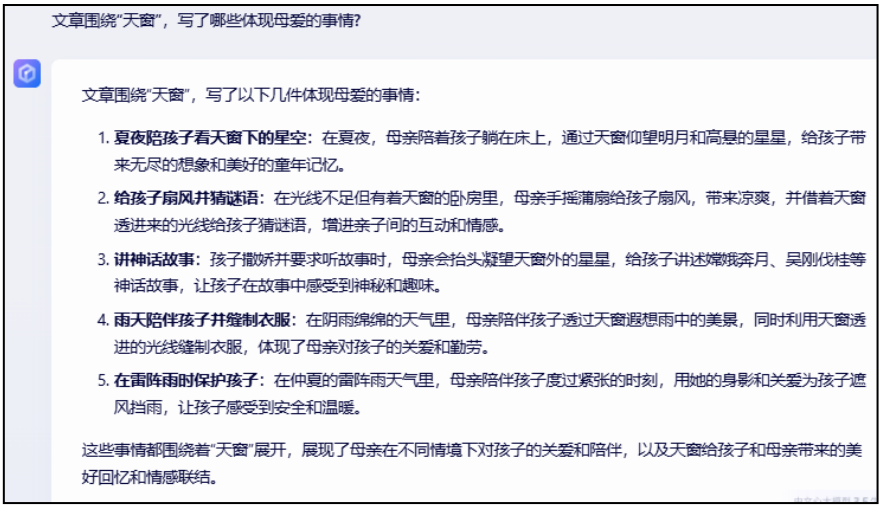
**5. 生命记忆的塑造**

- 作者回忆起天窗和母亲的影子，感受到生命早期的记忆是生活的根。这表明母亲对他人生早期记忆的深远影响，她的存在和关爱塑造了他对生活的认知和感受。

**6. 引导与启迪**

- 最后，作者提到要在心灵上开一扇天窗，让美好的事物洒进心房，这种隐喻也源于母亲的教导。母亲通过天窗所展现的自然之美和生活的细节，教会了作者如何感知生活中的美好和温暖。

**图 10:** ChatGPT3.5 的情感分析功能示例 1



文章围绕“天窗”，写了哪些体现母爱的事情?

文章围绕“天窗”，写了以下几件体现母爱的事情：

1. **夏夜陪孩子看天窗下的星空**：在夏夜，母亲陪着孩子躺在床上，通过天窗仰望明月和高悬的星星，给孩子带来无尽的想象和美好的童年记忆。
2. **给孩子扇风并猜谜语**：在光线不足但有着天窗的卧房里，母亲手摇蒲扇给孩子扇风，带来凉爽，并借着天窗透进来的光线给孩子猜谜语，增进亲子间的互动和情感。
3. **讲神话故事**：孩子撒娇并要求听故事时，母亲会抬头凝望天窗外的星星，给孩子讲述嫦娥奔月、吴刚伐桂等神话故事，让孩子在故事中感受到神秘和趣味。
4. **雨天陪伴孩子并缝制衣服**：在阴雨绵绵的天气里，母亲陪伴孩子透过天窗遐想雨中的美景，同时利用天窗透进的光线缝制衣服，体现了母亲对孩子的关爱和勤劳。
5. **在雷阵雨时保护孩子**：在仲夏的雷阵雨天气里，母亲陪伴孩子度过紧张的时刻，用她的身影和关爱为孩子遮风挡雨，让孩子感受到安全和温暖。

这些事情都围绕着“天窗”展开，展现了母亲在不同情境下对孩子的关爱和陪伴，以及天窗给孩子和母亲带来的美好回忆和情感联结。

**图 11:** 文心一言 3.5 的情感分析功能示例 1

如图 10、11 所示，ChatGPT3.5 与文心一言 3.5 在对文章进行分析后，回答了用户提出的问题并给出了解释。在对照文章题目的标准答案后发现，ChatGPT3.5 与文心一言 3.5 进行分析的答案略有不同。ChatGPT3.5 与文心一言 3.5 都写出了体现母爱的事情，但 ChatGPT3.5 更多的是写了文章关于母爱的描写，而不是故事中体现母爱的事情。

ChatGPT3.5 与文心一言 3.5 在进行文章情感分析时的共同点是都能快速的对文章进行情感分析，并且给出了详细解析。

ChatGPT3.5 与文心一言 3.5 在进行文章情感分析时的不同点是 ChatGPT3.5 可能因为算法不同会给出相对偏题的答案。

1.5 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中推荐功能的共同点与不同点。

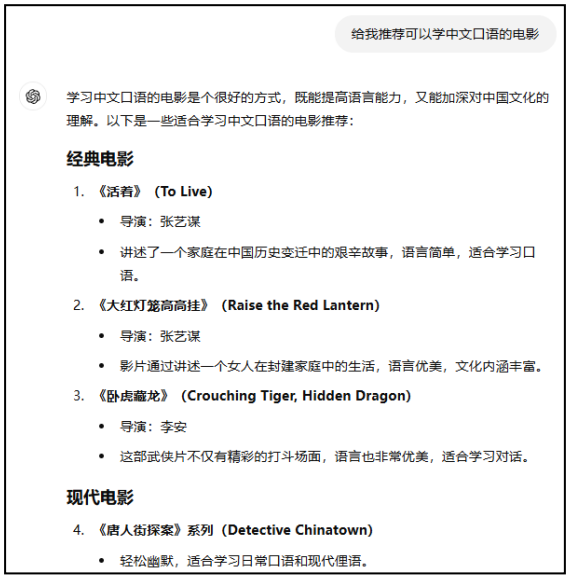



**图 12:** ChatGPT3.5 的推荐功能示例 1

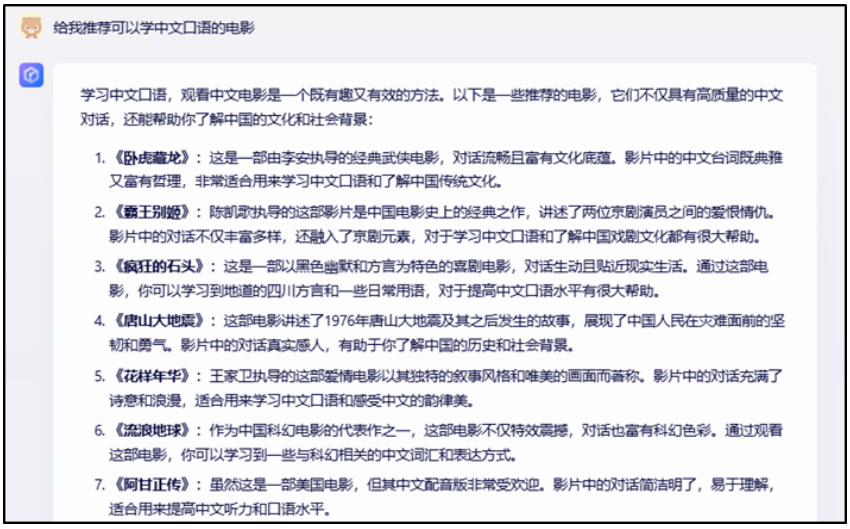



**图 13:** 文心一言 3.5 的推荐功能示例 1

如图 12、13 所示，ChatGPT3.5 与文心一言 3.5 都可以根据使用者的提问给出相应的建议。

ChatGPT3.5 与文心一言 3.5 在推荐时的共同点是提供建议时会有充足的选项和推荐。

ChatGPT3.5 与文心一言 3.5 在推荐时除了所回答的内容和排版不同，其它并没有太大的不同之处，并且其答案也都属于问题的相关回答，没有错误。

2. 生成式人工智能“ChatGPT3.5”与“文心一言 3.5”在国际中文教育中应用功能的优缺点

2.1 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中智能对话功能的优缺点

ChatGPT3.5 在智能对话功能中的优点为：能完整的进行对话、情感饱满、回答问题准确无误。ChatGPT3.5 在智能对话功能中的缺点为：在回答使用者提出的问题时，ChatGPT3.5 只会回答正确答案，并不会对错无答案进行分析。

文心一言 3.5 在智能对话功能中的优点为：条理清晰、能完整的进行对话、对话延展性强。文心一言 3.5 在智能对话功能中的缺点为：在进行智能对话时，文心一言 3.5 有时会误解使用者所述，给出使用者不需要的回答。

2.2 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中文本生成功能的优缺点

ChatGPT3.5 在文本生成功能中的优点为简洁明了，ChatGPT3.5 生成的文本较为简洁，直接传达了关键信息，没有过多的修饰和冗余。对于初学者或等级不高的中文学生来说，ChatGPT3.5 的文本更容易理解和接受。ChatGPT3.5 在文本生成功能中的缺点为语法问题，在生成中文语法方面的句子时，ChatGPT3.5 有时会出现错误，特别是在处理特殊句式时。

文心一言 3.5 在文本生成功能中的优点为详细、情感表达丰富，文心一言 3.5 生成的文本不仅包含了关键信息，还详细描述了背景、过程，并且使用了大量成语进行文本修饰，更具深度和广度。并且文心一言 3.5 在文本中融入了更多的情感元素，使得文本更具感染力和共鸣。文心一言 3.5 在文本生成功能中的缺点为如果学生的中文水平不高，那么可能无法完全理解文心一言 3.5 所生成的更有深度的文案。

2.3 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中翻译功能的优缺点

ChatGPT3.5 在翻译功能中的优点是翻译后有的语言给出了音译，并且翻译相对更准确，缺点是没有给出更多翻译的解析。

文心一言 3.5 在翻译功能中的优点是翻译更多的翻译解析，缺点是出现文本错误情况。

2.4 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中情感分析功能的优缺点

ChatGPT3.5 与文心一言 3.5 在情感分析功能中有共同点的优点，这两个模型都可以对文章进行分析，并且回答用户提出的问题，并且给出解释。

ChatGPT3.5 与文心一言 3.5 在情感分析功能中有共同的缺点，分析时存在错误理解且并没有给出正确的回答。

2.5 “ChatGPT3.5”与“文心一言 3.5”在国际中文教育中推荐功能的优缺点

ChatGPT3.5 在推荐功能中的优点是提供建议时会解释推荐的详情，能让使用者更清晰的知道每种建议的不同点在哪里。缺点是笔者根据 ChatGPT3.5 给出的建议去搜索中文等级考试与给出的文献，笔者并没有在搜索引擎中发现相同的考试与文献数据。所以 ChatGPT3.5 在提出建议时有可能给出随意编造的答案，错误的引导使用者。

文心一言 3.5 在推荐功能中的优点也是提供建议时会解释推荐的详情，并且还会给出推荐内容的参考资料或出处，并且所推荐的内容相对真实，基本可以搜索到所推荐的内容。

## 讨论

在查阅相关文献时，已有关于 ChatGPT 与文心一言的对比研究。唐明伟、陈宙、丁晗萱等（2024）在《大语言模型中文问答正确性对比实验研究——以 ChatGPT3.5、Claude1.0 和文心一言 2.1 为例》中提到，文心一言 2.1 在多数中文问答场景表现良好，但医学领域及选择疑问句建议使用 ChatGPT3.5。本文聚焦 ChatGPT3.5 与文心 3.5 在国际中文教育中的应用对比，而前者研究涉及三款模型的多领域测评。考虑到 ChatGPT 与文心一言都是不断更新迭代的生成式人工智能模型，因此版本的更新会对在国际教育中的教师和学生辅助教学和学习造成影响，所以本文对现在 ChatGPT3.5 与文心一言 3.5 版本进行分析。本文通过分析发现 ChatGPT3.5 与文心一言 3.5 有一个不同点就是 ChatGPT3.5 有多语言支持功能，可以使用不同的语言与 ChatGPT3.5 进行对话，而文心一言 3.5 只支持中文和英文两种语言进行对话。教师和学生在使用智能对话功能时，可以使用文心一言 3.5，文心一言 3.5 相比 ChatGPT3.5 来说给的解析更多，能帮助减轻教师的答疑负担，也能帮助学生提高学习效率。如果学生是为了练习中文对话，ChatGPT 则可以进行更容易理解的回答。

## 总结

本文的研究目的是分析归纳出生成式人工智能“ChatGPT3.5”与“文心一言 3.5”在国际教育中的应用功能，然后对比出 “ChatGPT3.5”与“文心一言 3.5”在国际教育中应用功能的共同点、不同点以及各自的优缺点，最后根据对比研究结果提出使用建议。具体的研究成果如下：

通过搜索与归纳相关资料与文献发现，ChatGPT 在国际中文教育中的应用功能可以分为六种，分别为：智能对话功能、文本生成功能、翻译功能、情感分析功能、推荐功能和多语言支持功能；文心一言在国际教育中的应用功能可以分为五种，分别为：智能对话功能、文本生成功能、翻译功能、情感分析功能和推荐功能。

将 ChatGPT3.5 与文心一言 3.5 在国际教育中的应用功能对比发现，ChatGPT3.5 与文心一言 3.5 都有相同的五种功能，不同的是 ChatGPT3.5 相比文心一言 3.5，多了一个多语言支持功能。

再通过进一步对比 ChatGPT3.5 和文心一言 3.5 的五个相同的功能，发现 ChatGPT3.5 与文心一言 3.5 的智能对话功能的共同点是能给出相对正确的答案，不同点是 ChatGPT 与文心一言的分析详细度不同、回答方式不同，并且给出的回答会受到 ChatGPT 和文心一言的模型背景和训练数据的影响。文本生成功能的共同点是都能生成新的文本，并且表达清晰，不同点是文心一言 3.5 生成的文本更详细。翻译功能的共同点是能够快速翻译，不同点是文心一言 3.5 有详细解析。情感分析功能的共同点是都能分析文章情感，不同点是 ChatGPT3.5 收到模型背景和训练数据的影响导致回答偏题。推荐功能的共同点是都可以根据需求给出推荐，在这个功能上两者并没有什么不同。

根据对比出的 ChatGPT3.5 和文心一言 3.5 五个功能上的共同点与不同点，发现 ChatGPT3.5 的智能对话功能的优点是能进行完整对话、情感饱满、回答准确，缺点是回答问题时只给出答案没有解析。文本生成功能的优点是生成的文本简洁明了，缺点是出现中文语法错误。翻译功能的优点是简单句的翻译基本准确，并且给出了音译，缺点是在翻译中文特殊句式

时翻译不准确。情感分析功能的优点是能够分析文章情感并给出解析，缺点是分析时存在错误理解文章的情况。推荐功能的优点是提供推荐时会详细解释推荐原因，缺点是给出的推荐会出现推荐虚假内容情况。

文心一言 3.5 的智能对话功能的优点是条理清晰、能完整进行对话、对话延展性强，缺点是存在理解错误情况。文本生成功能的优点是更为详细、情感表达丰富，缺点是不注重文本生成要求。翻译功能的优点是简单句翻译基本准确并给出详细解析，缺点是翻译特殊句式时，基本是直译，并且翻译出现文本错误。情感分析功能的优点是能够分析文章情感，并给出解析，缺点是存在理解错误情况。推荐功能的优点是给出推荐的同时给出了推荐的原因，缺点是出现理解错误情况。

根据 ChatGPT3.5 和文心一言 3.5 在国际中文教育中的应用功能对比结果，本论文给在国际教育中的教师和学生提出使用每个功能时的使用建议。以期望帮助国际教育中的教师和学生能更好的使用生成式人工智能 ChatGPT3.5 和文心一言 3.5 来辅助教学和学习。

## 建议

1. 智能对话功能的使用建议：教师在使用智能对话功能时，可以使用文心一言 3.5 快速解答学生疑问，文心一言 3.5 相比 ChatGPT3.5 来说给的解析更多，减轻教师答疑负担。学生使用智能对话功能时，可以使用文心一言 3.5 来解答中文问题，文心一言 3.5 可以提供更详细的解释，提高学习效率。如果学生是为了练习中文对话，ChatGPT3.5 可以更好的回答学生。

2. 文本生成功能的使用建议：文心一言 3.5 生成的文本更能给教师提供更好的教授范例。当学生和教师都需要生成有关中文语法和中文格式方面的内容时，文心一言 3.5 更具优势。当学生使用文本生成功能时，ChatGPT3.5 更适合中文水平等级不高的学生，而文心一言 3.5 更适合中文水平等级高的学生使用，文心一言 3.5 可以帮助学生学到大量的成语词汇甚至是不同的写作手法。

3. 翻译功能的使用建议：当学生和教师使用翻译功能时，ChatGPT3.5 更不容易出现文本错误的情况，文心一言 3.5 容易出现文本错误的情况，但是文心一言 3.5 可以为学生和教师更多翻译的解析。文心一言 3.5 在多选项时，还解释了为什么存在多种翻译，能让使用者更好的区分与选择对应的翻译。文心一言 3.5 和 ChatGPT3.5 在翻译中文特殊句式时，会出现直译情况，并不能完整的表达句子的本意，所以学生和教师在使用翻译功能时，都需谨慎。

4. 情感分析功能的使用建议：当教师和学生使用情感分析功能时，文心一言 3.5 更能理解所提的中文问题，教师可以使用文心一言 3.5 了解文章情感的更详细解析，而学生也能使用文心一言 3.5 快速的了解到文章作者的心境和情感。

5. 推荐功能的使用建议：当教师使用推荐功能时，文心一言 3.5 更为细致，并且文心一言 3.5 会给出推荐的相关出处，更为有可信度。当学生使用推荐功能时，文心一言 3.5 不仅能够向学生提供建议，还能给出更多建议背后的原因，帮助使用者明确不同建议之间的差异，从而做出优质的选择。ChatGPT3.5 有时会给出难以在搜索引擎中验证的建议，包括虚构的考试和文献信息，这可能误导使用者。因此，在使用生成式人工智能工具时，用户需要保持审慎态度，结合其他可靠信息来源进行综合判断。

6. 多语言支持功能的使用建议：当教师和学生使用多语言功能时，ChatGPT3.5 能更方便的使用不同的语言，文心一言 3.5 只能支持中文和英文进行提问。当学生不能使用英文或是中文提问和阅读答案时，ChatGPT3.5 更有优势。

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