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Original Paper

Balancing Efficiency and Depth in the Integration of Generative Artificial Intelligence into EAP Learning for Chinese Undergraduates

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Abstract

This study explores the integration of generative artificial intelligence tools into English for Academic Purposes (EAP) learning among Chinese undergraduates. The study adopts a questionnaire to investigate behavioral patterns, attitudinal structures, and perceived advantages of AI-assisted academic English learning. Findings indicate high level of AI exposure and positive perceived functionality of AI tools, especially in facilitating literature reading and writing. However, students demonstrated limited awareness of academic conventions and AI-related integrity issues, revealing an efficiency-depth paradox. Exploratory factor analysis identified three attitudinal dimensions, including perceived usefulness, self-assessed evaluation skills, and ethical apprehension. While students recognized dependence and plagiarism risks, such concerns coexisted with high reliance on AI. The findings highlight the need for targeted instructional strategies, such as offering dual literacy development, ethical training, and AI-integrated tasks in EAP courses, to balance productivity with critical skill development in AIGC-enhanced EAP contexts.

Keywords

generative artificial intelligence, English for Academic Purposes, academic integrity

1. Introduction

The rapid development of generative artificial intelligence, with large language models (LLMs) such as ChatGPT and DeepSeek at the core, is greatly transforming higher education. In terms of English language teaching, artificial intelligence generated content (AIGC) offer unprecedented opportunities (Chen & Lv, 2024; Li, 2024). Scholars have explored both the potential and challenges of AI-assisted

English teaching from multiple perspectives, highlighting its dual role as both a facilitator and a disruptor (Wen & Liang, 2024; Xu et al., 2024). While AI tools can enhance writing efficiency and quality (Feng & Zhang, 2024), their integration raises critical concerns regarding information accuracy, over-dependence, and the evolving role of educators (Wen, 2024).

Wen and Liang (2024) discuss AI's potential to foster human-machine interactive negotiation skills, whereby learners refine their linguistic and cultural awareness through iterative exchanges with LLMs. Yet, the efficiency–depth paradox persists. AI may accelerate surface-level language production but undermine critical thinking and metacognitive reflection at the same time (Xu et al., 2024). Survey data from this study reveal that 88.04% of participants have employed AI tools for academic English tasks, yet many express anxiety and concerns about over-reliance diminishing independent thought. This tension mirrors Wen's (2024) caution against reckless disruption in education; she argues that the continuity and stability of pedagogical traditions must be preserved, as reckless technological adoption may bring catastrophic consequences for cognitive development. Additionally, LLM bias can risk academic integrity if students just accept AI-generated content without critical thinking, including fabricated citations or data. Such situation underscores the urgent need for digital literacy training.

Current research concentrates more on general English instruction (Li, 2024) with limitations in the application scope. Crucially, the AI-assisted mechanisms for academic English learning, a cognitively demanding and genre-specific competency, remain largely under-explored. This reveals a critical research gap, as understanding how AI mediates complex academic literacy development is fundamental for designing human-AI collaboration teaching frameworks to effectively facilitate EAP learning.

Addressing the gap, this study adopts a mixed-methods approach to examine how AIGC shapes academic English learning among 326 second-year undergraduates, a preliminary stage in academic literacy development. This study aims to answer a pressing question: How can English for Academic Purposes (EAP) training strategically leverage AIGC to enhance productivity while safeguarding cognitive depth? This study argues that the solution lies not in resisting technological progress but in fostering dual literacy, where students master both AI tools and the critical–ethical competencies needed for their academic success. This study hopes to gather evidence-based guidelines for balancing technological efficiency with the preservation of essential academic skills.

2. Methodology

2.1 Participants

This survey-based study examined the applications of generative AI in academic English learning among Chinese undergraduates at an agricultural university with distinctive disciplinary characteristics. The study collected 326 valid responses from second-year students (top 15% based on their entrance English scores). All participants had completed a foundational EAP training in their sophomore Fall semester, emphasizing scholarly conventions and scientific text interpretation. At the time of data

collection at the beginning of Spring semester, they were commencing project-based academic English group work. The sample included 240 STEM majors (73.6%) and 86 humanities/social sciences students (26.4%), reflecting the university's agricultural specialization while ensuring representation across disciplines, which is consistent with the cross-disciplinary nature of general EAP instruction.

2.2 Instrument Design

A 22-item digital questionnaire was developed and administered via the Wenjuanxing platform. The questionnaire incorporated 4 systematically designed modules.

Module 1 collected demographic profile with 2 closed-ended items (Q1-Q2) capturing participants' academic year and disciplinary affiliation.

Module 2 examined behavioral patterns through 5 questions (Q3-Q7). Binary assessment of prior AI-assisted learning experience (Q3) revealed 88.04% adoption rate. Q4 (5-point single-choice scale from "Unfamiliar" to "Thoroughly understand") and Q5 (5-point ethical acceptability scale) explored students' academic literacy level focusing on academic convention awareness and academic integrity perceptions regarding AI use. Q6 identified existing challenges in English writing (6-option multiple-response addressing argumentation, literature synthesis, citation management, etc.) and Q7 examined common AI utilization scenarios (6-option multiple-response covering drafting, referencing, grammar checking, etc.).

Module 3 (Q8-Q21) focused on attitudinal assessment with 14 Likert-scaled propositions (1=Strongly Disagree to 5=Strongly Agree), measuring perceived utility, risk perception, self-efficacy, training needs, etc.

In the end, Module 4 (Q22) identified the primary perceived benefits of AI tools in EAP learning(6-option multiple choice with optional text entry).

Descriptive statistics were used to summarize behavioral patterns, and quantitative analyses (correlation, reliability, validity, and factor analysis) were performed using SPSS software.

3. Result

3.1 Academic Awareness at the Initial Stage of Academic Writing

This study investigated the relationship between students' understanding of academic writing conventions and their perceptions of academic integrity when using AI tools for academic writing at the early stage of their academic development. The findings of Q4 and Q5 are based on Pearson correlation analysis, as presented in Table 1.

Table 1. Correlation between Academic Conventions Awareness and AI Academic Integrity Perception

Variable	Mean	SD	Academic Conventions Awareness (Q4)	AI Academic Integrity Perception (Q5)
Academic Conventions Awareness (Q4)	2.37	0.61	1	-
AI Academic Integrity Perception (Q5)	2.52	0.65	0.18**	1

Note. **p < 0.01.

The mean score for students' self-reported understanding of academic writing norms (e.g., citations, references, academic tone) was 2.37 (SD = 0.61) on a 5-point scale. This suggests that most second-year undergraduates are in the early stages of academic writing proficiency, with preliminary understanding of essential conventions. The relatively low standard deviation indicates that this limited awareness is a common pattern, likely due to insufficient systematic training in formal academic writing at this stage of their education.

Students demonstrated mixed perceptions (M = 2.52, SD = 0.65) regarding the ethical implications of using AI for academic writing, suggesting that students recognize potential integrity concerns of using AI tools but lack a firm stance. Such uncertainty in attitudes towards AI usage and academic integrity means that some students may over-rely on AI tools without fully considering relevant ethical risks, treating them more as shortcuts than as learning aids, while others may adopt a more cautious approach, possibly due to established awareness or prior exposure to academic integrity policies about AI-generated content.

The correlation analysis revealed a statistically significant but weak positive relationship ($r = 0.18$, $p < 0.01$) between knowledge of academic writing norms and awareness of AI-related integrity issues. This result implies that students with stronger foundational knowledge of academic conventions tend to be slightly more critical of AI's ethical implications, possibly because they are more aware of originality and understand the importance of proper acknowledgement. However, the small correlation coefficient ($r = 0.18$) indicates that these two dimensions are more likely to be independent, implying that additional factors, such as prior AI exposure, policy awareness, and personal ethics, also shape attitudes. The significance ($p < 0.01$) suggests that this link is not coincidental, underscoring its relevance for teaching interventions.

3.2 Behavioral Patterns and Risk Perception in AIGC Application

3.2.1 Reliability Analysis

Table 2. Reliability of the Attitudinal Assessment Scale

Sample Size	Number of Items	Cronbach's α
326	14	0.863

The reliability analysis presented in Table 2 demonstrates excellent internal consistency for the 14-item attitudinal assessment scale (Q8-Q21). With a sample size of 326 respondents, the Cronbach's alpha coefficient of 0.863 indicates strong measurement reliability, exceeding the conventional threshold of 0.70 for research instruments (Nunnally, 1978) and approaching the more stringent 0.90 benchmark recommended for clinical applications (Streiner, 2003). The internal consistency indicates that all 14 items consistently measure the intended construct of AIGC adoption attitudes, meeting the prerequisites for factor analysis.

3.2.2 Validity Analysis

The appropriateness of factor analysis was confirmed through the following 2 key statistical tests. Kaiser-Meyer-Olkin (KMO) value is 0.866 (exceeding the 0.80 threshold for sampling adequacy), indicating strong inter-correlations among variables. Bartlett's Test of Sphericity ($\chi^2 = 1902.649$, df = 91, $p < .001$) validated the factorability of the correlation matrix. These metrics collectively demonstrate that the dataset in this study meets the requirements for exploratory factor analysis (EFA).

3.2.3 Three-Factor Structure

Principal component analysis with varimax rotation yielded a stable three-factor structure accounting for 61.10% of total variance (see Table 3). All factors exhibited eigenvalues >1.0, conforming to Kaiser's criterion.

Table 3. Rotated Factor Loadings and Variance Explained

Factor	Survey Items (Abbreviated)	F1	F2	F3	Communality
F1	Q8 Improves writing structure	0.70	0.14	0.29	0.589
F1	Q9 Assists citation/anti-plagiarism	0.55	0.33	-0.16	0.438
F1	Q10 Provides framework suggestions	0.74	0.05	0.28	0.623
F1	Q11 Enhances information retrieval	0.75	0.03	0.30	0.655
F1	Q12 Benefits outweigh risks	0.72	0.13	0.08	0.537

Factor	Survey Items (Abbreviated)	F1	F2	F3	Communality
F2	Q13 Identifies/corrects AI errors	0.08	0.87	0.04	0.762
F2	Q14 Detects logical flaws	0.14	0.80	0.12	0.678
F1	Q15 Develops critical thinking	0.60	0.33	-0.08	0.474
F3	Q16 Concerns about cognitive dependency	0.20	0.02	0.85	0.759
F3	Q17 Worries about plagiarism risks	0.23	0.04	0.84	0.754
F2	Q18 Judges information accuracy	0.14	0.79	-0.04	0.642
F1	Q19 Necessity of AI training	0.69	0.06	0.31	0.577
F1	Q20 Desire for institutional training	0.71	0.01	0.36	0.637
F1	Q21 Frequency of AI tool usage	0.64	0.11	0.06	0.428
Eigenvalues (rotated)		4.30	2.29	1.96	-
% of Variance (rotated)		30.73	16.37	14.00	-
Cumulative %		61.10			

Factor 1 summarizes students' perceived usefulness of AI tools (30.73% variance). This dimension captures students' positive attitudes toward AI's functional benefits for academic writing tasks. High-loading items (>0.70) include structural enhancement (Q8 Improves organization), research facilitation (Q11 Enhances information retrieval) and process scaffolding (Q10 Provides framework suggestions). Notably, the strong loading of Q12 (0.72) on perceived risk-benefit ratio suggests potential optimism bias regarding AI limitations, highlighting the need for teaching interventions to cultivate balanced perspectives.

Factor 2 centers on students' self-assessed evaluation skills (16.37% variance), highlighting the ability to identify or correct AI errors (Q13, 0.87) and logical analysis competence (Q14, 0.80). However, cross-loadings with Factor 1 (Q15 Develops critical thinking and Q18 Judges information accuracy) hint at possible self-efficacy inflation, where students overestimate their ability to critically evaluate AI outputs, a crucial gap requiring instructional intervention.

Factor 3 captures students' ethical concerns (14.00% variance), centering on fears of cognitive dependency (Q16, 0.85) and worries about plagiarism risks (Q17, 0.84). The weak negative link with Factor 1 Q15 Develops critical thinking (r=-0.08) manifests a paradoxical mindset that while

recognizing AI benefits, students fear intellectual deskilling at the same time.

3.3 Perceived Advantages of AI Tools in EAP Learning

Responses to Q22 indicate that AI tools are most valued for facilitating reading comprehension (80.67%) and constructing writing frameworks (72.09%), suggesting that students primarily view AI as an efficiency enhancer. Students also recognized AI tools' benefits in reducing language barriers (58.28%) and providing personalized feedback (43.87%). However, it is worth noting that fewer students recognized AI's effectiveness in enhancing critical thinking (39.57%) or ensuring academic compliance (31.90%), suggesting a perceived gap in AI's capacity for deep cognitive support and ethical assurance. Overall, as the findings in Table 4 suggest, AI tends to be portrayed as a powerful tool for surface-level efficiency in EAP learning, but with limited perceived impact on deep learning outcomes such as argument development and ethical compliance.

Table 4. Perceived Advantages of AI Tools in EAP Learning

Advantage	Frequency (n)	Percentage (%)
Accelerating literature reading & key information extraction	263	80.67
Assisting in constructing logical frameworks for academic writing	235	72.09
Reducing language barriers & polishing expressions	190	58.28
Providing personalized writing feedback	143	43.87
Enhancing critical thinking & argument depth	129	39.57
Supporting academic norm compliance	104	31.90
Total valid responses	326	100

4. Discussion

This study examined how generative AI is being used in English for Academic Purposes (EAP) classes when students are still developing their academic literacy in the early stages. Most students had some experience with AI-assisted learning and valued its practical benefits, especially for speeding up reading and creating writing frameworks. However, their understanding of academic writing rules and their awareness of AI-related integrity issues were limited. This reveals an efficiency–depth paradox, whereby AI tools can improve writing efficiency yet limit opportunities for deeper thinking and critical reflection.

4.1 Academic Awareness and Integrity Perception

A weak but statistically significant correlation was found between students' knowledge of academic writing conventions and their views on AI-related ethics. Students who understood these conventions better were more inclined to think critically about ethical AI use. However, awareness of conventions alone is not enough to guide and ensure ethical practice. Other factors also shape students' ethical understanding. This supports Wen's (2024) warning that without direct teaching guidance, students may depend too heavily on AI tools without checking the accuracy, originality, or disciplinary standards of its output.

4.2 Students' Attitudinal Structure

The three-factor structure resulted from exploratory factor analysis provides deeper insight into students' attitudes toward AI, including perceived usefulness, self-assessed meta-cognition, and ethical apprehension.

Perceived usefulness (Factor 1) reflects students' strong belief in AI's capacity to enhance productivity and streamline academic writing. Students' functional recognition of AI tools, while being potentially beneficial for engagement, may also foster an optimism bias that reduces their awareness of AI's limitations and weaknesses.

Self-assessed evaluation skills (Factor 2) involves students' confidence in their ability to detect errors, assess logic, and verify the accuracy of information generated by AI. However, such confidence may be overestimated, particularly when students lack systematic training in evaluation strategies. This gap between perceived skills and actual competence may lead to over-reliance on AI outputs without adequate scrutiny.

Ethical apprehension (Factor 3) reflects concerns about over-dependence on AI and the risk of possible academic misconduct. The coexistence of such concerns with high trust in AI's usefulness suggests a mix of risk awareness and continued dependence. Students are aware of potential cognitive and ethical risks, yet continue to integrate AI into their work. This tension mirrors prior observations that human–machine interaction often involves an ongoing negotiation between perceived benefits and latent risks, underscoring the need for teaching guidance.

4.3 Perceived Functionality of AI Tools

Students' perceptions of AI's role suggest that the technology is being used primarily as a structural and procedural tool rather than as a means to deepen cognitive engagement. While AI appears effective in accelerating preliminary stages of academic work, such as organizing ideas or drafting outlines, it is less frequently perceived as a tool for enhancing argumentation, fostering critical thinking, or ensuring compliance with academic norms.

This imbalance points to an under-utilization of AI's potential as a cognitive catalyst. Without targeted guidance, students may remain focused on the immediate efficiencies AI offers, overlooking its possible role in supporting reflective analysis and intellectual independence. The transformative capacity of AI in academic settings depends not only on access to the technology, but also on the

teaching frameworks that shape its use.

4.4 Implications for AIGC Integration into EAP Instruction

The integration of AIGC into EAP courses should move beyond mere facilitation of writing output to the cultivation of critical and ethical academic literacy.

First, instruction should address both technological literacy (effective and efficient use of AI tools) and academic literacy (critical engagement with ideas, argumentation, and disciplinary conventions). Such dual literacy development means embedding AI usage within activities that require source verification, argument refinement, and style alignment, ensuring that operational fluency is matched by depth of intellectual engagement.

Second, the focus should be put on ethical AI literacy training. Given students' partial awareness of academic integrity issues, dedicated modules on AI-related ethics should be designed and introduced to the class. These modules can incorporate case-based learning on plagiarism detection, recognition of fabricated references, and responsible paraphrasing. Besides, linking these activities to academic integrity policies will help bring ethical considerations into real-life academic contexts.

Third, teachers should develop AI-integrated tasks to encourage the interaction between students and AI outputs. AI-supported writing assignments should be designed for students to revise, justify, and defend AI-generated content. For example, students could be tasked with identifying weaknesses in AI drafts, strengthening arguments with additional evidence, or debating the validity of AI-generated claims. Such tasks transform AI from a passive information provider into an active partner in the learning process, fostering higher-level thinking and promoting a collaborative human–machine workflow.

5. Conclusion

This study shows how Chinese undergraduates in the early stages of higher education engage with AI tools for EAP learning. While most participants appreciated and recognized AI's practical functions, particularly in accelerating information processing and supporting writing, they exhibited limited awareness of academic conventions and AI-related ethical considerations. The identified efficiency–depth paradox suggests that current AI usage tends to facilitate surface-level production rather than fostering deeper cognitive engagement or critical thinking.

The attitudinal structure revealed by factor analysis further highlights the coexistence of optimism bias, overconfident self-assessment of evaluative skills, and ongoing ethical concerns. These findings point to the necessity of targeted curriculum design that integrates AIGC in ways that build technical skills, critical thinking, and ethical literacy at the same time. By designing tasks that require checking, improving, and defending AI-generated work, teachers can help AI become a tool for higher-order learning, not just efficient production. Ultimately, the sustainable integration of AIGC into EAP should not be driven solely by technological familiarity but by teaching guidance that preserves the integrity, depth, and disciplinary relevance of academic communication.

Limitations of this study should also be acknowledged. Participants were mainly STEM students from an agricultural university, which limits the generalizability of findings to more balanced or humanities-oriented contexts. Different disciplinary fields may shape writing practices and AI adoption differently. Future research could include more diverse institutions and examine changes over time, using performance-based tasks to study how AI supports different academic disciplines.

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