ingegneria sismica
International Journal of Earthquake Engineering
Anno XLIII - Num. 1 - 2026

The Role of a Hybrid Model Combining Artificial Intelligence Feedback and Teacher Feedback in German Academic Writing on the Improvement of Learners' Writing Skills

Haopin Luo[1,*]

[1] School of International Exchange, Wuhan Business University, Wuhan 430056, China

SUMMARY: *The scientific use of hybrid feedback is the focus of German academic writing teaching and research in the new era. This study constructs a hybrid model of German academic writing through the organic integration of teacher feedback, peer feedback and AI feedback, and discusses the AI chatbot. The teaching experiment was designed with a university's senior non-German majors as the research subjects, and the German academic writing achievement scores of the students in the mixed feedback group gained a significant improvement after the experiment (14.40%, $P < 0.01$), and there was a significant difference with the other three single-feedback groups. On the other hand, the mixed feedback group improved 20.98% and 33.32% in writing fluency and writing accuracy, respectively, and the students' planning ability, self-monitoring ability, task evaluation ability, illustrative-narrative ability, self-correction ability, and self-assessment ability also increased significantly compared with those before the experiment. The results show that the mixed feedback model helps to improve learners' writing performance, writing fluency and accuracy, and promotes learners' German academic writing ability.*

KEYWORDS: *statistical analysis; AI chatbot; German academic writing; mixed feedback*

1 Introduction

In the context of the era of globalization and informatization, German continues to be an important language in scientific and technological research, with a rich tradition in disciplines like chemistry and engineering [1, 2]. The current situation of German writing teaching is that it is obvious that it has not yet met all the requirements of writing teaching in the new curriculum standard [3]. At present, the actual situation of German writing teaching is [4-7]:

First, German writing teaching often focuses on mechanical imitation and rote memorization, neglecting the cultivation of students' independent writing ability and creativity. In the process of writing teaching, teachers are often in a dominant position, while students are passive recipients of knowledge, often just mechanically memorizing some vocabulary, sentence patterns or model texts, and failing to apply what they have learned about writing to actual writing. These problems lead to the fact that students seldom have independent thinking and lack of creativity in the process of writing, and the compositions they write are often single in content and lack of depth and breadth. At the same time, due to the lack of knowledge of writing and the lack of a sense of the German language, some students are prone to the problem of Chinese-German in the process of German writing, which leads to the problem of unorthodox and unnatural expressions in their writing.

*luohaopin@hotmail.com
https://doi.org/10.65102/is2026279
Published: 30 April, 2026

Secondly, German writing teaching lacks effective teaching methods, teachers' guidance to students' writing is not specific and detailed enough, and many students feel confused and helpless in the process of writing, don't know how to start, and lack clear ideas and directions for writing. Teachers' guidance often stays on the surface and does not go deep into students' writing practice, which leads to students' difficulty in improving their writing level, and then lose their self-confidence and interest in German writing.

Thirdly, students lack sufficient opportunities for writing practice. Many schools tend to focus only on classroom teaching in German writing teaching and lack training and guidance for students' writing practice, so students don't have enough opportunities to practice writing and find it difficult to improve their writing level.

Based on this background, German teachers need to explore teaching strategies that are more suitable for the objectives of writing teaching, so as to better solve the many problems existing in the current writing teaching, stimulate students' interest in learning German writing, improve classroom participation and motivation, and then improve the teaching effectiveness of the German writing classroom [8-11].

The rise of artificial intelligence marks a revolutionary change in the development of society and an important opportunity for the leaping development of the education field [12, 13]. It is clearly stated in Education Informatization 2.0 that, based on emerging technologies such as artificial intelligence, big data, and the Internet of Things, and relying on various types of intelligent devices and networks, we will actively carry out commanding educational innovation teacher training and build an intelligent learning support environment [14, 15]. Artificial intelligence-inspired content generation ability, dialogue context understanding ability, sequence task execution ability and program language parsing ability, can provide a variety of forms of help and services for teachers' teaching, but also can be targeted to complete a number of tasks in educational evaluation, through the analysis of vocabulary, grammar, sentence structure and the way of viewpoints expressed and events described in the dialogue process to give targeted feedback [16-19]. The ChatGPT is an example of an educational evaluation program that has been developed in the past few years. For example, ChatGPT, an AI chatbot launched in 2022, uses deep learning to generate human text-like language models, works by analyzing a large textual dataset and learning patterns and relationships between words and phrases, and can generate natural and diverse answers based on contextual contexts in conversations, outputting feedback similar to human texts [20-22]. In addition, compared to direct teacher feedback, hybrid human-computer feedback can significantly increase learners' feedback input, thus improving German writing [23]. Artificial intelligence has shown significant advantages in facilitating educational feedback. Therefore, the use of AI technology for such tasks as correcting students' compositions and assisting teachers' feedback can improve learners' feedback input and make up for the current problems such as the single form of teachers' feedback and the lack of personalized feedback [24-26].

In this paper, under the guidance of the process writing theory, a multi-party collaborative hybrid model of German academic writing is established by combining AI feedback with teacher feedback and introducing peer feedback. Based on the AI feedback level, the Open Assistant self chatbot is selected and the functional architecture of the AI chatbot learning system is analyzed. On this basis, the teaching experiment of the hybrid feedback model is carried out. The senior non-German majors of a university were selected as the experimental subjects and divided into four groups: teacher feedback, peer feedback, AI feedback and hybrid feedback. Comparative analysis of German academic writing scores, writing fluency and accuracy of the four groups, as well as questionnaire analysis of writing ability improvement of students in the mixed feedback group were conducted after the experiment to examine the role of the mixed feedback model on the improvement of learners' writing ability.

2 Mixed mode of German academic writing

Familiarizing with German discourse patterns, possessing clear language expression and writing according to international German academic writing examples are the abilities that students need to improve urgently. With the development of artificial intelligence technology, it is more worthwhile to actively try how to utilize the advantages of AI technology to explore new German academic writing teaching methods. In this context, this paper combines the process writing method with an AI technology to construct a hybrid model of German academic writing that combines AI feedback, teacher feedback, and student feedback.

2.1 Process Writing Theory

Process writing theory holds that one-time writing affects students' thinking, confidence and interest, and is not conducive to the improvement of writing quality; it focuses on the writing process and advocates the “process” teaching method. It focuses on the writing process and advocates the “process” teaching method. The theory advocates that the writing task should be completed through the interaction, sharing and negotiation of the writing process, changing the one-time draft into a draft after repeated consultations and revisions, changing the one-way feedback into a two-way or multidirectional feedback, emphasizing the central position of students in the writing process, and giving full play to the advantages of teaching resources and means brought about by the modern educational technology, so as to optimize the teaching process of writing. The theory of process writing suggests that attention should be paid to students' writing process, which is a kind of communicative activity between teachers and students and between students, aiming at cultivating students' independent writing ability.

2.2 Hybrid feedback model construction

Based on the process writing theory, this study innovatively adopts the hybrid feedback mode to teach German academic writing, aiming to help students master the knowledge and skills of German academic writing, improve their writing confidence, and then improve their German academic writing level. This teaching mode through online and offline learning interactions, German teachers and artificial intelligence and other multi-party synergies, the real restoration of the German academic writing process, to achieve the maximization of offline and online learning effects, German academic writing hybrid feedback teaching mode is shown in Figure 1.

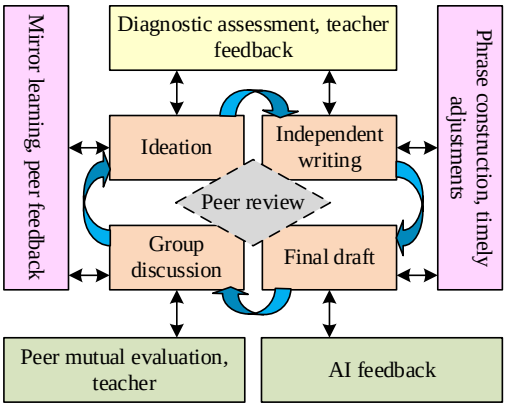

Figure 1: The mixed feedback teaching model for German academic writing

2.2.1 Online Learning and Communication

After learning about German academic writing, students write their first drafts according to their self-defined writing topics. In this process, students use the AI chatbot to assist them in writing the first draft, and make revisions according to the prompts of the AI chatbot until the first draft is perfected. The AI chatbot can be used as the students' learning partner or companion, and through the underlying big data storage and analysis and calculation, it can provide personalized German academic writing learning coaching and feedback for students. At this stage, the AI chatbot serves as a carrier for students' German academic writing practice, which not only allows students to freely complete writing practice online without taking up class time, but also allows teachers to utilize class time to provide one-on-one individual writing guidance to students online.

2.2.2 Offline learning and communication

The offline learning format includes the teacher leading the students from the process of literature collection, reading, writing papers and presenting the results to improve the students' academic German expression and writing ability, strengthen the mastery of standard stylistic paradigms, and cultivate team writing habits and examples. Specific methods include teachers explaining video content and model essays, improving students' language organization and expression skills, demonstrating the process of literature writing, providing writing feedback according to the group's writing progress, conducting group lectures and group discussions and peer-to-peer corrections in response to problems, and so on. The purpose is to refine the teaching content according to the students' progress, and to let the students understand the learning focus and deepen their understanding of German academic writing through explanation.

2.2.3 Multi-party feedback synergies

One of the major innovations of this hybrid model is the synergy of multiple parties involved in teaching and learning. German academic writing teachers collaborate to guide students to read literature, cultivate students to link German academic reading and German academic writing, and develop reading and writing skills at the same time, and students can also get writing feedback in real time through the AI chatbot and peer feedback in classroom discussions. Through the collaboration of German academic writing teachers, students and AI, peer feedback, AI feedback and teacher feedback establish a diversified and extended writing support system.

2.3 AI chatbot learning system

In this section, the AI chatbot learning system in the hybrid model of German academic writing is designed to provide students with intelligent German academic writing companion objects, analyze students' learning behaviors through a big data analysis system, and help students play to their strengths as well as discover and make up for their deficiencies, with a view to improving learners' German academic writing.

2.3.1 AI Chatbot Selection

With the development of science and technology, AI chatbots are also diverse. Comparative analysis of the current mainstream chatbots, to meet the four aspects of easy access, high chat intelligence, rich technical support and low cost are Open Assistant, Google Assistant and RASA chatbot, but Google Assistant chatbot in can not be directly accessed, so it is not selected. Meanwhile, RASA chatbot's corpus needs to be accumulated and trained

continuously, and has the problem of low chatting accuracy, so it is also not chosen. Therefore, the Open Assistant chatbot was finally selected as the AI chatbot for German academic writing in mixed mode in this study.

2.3.2 Overall system functional architecture

The overall functional architecture design of the AI chatbot learning system is shown in Figure 2, which is divided into three major modules in total: the AI chatbot Open Assistant, the big data analysis system, and the backend management system.

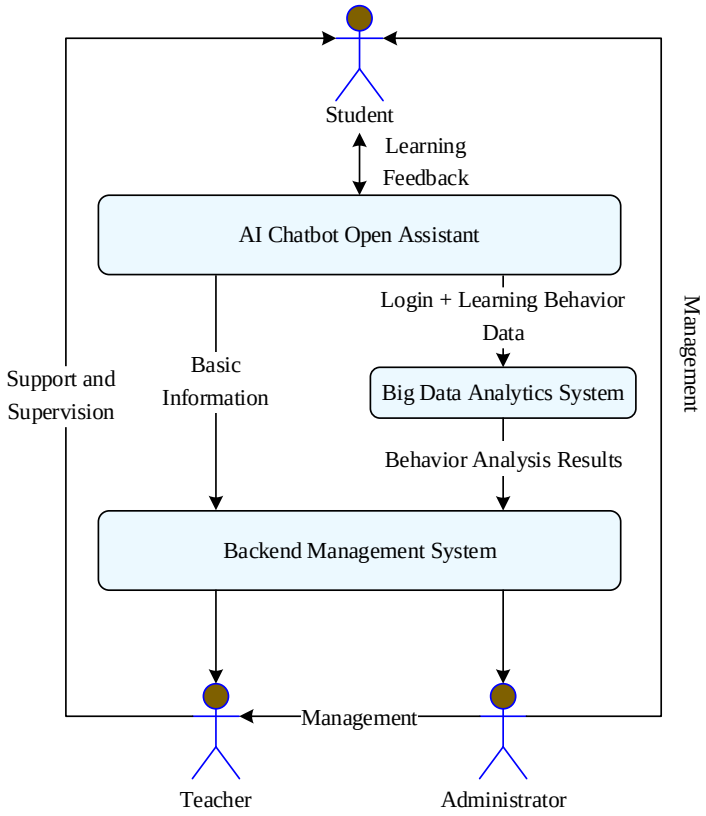

Figure 2: Overall architecture of AI chat robot learning system

(1) AI Chatbot Open Assistant

AI chatbot Open Assistant mainly provides intelligent German chat application services for students, adopting natural language processing technology to recognize the input content according to the students' input content, and providing fast and efficient feedback to the students by advancing the most relevant content according to the corpus. At the same time, the basic information of the students is sent to the background management system for easy use in data visualization, and the chat content between the students and them as well as the login information are continuously recorded and accumulated for the next big data analysis system to conduct learning behavior analysis.

(2) Big Data Analysis System

The big data analysis system mainly conducts big data behavioral analysis on the student chat data collected by Open Assistant, which mainly contains login and chat behavioral data, analyzes students' learning progress, learning habits and problems in learning, etc., and helps teachers to monitor students' progress in German academic writing and solve problems in a timely manner, so as to facilitate the monitoring of students' progress in German academic writing and to solve the problems found in time.

(3) Background Management System

The background management system mainly visualizes the basic information and behavioral information of students, teachers and administrators. The basic information of students comes from Open Assistant, and the results of learning behavior analysis come from the big data analysis system. Teachers and administrators can intuitively add, delete, change and check the data of the system through this system, or give feedback on German academic writing, which helps to improve the efficiency of teaching assistance.

3 Study design

3.1 Subjects

A pedagogical experimental study was conducted to investigate the effects of the proposed mixed feedback model of German academic writing on the improvement of learners' writing ability. The experimental subjects of this study were 100 senior non-German majors at University X. They were randomly divided into four groups of 25 students each according to four feedback modes: teacher feedback, peer feedback, AI feedback, and hybrid feedback. All 100 students had completed the study of Basic German, all were taught by the same teacher, used the same textbook, and received one-week German essay writing skills training and writing assessment training. A mock German academic writing test was given to the students before the experiment, and the test results showed no significant difference in the students' performance. It can be concluded that the subjects' German academic writing skills are generally at the same level.

3.2 Research tools

To investigate the effectiveness of the mixed feedback model, the research instrument used writing test questions for pre-test and post-test as well as a questionnaire to find out the changes in writing scores before and after the instructional experiment and students' self-assessment of their writing skills before and after the instruction.

The questionnaire consists of 30 questions and items 1-5 are planning skills, 6-10 are self-monitoring skills, 11-15 are task evaluation skills, 16-20 are descriptive-narrative skills, 21-25 are self-correction skills, and 26-30 are self-evaluation skills. The questionnaire consists of 30 questions. The questionnaire adopts a five-point Likert scoring system, which is divided into five levels from "5 = 'always'" to "1 =' never '". The higher the score, the stronger the German academic writing ability. The questionnaire items were reordered to avoid the categorized ordering inducing student responses.

3.3 Steps of the study

3.3.1 Before teaching experiments

Prior to the start of the experiment, a pre-test was administered to four groups of students, which was in the form of a propositional essay in which students were asked to complete an essay of about 5000 words. In addition the number of words in the essay, the total number of errors within 100 words, and the number of four types of errors, i.e., spelling errors, lexical errors, collocational errors, and sentence errors, were counted. Meanwhile, a questionnaire of the pre-test stage was distributed to the students in the mixed feedback group to find out the students' independent writing skills before self-testing the mixed feedback model of writing instruction, including planning, drafting, revising, and evaluating.

3.3.2 Teaching experiments

(1) Single feedback groups

Students in all 3 types of single-feedback groups were given the same writing task and were given a set amount of time to complete the first draft of their writing independently. During the marking stage, students in the teacher feedback group received traditional teacher feedback, and students completed the second draft based on the teacher's comments and revisions. Students in the peer feedback group circulated their essays individually in small groups, reviewed and revised their essays through face-to-face group discussions among group members, and then each group member completed the second draft based on the comments and revisions. Students in the artificial intelligence feedback group used an AI chatbot to discuss and review the writing articles, and then completed the second draft based on the comments. Finally, the 3 types of feedback groups submit the second draft together with the first draft to the teacher for review within the specified time.

(2) Mixed Feedback Groups

The teaching experiment of the mixed feedback group is shown in Figure 3. Stage 1: The teacher introduces the main points of this round of writing knowledge, provides learning materials such as writing knowledge points, writing skills, and analysis of example essays, introduces students to the public domain of knowledge, and stimulates students' thinking. Stage 2: Students combine what they have learned and use the AI chatbot learning system to write and complete the first draft. Teachers set up the AI chatbot learning system to intelligently evaluate the first drafts submitted by students through the dimensions of content relevance, chapter structure, sentences, word combinations, vocabulary, and fluency, etc. Students refine their papers according to the system's prompts until they are satisfied. After completing the first draft, peer-to-peer evaluation was conducted, in which students swapped papers with their group members for reading, revised their essays based on reading, reflecting, and listening to their peers' suggestions and submitted the second draft. Each group of students submits their selected masterpieces and difficult questions in preparation for class presentations. Phase 3: Each group will prepare a presentation statement of their recommended masterpieces and problems with the writing process. The teacher will summarize the round of teaching writing knowledge and skills, evaluate the students' papers, and address specific issues in the papers. Stage 4: The teacher organizes the students' papers and selects good examples (including good chapter structure, sentences, wording, etc.) as well as suggestions for revising representative errors to be sent to the students. Students read, reflect and revise their essays again to complete the third draft.

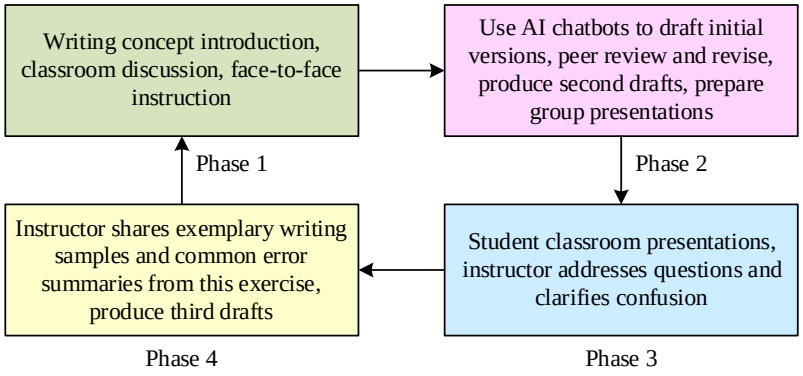

Figure 3: The teaching experiment of the mixed feedback group

3.3.3 Post-teaching experiments

At the end of one round of the teaching experiment, a post-test was administered to the students, the form of which and the evaluation indexes were exactly the same as those of the pre-laboratory test. Autonomous ability questionnaire was distributed again, and the data were processed using the Statistical Package for the Social Sciences SPSS 15.0, mainly on the total scores of the papers before and after the four-phase writing instruction, the total number of errors within 100 words, the number of spelling, vocabulary, collocation, and sentence errors, and the indicators of the writing ability to compare the changes in the writing ability of the students before and after the experiments.

4 Analysis of the results of the study

4.1 Comparison of writing scores

The learners' German academic writing performance was analyzed from four dimensions: structure, content, language, and grammar, and the statistical results of the total and individual scores of the pre-test and post-test essays were obtained by the independent samples t-test of SPSS 19.0, and the comparison of the means of the scores of the pre-test and post-test essays is shown in Fig. 4, and the results of the independent samples t-test of the four types of feedback groups are shown in Table 1. All four groups improved their papers after the writing training, which shows that the four feedback methods are useful in improving students' German academic writing skills and language ability. However, in terms of individual scores, each type of feedback had different effects on different dimensions of students' writing respectively. In the teacher feedback group, the chapter structure of the students' papers improved significantly (Sig. = 0.003 < 0.05). In the peer feedback group, the students' language expression and grammar improved significantly (Sig. = 0.004, 0.022 < 0.05). In the AI feedback group, students significantly improved in terms of article content and language expression (Sig. = 0.002, 0.009 < 0.05). In the mixed feedback group, students gained significant improvement in all four dimensions of structure, content, language, and grammar, with Sig. values less than 0.05. In terms of total scores, there was a significant difference between the pre-test and post-test German academic writing scores of the four groups of students, with the significance of the difference between the pre and post-tests of the mixed feedback group being extremely high (Sig. = 0.006 < 0.01).

In terms of scores, the four groups of students improved in both individual and total scores of German academic writing scores, and the total scores of the posttests of the teacher feedback group, the peer feedback group, the AI feedback group, and the mixed feedback group, improved by 8.40%, 9.80%, 7.67%, and 14.40%, respectively, compared with the pre-tests, and the students who used the mixed feedback instructional model had the greatest improvement in their German academic writing scores, followed by the peer feedback group.

Table 1: Independent sample t test results of 4 feedback groups

Previous test—After test(Sig. 2-tailed)				
	Teacher feedback	Peer feedback	AI feedback	Mixed feedback
Structure	0.003	0.341	0.214	0.003
Content	0.476	0.474	0.002	0.005
Language	0.297	0.004	0.009	0.004
Grammar	0.336	0.022	0.323	0.017
Total score	0.026	0.047	0.017	0.006

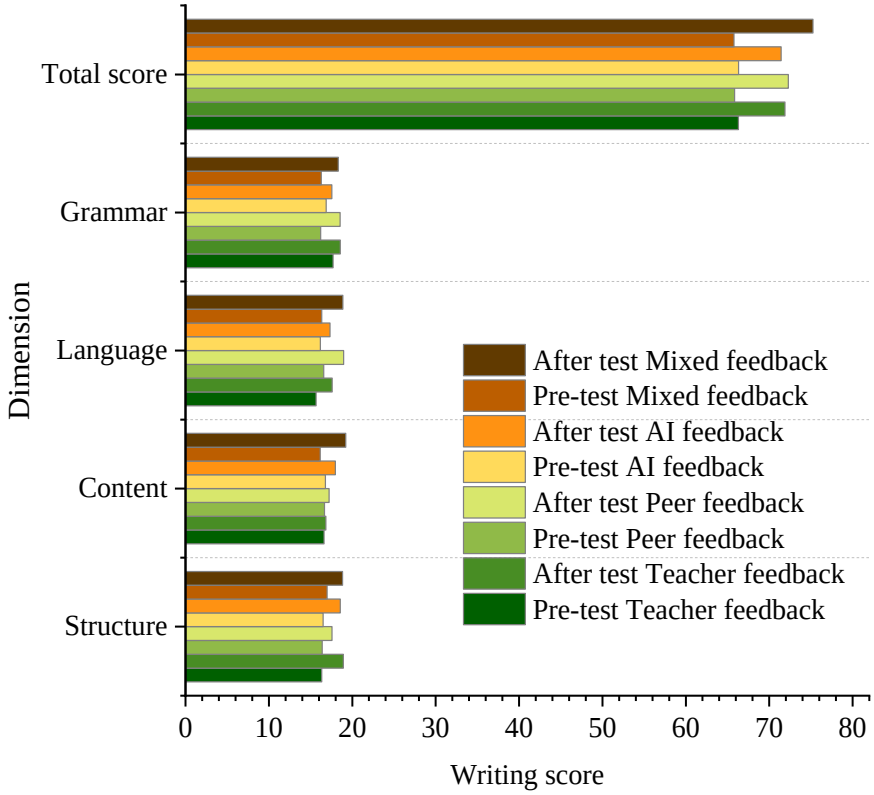

Figure 4: The average score of the previous test and the after test composition

In order to further compare the different effects of the 4 feedback modes on students' writing level, a one-way ANOVA test was conducted on the posttest scores, and the results of the one-way ANOVA test for the posttest scores are shown in Table 2.The differences between the 3 single feedback modes in terms of total scores did not reach the significant level, indicating that the 3 single feedback modes were close to each other in terms of their effects on improving students' writing level. However, there is a significant difference between all 3 single feedback modes and mixed feedback (Sig. < 0.05), and the German academic writing scores of the mixed feedback group are higher than those of the other 3 single feedback groups, which indicates that the mixed feedback mode has an effect of improving the learners' German academic writing scores.

In terms of chapter structure improvement, there is a significant difference between teacher feedback and peer feedback (Sig. = 0.039 < 0.05). In terms of article content improvement, the difference between AI feedback and the other two feedback modes is highly significant (Sig. = 0.011, 0.037 < 0.05), indicating that AI feedback has a greater advantage in expanding and enriching article content. In terms of language expression improvement, the difference between teacher feedback and peer feedback is significant (Sig. = 0.048 < 0.05). In terms of grammar improvement, the difference between AI feedback and the other two feedback methods reached a high significant level (Sig. = 0.027, 0.025 < 0.05). And in all four dimensions, there is a significant difference between the hybrid feedback mode and the other three modes (Sig. < 0.05), and the hybrid feedback mode is better than the other three feedback modes in improving the chapter layout, essay content, language expression and grammar of students' writing.

Table 2: The single factor variance test results of the after test

Dependent variable	(I) Feedback mode	(J) Feedback mode	MD (I-J)	Standard error	Sig.
Total score	Teacher feedback	Peer feedback	-0.41	-2.219	0.528
	Teacher feedback	AI feedback	0.46		0.177
	Teacher feedback	Mixed feedback	-3.36		0.029
	Peer feedback	AI feedback	0.87		0.111
	Peer feedback	Mixed feedback	-2.95		0.035
	AI feedback	Mixed feedback	-3.82		0.019
Structure	Teacher feedback	Peer feedback	1.35	0.629	0.039
	Teacher feedback	AI feedback	0.36		0.295
	Teacher feedback	Mixed feedback	0.09		0.016
	Peer feedback	AI feedback	-0.99		0.159
	Peer feedback	Mixed feedback	-1.26		0.031
	AI feedback	Mixed feedback	-0.27		0.025
Content	Teacher feedback	Peer feedback	-0.39	0.732	0.303
	Teacher feedback	AI feedback	-1.15		0.011
	Teacher feedback	Mixed feedback	-2.39		0.023
	Peer feedback	AI feedback	-0.76		0.037
	Peer feedback	Mixed feedback	-2.00		0.006
	AI feedback	Mixed feedback	-1.24		0.003
Language	Teacher feedback	Peer feedback	-1.38	0.664	0.048
	Teacher feedback	AI feedback	0.25		0.247
	Teacher feedback	Mixed feedback	-1.29		0.014
	Peer feedback	AI feedback	1.63		0.321
	Peer feedback	Mixed feedback	0.09		0.009
	AI feedback	Mixed feedback	-1.54		0.005
Grammar	Teacher feedback	Peer feedback	0.01	0.742	0.576
	Teacher feedback	AI feedback	1.00		0.027
	Teacher feedback	Mixed feedback	0.23		0.014
	Peer feedback	AI feedback	0.99		0.025
	Peer feedback	Mixed feedback	0.22		0.004
	AI feedback	Mixed feedback	-0.77		0.002

4.2 Changes in writing fluency

The length of the article written within the specified time is positively correlated with writing fluency, and writing fluency can reflect the writing level. Using the paired-samples t-test, the writing fluency pairs of the pre-test and post-test are shown in Figure 5.The pre and post-test German academic writing fluency of the three single-feedback groups improved, but there was no significant difference ($p > 0.05$). The mean difference between the pre-test and post-test writing fluency of the mixed feedback group was 24.38, and the overall improvement was 20.98%, $p=0.012 < 0.05$, which is a significant difference, and the writing instruction of the mixed feedback model can improve students' German academic writing fluency.

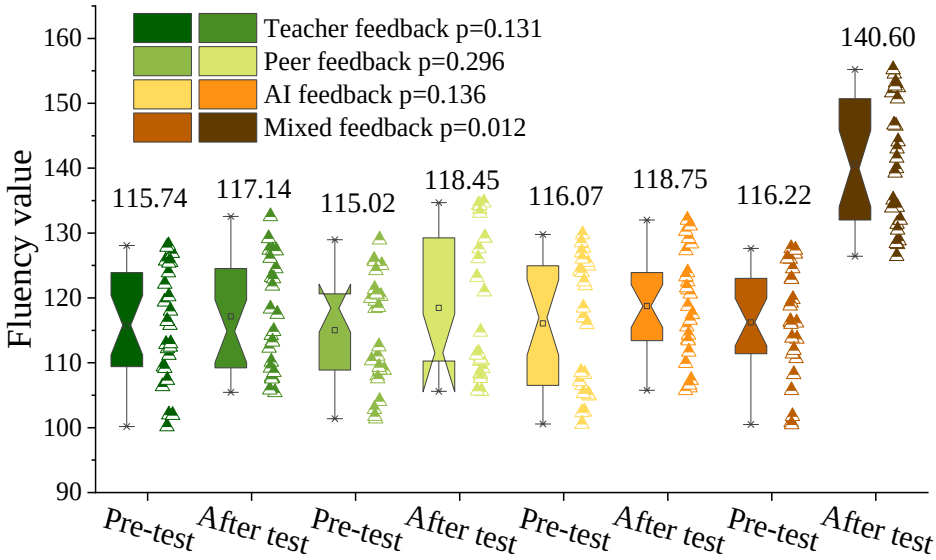

Figure 5: The fluency comparison of the previous test and the after test

4.3 Changes in writing accuracy

By comparing the number of errors per unit word count (100 words), i.e., the frequency of errors per 100 words. The results of the comparison of pre-test and post-test writing accuracy using a paired samples t-test are shown in Figure 6. The difference between the mean values of pre-test and post-test writing accuracy in the mixed feedback group was 7.43, i.e., the frequency of errors per 100 words was reduced by 33.32%, $P = 0.008 < 0.05$, and writing accuracy was significantly improved. It can be seen that the mixed feedback model of writing instruction can significantly improve writing accuracy. And although the writing accuracy of the teacher feedback group, the peer feedback group and the AI feedback group all had some improvement, there was no significant difference.

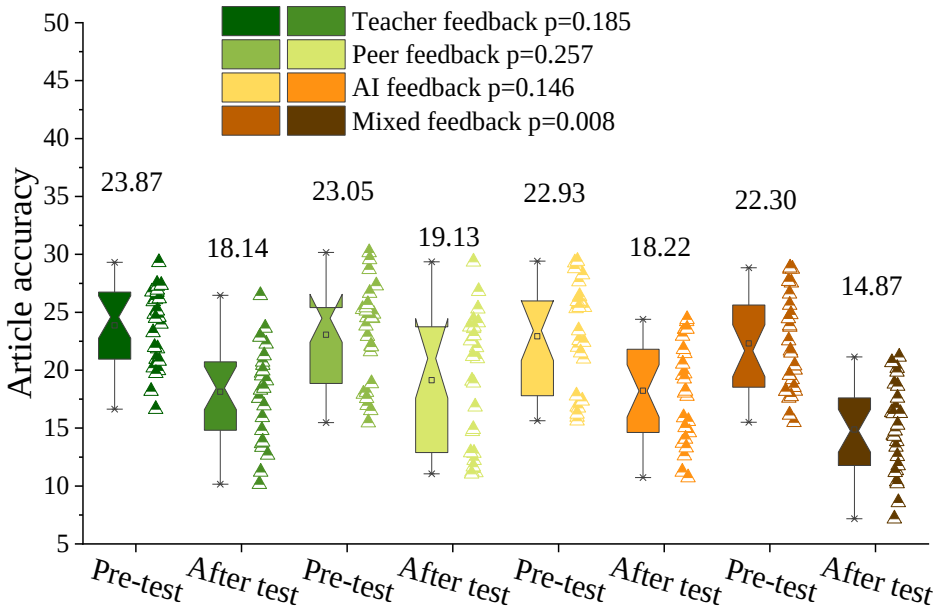

Figure 6: The article accuracy comparison of the previous test and the after test

4.4 Improvement of writing skills

Based on the questionnaires conducted before and after writing instruction in the mixed-feedback model, the descriptive statistics and t-tests of German academic writing skills are shown in Table 3. The mean values of the six competency dimensions of students' essay writing ability in the post-test questionnaire, i.e., planning ability, self-monitoring ability, task evaluation ability, descriptive-narrative ability, self-correcting ability, and self-assessment ability (3.567, 3.856, 3.255, 3.306, 3.552, and 3.703) were higher than the performances in the pre-test questionnaire (2.662, 2.792, 2.382, 2.538, 2.821, and 2.432), and the posttest questionnaire improved by 35.91% in terms of overall score. In addition, the t-test further showed that the p-values of all six competency dimensions were below 0.05, reflecting that these six competency dimensions had statistically significant differences in the pre- and post-test questionnaires. This suggests that the mixed-feedback model of writing instruction helps to help improve learners' writing ability and realize the sustainable development of German academic writing learning.

Table 3: Descriptive statistics and t tests of German writing ability

	Pre-test questionnaire		After test questionnaire		t Statistic	P value
	Mean	Variance	Mean	Variance		
Planning ability	2.662	1.357	3.567	0.599	-0.795	0.034
Self-monitoring ability	2.792	0.357	3.856	0.224	1.503	0.026
Task evaluation ability	2.382	0.672	3.255	0.316	0.238	0.024
Descriptive ability	2.538	1.374	3.306	0.454	-0.528	0.015
Self-correcting ability	2.821	0.594	3.552	0.401	1.395	0.031
Self-evaluation ability	2.432	0.137	3.703	0.247	0.061	0.018

5 Conclusion

German academic writing feedback is an important part of writing teaching, based on the needs of academic writing ability cultivation, this paper constructs a German academic writing hybrid model, which integrates multiple opinions such as teacher feedback, peer feedback and AI feedback to realize online and offline writing teaching and communication. Meanwhile, an AI chatbot learning system is proposed based on AI feedback.

In order to investigate the role of this hybrid model on German academic writing learning, senior non-German majors of a university were selected to conduct teaching experiments. Different feedback modes have different effects on different aspects of students' writing, respectively. The post-test writing scores of the hybrid feedback mode are significantly different from the pre-test scores at the 1% level, and the total score of the scores is improved by 14.40%, which is higher than that of the other three single-feedback groups. It indicates that the hybrid feedback model proposed in this paper improves learners' German academic writing scores better than the separate feedback model. Writing fluency and writing accuracy increased by 20.98% and 33.32% from the preexperiment, and there was a significant difference between the pre- and post-tests. In addition, students in the mixed-feedback group showed significant development in planning, self-monitoring, task evaluation, illustrative-narrative, self-correction, and self-evaluation skills. Therefore, it can be assumed that the hybrid feedback model combining teacher, peer and AI has an enhancing effect on learners' writing ability.

Accordingly, a flexible and diverse feedback mechanism should be established in the teaching of German students' writing to give full play to the superiority of the hybrid feedback

mode, to truly form a good writing teaching atmosphere of cooperation and mutual assistance, teaching and learning, and to fundamentally stimulate students' subjective initiative and creativity in learning, so as to effectively improve students' writing proficiency and comprehensive application of language skills.

Funding

This study was supported by The Ministry of Education's Project for Collaborative Education and Industry Cooperation “Intelligent Technology-Empowered German Language Practice Teaching and Skills Development Base Construction Project” (241101359270630).

About the Author

Haopin Luo was born in Wuhan, Hubei Province, P.R. China, in 1988. She obtained a Master of Arts from the Technische Universität Dresden, Germany. She is a lecturer at the School of International Exchange of Wuhan Business University. Her main research interests include German language and literature, German language teaching, and Sino - foreign cooperative education.

References

[1] Paetsch, J., & Heppt, B. (2021). Teaching German as a second language: Implications for teacher education in Germany. In Quality in Teacher Education and Professional Development (pp. 253-267). Routledge.

[2] Ferreira, M. A. V., & Gondar, A. F. (2024). Knowledge in German as a Foreign Language Teachers' Initial Education. Tools, Techniques and Strategies for Reflective Second & Foreign Language Teacher Education: Insights from Contexts Around the World, 145.

[3] Renau, M. (2016). A review of the traditional and current language teaching methods. International Journal of Innovation and Research in Educational Sciences, 3(2), 82-88.

[4] Betz, E. M., & Huth, T. (2014). Beyond grammar: Teaching interaction in the German language classroom. Die unterrichtspraxis/Teaching german, 47(2), 140-163.

[5] Finkbeiner, C., Olson, A. M., & Friedrich, J. (2013). Foreign language learning and teaching in Germany: A review of empirical research literature from 2005 to 2010. Language Teaching, 46(4), 477-510.

[6] Bin Saran, A. A. (2024). Effect of teaching strategies on students’ German writing skills at Saudi international schools. Saudi Journal of Language Studies, 4(1), 47-68.

[7] Müller, N., Lindefjeld, K. A., & Busse, V. (2021). Underlying beliefs about writing and teaching writing in Germany: An analysis of policy documents for German in Year 9 at secondary school. In International Perspectives on Writing Curricula and Development (pp. 123-146). Routledge.

[8] Li, B., Tan, Y. L., Wang, C., & Lowell, V. (2025). Two years of innovation: A systematic

review of empirical generative AI research in language learning and teaching. Computers and Education: Artificial Intelligence, 100445.

[9] Nuri, A. (2025). Innovative Strategies for Teaching English to University Students: A Global Perspective. EuroGlobal Journal of Linguistics and Language Education, 2(2), 39-45.

[10] Ariyati, D., & da Silva, A. M. (2025). CHALLENGES AND STRATEGIES IN WRITING ENGLISH ACADEMIC PAPERS: A GRADUATE STUDENT'S SELF-REFLECTION. IJIET (International Journal of Indonesian Education and Teaching), 9(2), 457-469.

[11] Sihombing, M., & Napitupulu, S. (2025). Enhancing the English writing skill through active reading in English teaching. Innovative: Journal Of Social Science Research, 5(1), 1428-1440.

[12] Sayyad, J., & Attarde, K. (2025). Synergizing Nanotechnology and Artificial Intelligence for Society 5.0 Advancement Through Intelligent Systems. In NanoMind: Exploring Synergies in Nanotechnology and Machine Learning (pp. 225-249). Cham: Springer Nature Switzerland.

[13] Yadav, U., & Shrawankar, U. (2025). Artificial intelligence across industries: A comprehensive review with a focus on education. AI applications and strategies in teacher education, 275-320.

[14] Li, Y. (2023). Innovation and Practice of College Education Technology Work in the Era of Education Informatization 2.0. The Educational Review, USA, 7(10).

[15] Long, T. (2024). Smart classroom in the era of education informatization 2.0. Int. J. Educ. Hum, 12(2), 279-282.

[16] Kim, T. W. (2023). Application of artificial intelligence chatbots, including ChatGPT, in education, scholarly work, programming, and content generation and its prospects: a narrative review. Journal of educational evaluation for health professions, 20, 38.

[17] Zhen, Y., Shi, S., Wang, W., & Wang, G. (2022). Construction of Teacher-Student Interaction Evaluation Index System for High School Mathematics Concept Assimilation Learning Based on Artificial Intelligence. In Artificial Intelligence in Education and Teaching Assessment (pp. 125-148). Singapore: Springer Singapore.

[18] Muñoz-Basols, J., Neville, C., Lafford, B. A., & Godev, C. (2023). Potentialities of applied translation for language learning in the era of artificial intelligence. Hispania, 106(2), 171-194.

[19] Mudhsh, B. A., Muqaibal, M. H., Al-Maashani, S., & Al-Raimi, M. (2025). Utilization of artificial intelligence tools in fostering English grammar and vocabulary among Omani EFL learners. World, 15(5).

[20] Nazir, A., & Wang, Z. (2023). A comprehensive survey of ChatGPT: advancements, applications, prospects, and challenges. Meta-radiology, 1(2), 100022.

[21] Baskara, R. (2023). Exploring the implications of ChatGPT for language learning in higher education. Indonesian Journal of English Language Teaching and Applied Linguistics, 7(2), 343-358.

[22] Balcı, Ö. (2024). The role of ChatGPT in English as a foreign language (EFL) learning and teaching: A systematic review. International Journal of Current Educational Studies, 3(1), 66-82.

[23] Xue, Q., & Li, H. (2024, November). Human-Machine Symbiosis in action: Innovation of Foreign Language Teaching Mode in Higher Education Empowered by ChatGPT. In Proceedings of the 2024 7th International Conference on Educational Technology Management (pp. 166-172).

[24] Zhang, F. (2023). Design and application of an automatic scoring system for english composition based on artificial intelligence technology. International Journal of Advanced Computer Science and Applications, 14(8).

[25] Chandrakant, N. S. M. (2025). AI-powered teaching assistants: Enhancing educator efficiency with NLP-based automated feedback systems. International Journal of Science and Research Archive, 14(3), 009-018.

[26] Castro, G. P. B., Chiappe, A., Rodríguez, D. F. B., & Sepulveda, F. G. (2024). Harnessing AI for Education 4.0: Drivers of Personalized Learning. Electronic Journal of e-Learning, 22(5), 1-14.