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Investigation and Analysis on the Effectiveness of Artificial Intelligence Technology-Assisted English Learning for College Students

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Abstract: The widespread application of artificial intelligence (AI) has subtly influenced learning, making it increasingly important to explore its supportive role in college students' English education. This study investigates the effectiveness of AI technology in assisting English learning among college students by employing questionnaire surveys and analyzing academic performance data. The results indicate that AI technology significantly enhances vocabulary acquisition, oral imitation skills, and reading speed. However, its impact is more limited in areas such as writing logic and cross-cultural understanding, constrained by factors including technical barriers and algorithmic biases. These findings provide valuable insights for promoting personalized English teaching reforms and improving students' overall English proficiency.

Keywords: artificial intelligence technology; college students; English learning; auxiliary value; learning effect; personalized teaching

1. Research Background

With the rapid development of artificial intelligence (AI) technology, its application in education has become increasingly widespread, offering new opportunities for college students' English learning. As a key aspect of cultivating students' comprehensive competencies, traditional teaching models exhibit limitations in personalization, interactivity, and learning efficiency, making it difficult to meet the demands of the modern era. Currently, college students generally face four major challenges in English learning: first, insufficient learning interest and initiative; second, unbalanced proficiency across listening, speaking, reading, and writing, particularly weaknesses in oral communication and writing; third, scattered learning resources that lack systematic organization and relevance; and fourth, difficulties for teachers in implementing personalized instruction tailored to individual aptitudes.

At the policy level, promoting educational digitalization has been emphasized in national government initiatives, and the Ministry of Education has proposed a strategic goal of building an "intelligent, personalized, and lifelong" education system. Against this backdrop, domestic large-scale educational models (such as Ziyue, NetEase Youdao, and IFLYTEK) and generative AI systems (such as Deepseek and Ernie) are increasingly integrated into college English teaching. These technologies are gradually evolving from mere "tools" to "learning partners" and "intelligent tutors," supporting scenarios such as oral practice, composition correction, and personalized learning path recommendations. This transformation is driving teaching methods from "experience-driven" to "data-driven." For example, AI-based composition systems can rapidly provide multi-dimensional evaluations and revision suggestions, while intelligent speech systems can

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simulate real-life conversational contexts, significantly enhancing interactivity and learning relevance.

Nevertheless, the practical application of AI in college English teaching still presents several challenges. First, there is a lack of systematic empirical research targeting college students. Existing studies primarily focus on technical aspects or K-12 educational contexts, lacking comparative analyses between AI-assisted and traditional teaching, as well as comprehensive evaluations of learning outcomes, attitudes, and habits. Second, there are potential issues of a "technical divide" and unequal access to learning opportunities. Some students may face marginalization due to limited equipment, technical skills, or confidence. Third, most AI applications remain at the pilot or tool level, with insufficient systematic instructional design and empirical evaluation. Data on whether AI enhances academic performance, changes learning attitudes, or generates dependence is limited [1].

This study aims to systematically investigate the effectiveness of AI-assisted English learning among college students. It analyzes AI's role in improving academic performance, stimulating interest, and optimizing learning strategies, while identifying challenges and proposing improvement pathways. The goal is to provide a scientific basis for innovating college English teaching models, promote deeper integration of AI into education, and enhance students' overall English proficiency.

2. Literature Review

Focusing on the core theme of "Artificial Intelligence Technology + College Students' English Learning," this study reviews recent domestic and international literature. Domestically, literature was retrieved from CNKI and Wanfang Data using keywords such as "artificial intelligence technology," "college students' English learning," and "auxiliary teaching"; internationally, searches were conducted on Web of Science and Elsevier ScienceDirect with English keywords including "Artificial Intelligence Technology" and "College Students' English Learning." Over 100 valid studies were selected, and analysis was conducted from three perspectives: application status, research outcomes, and research gaps. In addition, by referencing representative studies, the connection between this study and existing research, as well as its innovative direction, is clarified.

2.1. AI Application Scenarios

Existing studies demonstrate that AI technology has been applied in multiple scenarios of college students' English learning, although coverage and focus vary. Regarding tool application scenarios, some studies focused on vocabulary modules, showing improvement in learning outcomes through thematic vocabulary delivery via online platforms combined with offline interactive activities. Other studies concentrated on oral training, utilizing AI-based oral English systems for pronunciation correction and simulation exercises, which led to measurable improvements in students' oral test performance [2].

Moreover, research has highlighted the application of AI technology in intelligent resource delivery and multi-modal teaching environment construction. Examples include the personalized recommendation of learning materials through intelligent algorithms and the creation of immersive learning scenarios using VR technology. These applications extend the traditional view of "tool usage" to include resource provision and environmental support, presenting a more comprehensive depiction of "full-chain scenarios" for AI-assisted English learning. Such scenarios not only enrich students' learning experiences but also enhance the interactivity and pertinence of instructional processes.

2.2. AI Application Effects

The impact of AI technology on college students' English learning has been empirically supported, though findings vary across specific domains. At the overall effect level, meta-analytical evidence indicates that AI can significantly enhance cognitive abilities such as reading and oral English proficiency, while also boosting learning motivation and self-efficacy. These findings align with this study's focus on students' "perception of learning effects" and "learning interest and attitude," providing a quantitative foundation for summarizing AI's positive impact on learning.

In writing, research conclusions differ. Some evidence suggests that AI can improve language expression and structural logic, contributing to higher writing scores in standardized English tests, but excessive reliance on AI may lead to homogenized expressions. Other studies report that most students recognize the benefits of AI-based automatic correction in improving writing skills, and generative AI can help optimize sentence complexity [3]. Building on these insights, this study further investigates students' dual perceptions of the advantages and potential risks of AI writing assistance, addressing an existing gap at the level of subjective student perception.

In listening, evidence shows mixed results. While some studies indicate that AI technology does not significantly improve listening performance, others highlight the potential of speech synthesis technology to generate diverse listening materials without verifying actual effectiveness. These differences provide a foundation for examining "variations in AI assistance effects across different English proficiency modules," consistent with this study's aim to comprehensively summarize the technical impact of AI on learning.

2.3. Research Gaps and Innovations of This Study

Existing studies reveal several gaps that provide opportunities for this study's contributions. Regarding sample representativeness, previous research often focused on specific student populations, such as English majors or students from single universities, limiting generalizability. This study, in contrast, includes over 300 college students from multiple universities nationwide, covering diverse majors and varying English proficiency levels. The expanded and more representative sample allows for a more accurate reflection of the actual conditions among college students.

From a research perspective, existing studies primarily emphasize the objective effects of AI on English proficiency, with less attention to the relationship between students' "tool usage behavior" and "learning attitudes." To address this, this study designs questionnaires targeting both "tool usage behavior" and "learning interest and attitude," enabling a detailed exploration of their interaction and supplementing gaps in prior research at the "student behavior-attitude" level. Additionally, by incorporating the dimension of "autonomous learning ability," this study enriches the research scope, ensuring that findings better align with the practical needs of college students' English learning [4].

3. Research Design

3.1. Research Objects

The research aims to investigate the effectiveness of artificial intelligence technology in assisting college students' English learning. To ensure representativeness, over 300 college students from a variety of universities-including comprehensive universities, science and engineering universities, and language-based universities-across the country were selected. The participants represent diverse majors such as science, engineering, liberal arts, and business, and were chosen to reflect differences in English proficiency levels among different student groups. This sampling strategy ensures that the findings accurately reflect the learning behaviors and attitudes of a broad range of college students, providing a solid empirical foundation for evaluating AI-assisted English learning.

3.2. Research Tools

The study designed a structured questionnaire based on the dimensions of the "Questionnaire on AI-Assisted English Learning," combined with relevant questionnaire items collected from online sources. The final instrument includes four modules: "Basic Information," "Tool Usage Behavior," "Learning Interest and Attitude," and "Perception of Learning Effects."

The "Tool Usage Behavior" module investigates students' engagement with AI English learning tools. For example, participants were asked: "Which of the following AI English learning tools have you used? (Multiple choices: vocabulary tools, oral English tools, writing and translation tools, etc.)" The design of these items aligns with actual usage patterns observed in the study, such as 173 instances of vocabulary tool usage and 163 instances of oral English tool usage, providing a realistic reflection of student engagement [5].

The "Learning Interest and Attitude" module explores students' motivation and willingness to adopt AI-assisted methods. A representative item asks: "Compared with traditional English learning methods, how willing are you to participate in AI-assisted English learning? (Very willing/Willing/Neutral/Not very willing/Not willing at all)." This item corresponds to survey responses indicating 147 "Very willing" and 124 "Willing" selections, capturing the general trend in student attitudes.

The "Perception of Learning Effects" module assesses students' subjective evaluation of AI-assisted learning outcomes. Items such as "Do you think the English learning effect has met your expectations after using AI tools? (Rating from 1 to 5)" were designed to quantify students' perceived improvements in vocabulary acquisition, oral skills, reading speed, and overall learning effectiveness. This module emphasizes students' subjective judgment of AI's auxiliary role and provides nuanced insights into the perceived benefits and limitations of the technology.

3.3. Data Analysis

Prior to the formal survey, a preliminary questionnaire was administered to more than 30 college students from different majors and grade levels to conduct a pilot test. The Cronbach's α coefficient for the pilot survey was 0.89, indicating high internal consistency and confirming that the questionnaire met the required standards of reliability and validity.

The formal survey was distributed online via the Tencent Questionnaire, yielding 286 valid responses. For data analysis, correlation analysis was employed to examine the relationships between "tool usage frequency" and both "degree of learning interest improvement" and "perception score of learning effects." Additionally, difference analysis was conducted to compare students' tool preferences and attitudes across different majors and grade levels. This dual approach allows the study to identify not only general trends but also subgroup-specific patterns in AI-assisted learning, providing a detailed empirical basis for evaluating the effectiveness and applicability of AI technologies in college English education [6].

By combining descriptive statistics with inferential analyses, this research can reveal nuanced interactions between students' engagement with AI tools, their learning motivation, and perceived learning outcomes. Furthermore, the analysis enables identification of potential challenges, such as differential adoption across proficiency levels or varying attitudes toward tool reliance, which can inform targeted strategies for improving AI-assisted English learning practices.

4. Research Results

4.1. Effectiveness of AI-Assisted English Learning

4.1.1. General Overview of the Effectiveness of AI-Assisted English Learning

The analysis of students' recognition levels, ranging from 1 to 5, provides an overview of the perceived effectiveness of AI tools in assisting English learning. As shown in Figure 1, most students rated the listed viewpoints at levels 3 to 5, indicating a general acknowledgment of the benefits provided by AI tools. A smaller proportion of students rated the viewpoints at levels 1 to 2, reflecting a lack of recognition that AI tools can effectively enhance English learning. Notably, the number of students who do not recognize AI tools as being more effective than traditional methods is relatively higher, suggesting some skepticism regarding comparative effectiveness [7].

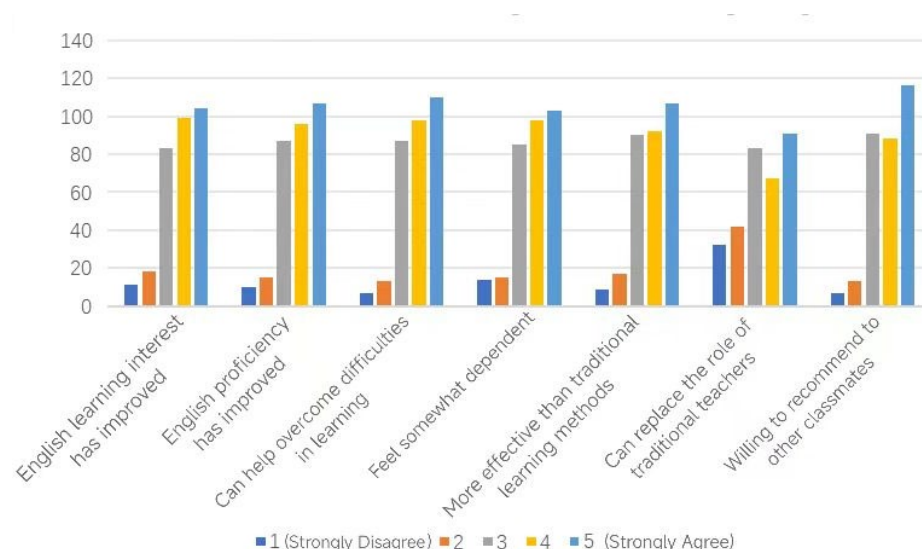


Figure 1. Students' Evaluation of Artificial Intelligence Tools Assisting in English Learning.

The questionnaire results further indicate that 91% of students selected levels 3 to 5 for the question "Has the AI tool's assistance in English learning met your expectations?" (see Figure 2). This finding demonstrates that, for the majority of students, AI-assisted tools have a positive effect on their English learning, contributing to measurable improvements in learning outcomes and overall engagement.

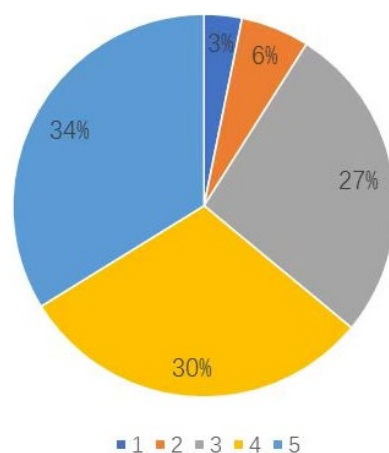


Figure 2. Percentage of Students' Different Agreement Degrees on the Effectiveness of Artificial Intelligence Assistance in Total.

4.1.2. Differences in the Effectiveness of AI-Assisted English Learning in Terms of Students' English Proficiency, Usage Frequency, and Concentration

To investigate differences in AI tool effectiveness across specific dimensions, this study examined students' English proficiency, usage frequency, and concentration levels as key variables.

As shown in Table 1, the correlation analysis between students' usage frequency and expected benefits of AI-assisted English learning reveals a clear pattern: when usage frequency is "Always," the number of students who believe the benefit fully meets expectations at level 5 is the largest, reaching 38. This indicates that students who frequently engage with AI English learning tools perceive the highest alignment between expected and actual benefits. Conversely, as usage frequency decreases from "Always" to "Seldom," the number of students rating high expected benefits (levels 4 and 5) generally declines. For instance, among students with "Seldom" usage, only 0 and 2 students believe the benefits meet levels 4 and 5, respectively, highlighting a potential positive correlation between usage frequency and perceived benefit: the more frequently AI tools are used, the higher the perceived effectiveness.

Table 1. Correlation Analysis Between Students' Usage Frequency and Expected Benefits of AI Tools-Assisted English Learning.

Usage Frequency \ Expected Benefits	1(Low)	2	3	4	5(High)
Always	1	2	9	9	38
Often	1	5	26	50	28
Sometimes	2	7	29	25	20
Occasionally	0	3	8	4	3
Seldom	5	1	4	0	2

Table 2 presents the correlation analysis between students' concentration levels during AI tool usage and the expected benefits obtained. The data indicate that students who are "Fully Concentrated" or "Concentrated" report higher levels of expected benefit achievement, with 32 and 28 students, respectively, rating level 5. In contrast, students with lower concentration levels show a downward trend in perceiving high-level benefits. These findings suggest that concentration during AI-assisted learning is a significant factor influencing perceived effectiveness, emphasizing the role of focused engagement in maximizing the advantages of AI tools.

Table 2. Correlation Analysis Between Students' Concentration in Using AI and Expected Benefits of AI-Assisted English Learning.

Concentration Level in Using AI \ Expected Benefits	1(Low)	2	3	4	5(High)
Fully Concentrated	1	0	4	7	32
Concentrated	1	1	20	42	28
Relatively Concentrated	2	7	33	30	21
Average	1	7	15	8	8
Not Concentrated	4	3	4	1	2

4.2. Main Obstacles to the Continuous Improvement of the Effectiveness of AI-Assisted English Learning

4.2.1. Students' Willingness

Analysis of Figure 3 and Figure 4 reveals that 86.8% of students are categorized as "Very willing" or "Willing" to use AI-assisted English learning tools. However, only 192 students scored levels 5 and 4 on active engagement measures, accounting for

approximately 67.1%. This indicates that while students generally express positive attitudes toward AI-assisted learning, the proportion of actively engaged users is lower, suggesting that passive participation is more common. Consequently, students' initiative in using AI tools remains relatively limited, which constitutes one of the main obstacles to maximizing the effectiveness of AI-assisted English learning [8,9].

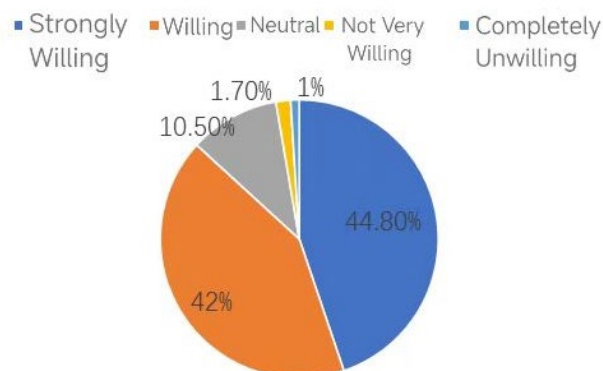


Figure 3. Percentage of Students' Participation in Passive Use of Artificial Intelligence to Assist English Learning (Compared with Traditional English Learning Methods).

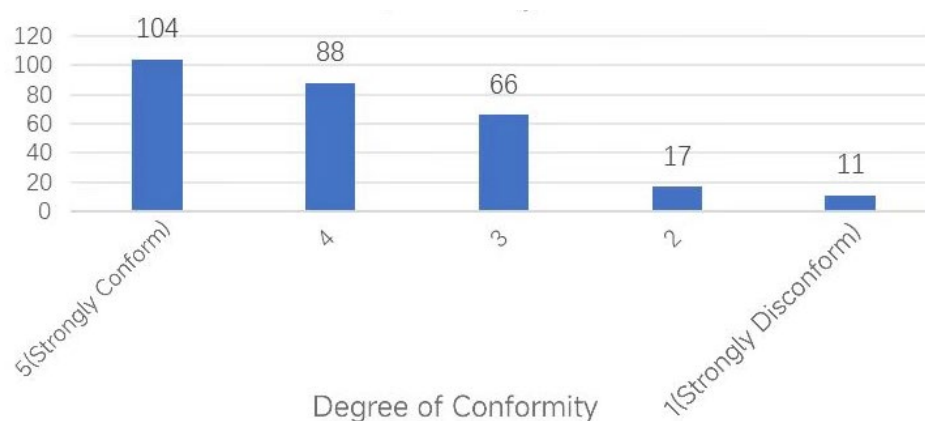


Figure 4. Degree of Conformity of Students' Actively Using Artificial intelligence Tools to Improve English.

4.2.2. Limitations of AI Tools

Survey results indicate that students perceive several limitations in current AI tools, including occasional misunderstanding of questions, insufficient creativity, limited analytical capability, and lack of personalized learning features (Figure 5). These technical constraints not only reduce the overall effectiveness of AI-assisted learning but also highlight areas where further development and optimization are needed. Addressing these limitations is essential to improve students' learning experience and to fully realize the potential of AI technologies in English education [10].

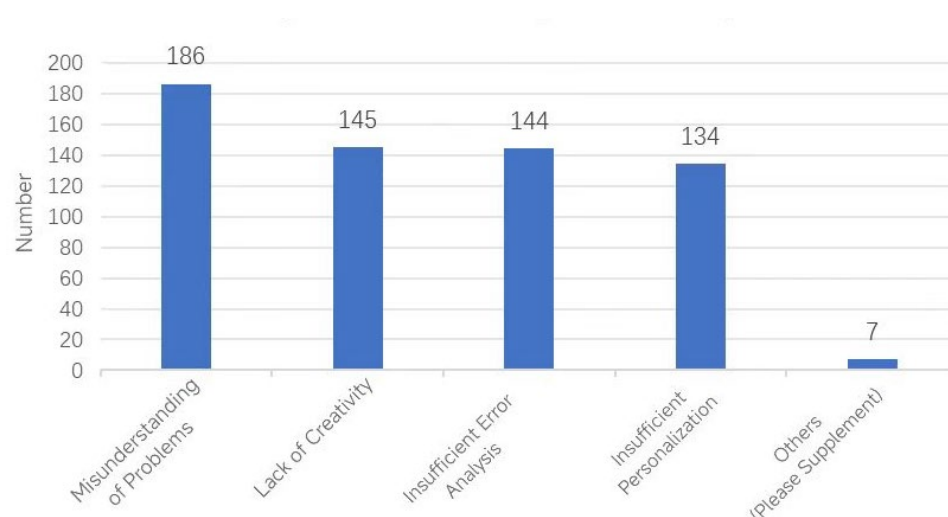


Figure 5. Students' Perceived Shortcomings of Artificial Intelligence Tools in English Learning.

4.3. Students' Suggestions

Figure 6 summarizes students' expectations for new functionalities in AI English learning tools. Regarding simulation of real English communication scenarios, 218 students expressed the desire for this feature, indicating a strong demand for immersive, context-rich learning environments. Many students noted that while current AI tools are effective for knowledge acquisition, such as vocabulary and grammar learning, they often lack authentic communication contexts.

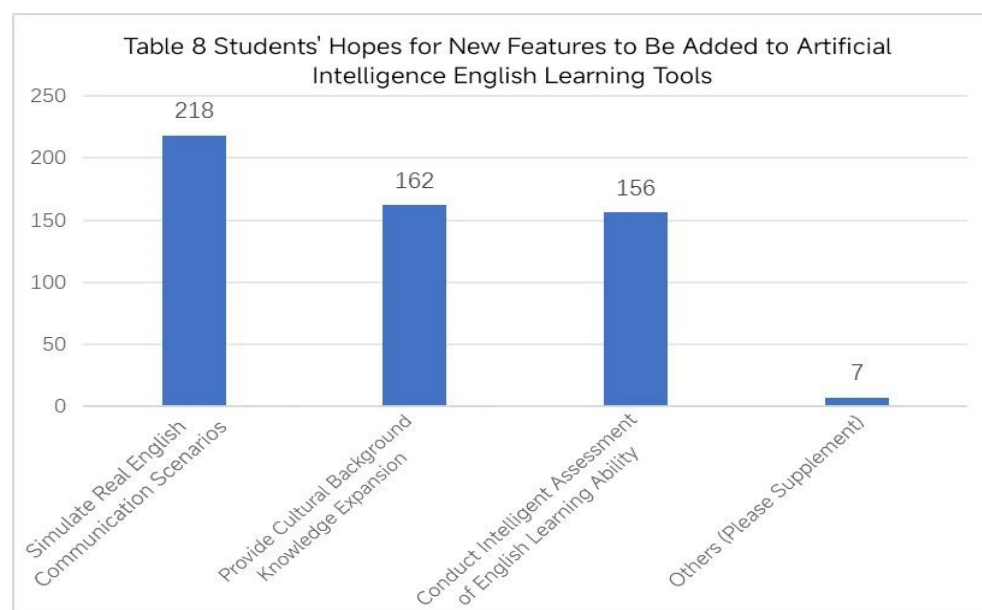


Figure 6. Students' Hopes for New Features to Be Added to Artificial Intelligence English Learning Tools.

Additionally, 162 students indicated the need for AI tools to provide expanded cultural background knowledge. They hope that AI can automatically integrate relevant cultural information when learning new vocabulary or reading English texts. Such functionality would enable students to better understand content, enhance cross-cultural communication skills, and reduce misunderstandings arising from cultural differences.

Moreover, 156 students expressed a desire for AI-assisted intelligent assessment of English learning ability. They expect AI to evaluate their proficiency more accurately and comprehensively, providing personalized feedback to guide further learning.

In summary, AI English learning tools have substantial potential for future development in several directions: creating immersive communication scenarios, deepening cultural knowledge integration, enabling precise and intelligent assessment, and catering to diverse personalized learning needs. These improvements are expected to better support students in achieving more effective and holistic English learning outcomes.

5. Discussion

This study primarily explores issues related to the effectiveness of AI-assisted English learning. The questionnaire survey demonstrates that the use of AI-assisted English learning tools is relatively widespread among college students. More than 80% of users are freshmen, reflecting early engagement with such technologies, and the types of tools utilized are diverse, encompassing writing and translation tools (e.g., Grammarly) as well as vocabulary learning tools (e.g., Cheese Vocabulary). Certain tools have been used over 200 times, indicating both popularity and high acceptance among students.

Students exhibit a strong willingness to participate, with over 270 respondents selecting "Very willing" or "Willing" to use AI-assisted tools. Approximately half of the students reported maintaining concentration during use, and more than 110 students actively leverage these tools to enhance their English proficiency. This pattern indicates that the AI-assisted learning model has considerable appeal, stimulating student initiative and promoting engagement to a notable extent.

From the perspective of learning objectives, students primarily use AI tools to improve practical skills such as oral English and writing ability. This aligns with the conclusion that AI can enhance comprehensive English application skills through simulation of real scenarios and intelligent corrective feedback. Some students report that the benefits obtained after using AI tools meet or exceed their expectations, further validating the effectiveness of AI-assisted methods in addressing specific learning needs and enhancing skill development.

The study suggests several avenues for improving AI English learning tools. First, optimizing semantic understanding accuracy and establishing personalized student profiles can provide tailored learning services. Second, simulating real communication scenarios allows AI to complement traditional classroom instruction by offering extracurricular practice opportunities and real-time feedback. These improvements can deepen the engagement of students, expand their practical application of English, and maximize the pedagogical value of AI technologies.

Despite its contributions, this study has several limitations. First, the sample primarily consists of students from the same undergraduate university, and the overall data volume is relatively limited. Future research should increase sample size and include participants from diverse regions and institutions to enhance the scientific validity and generalizability of findings. Second, 80% of the participants are freshmen. As these students have just entered university, their majors vary, and their enthusiasm for English learning may influence the observed outcomes. Including students from different grade levels in future studies would improve the representativeness and validity of the data. Third, this study relies solely on questionnaire-based survey analysis and does not include in-depth interviews. As AI application in English education remains in the developmental stage, conducting interviews could provide deeper insight into students' perceptions, attitudes, and experiences, thereby enhancing the credibility, depth, and interpretive power of the research.

In conclusion, while AI-assisted English learning tools show promising effectiveness in improving student engagement, practical skills, and perceived learning outcomes, optimizing tool functionality, expanding sample diversity, and employing mixed-method

approaches are crucial for further validating and enhancing their pedagogical impact. These steps will contribute to a more comprehensive understanding of how AI can be effectively integrated into college English education and support the development of more personalized and effective learning strategies.

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