

A Review of Empirical Studies on Second Language Writing Feedback in the Background of AI (2014 - 2024)

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Abstract: This review study, with the retrieval scope covering SSCI- and CSSCI-indexed journals, comprehensively analyzes the empirical studies on second language (L2) writing feedback in the context of artificial intelligence (AI) published between 2014 and 2024. It focuses on the impacts of automated evaluation systems, peer review, teacher feedback, and human-machine hybrid feedback on the quality of L2 writing. The research findings suggest that AI technology can significantly improve the effectiveness of writing instruction. However, it has limitations in understanding context and performing logical reasoning. There is a lack of long-term follow-up studies, making it difficult to fully evaluate the long-term impacts of AI feedback on the development of learners' writing abilities. Future research needs to specifically address these issues to promote the in-depth development and effective application of AI technology in L2 writing teaching.

1. Introduction

With the continuous development and popularization of artificial intelligence (AI) technology, its application in the field of education has become increasingly widespread. Particularly in second - language writing instruction, writing feedback in the context of AI has emerged as one of the current research hotspots^[1]. In recent years, a growing number of scholars have turned their attention to the application of AI technology in second - language writing feedback and conducted numerous empirical studies. These studies not only reveal the potential and advantages of AI technology in second - language writing feedback but also provide valuable insights for our further understanding of the application of AI technology in the educational field. Additionally, with the acceleration of globalization and the increase in cross - national exchanges, second - language writing has become an important component of the education systems in many countries and regions^[2]. However, traditional second - language writing feedback methods often suffer from problems such as untimely feedback, single - dimensional feedback content, and limited feedback effectiveness, which are difficult to meet the current needs of second - language writing instruction. Therefore, exploring new feedback methods to improve the quality and efficiency of second - language writing instruction has become an important topic in current second - language writing research. The introduction of AI technology offers new possibilities and solutions for second - language writing feedback. This paper aims to comprehensively present the research status and development trends in this field by reviewing empirical studies on second - language writing

feedback in the context of AI, providing reference for future research. At the same time, it can also uncover the potential and advantages of AI technology in second - language writing feedback, offering useful inspiration for the reform and innovation of second - language writing instruction. Moreover, by summarizing different research topics, research methods, and main findings, this paper can provide practical guidance and theoretical support for educators and researchers, promoting the in-depth development of research on second - language writing feedback in the context of AI.

2. Overall Research Status

In the past decade, empirical research on second - language writing feedback in the context of AI has witnessed a booming development. In terms of the quantity of research, the number of relevant research papers has been increasing year by year, showing a steady growth trend. Regarding research topics, the research content covers various aspects such as automated essay evaluation systems, peer review, teacher feedback, and human - machine hybrid feedback, forming a diversified research pattern. Concerning research methods, empirical research mostly adopts experimental designs, comparative analyses, and questionnaire surveys. By collecting and analyzing students' writing works, feedback records, and questionnaire data, researchers explore the impact of different feedback modes on the quality of second - language writing.

Specifically, as one of the important applications of AI technology in second - language writing feedback, the automated essay evaluation system has received extensive attention^[3]. Relevant research mainly focuses on aspects such as the feedback effectiveness, advantages and disadvantages, and improvement suggestions of the automated essay evaluation system^[4]. Peer review and teacher feedback, as traditional second - language writing feedback methods, have also been newly studied and explored in the context of AI. Relevant research mainly focuses on aspects such as their application effectiveness, advantages and disadvantages, and comparative analysis in the context of AI. In addition, human - machine hybrid feedback, as a new feedback method that combines AI technology with teacher feedback, has also received increasing attention and research.

Overall, significant progress and achievements have been made in empirical research on second - language writing feedback in the context of AI in the past decade. However, there are still some problems and challenges in this field. For example, how to effectively integrate different feedback modes to achieve complementary advantages; how to provide personalized feedback for students with different levels and needs; how to further enhance students' feedback literacy, etc. These issues require further in - depth exploration and resolution in future research.

3. Classification of Research Topics

3.1 Validation of the Effectiveness of AI Writing Feedback Tools

A large number of studies are dedicated to examining the actual effects of various AI writing feedback tools. Wang Lina's^[5] meta - analysis integrated 25 related studies, strongly demonstrating that the feedback from the automated essay evaluation system has a medium - effect size and can effectively promote English writing instruction. Huang Xiaoting et al.'s^[6] research shows that large language models perform outstandingly in English writing scoring and feedback, and the quality of their feedback has been recognized by the expert group, providing a new teaching aid for teachers in areas with weak educational resources. These studies provide solid theoretical support for the wide application of AI writing feedback tools in teaching practice.

3.2 Comparison and Integration of Different Feedback Methods

3.2.1 Comparative Studies between Teacher Feedback and AI Feedback

Comparative studies between teacher feedback and AI feedback have been one of the hot topics in this field in recent years. Such studies mainly explore the differences and complementarities between teacher feedback and AI feedback in enhancing students' writing abilities.

(1) Comparison of Feedback Effects.

Some studies indicate that both teacher feedback and AI feedback have their respective advantages in improving students' writing abilities. For example, Liu Yuanbo and Xie Yue^[7] compared the effects of ChatGPT and teacher feedback in English writing instruction and found that ChatGPT has advantages in grammar correction, vocabulary replacement, etc., while teacher feedback is more authoritative in explaining language problems and providing revision suggestions.

(2) Cultivation of Feedback Literacy.

There are also differences between teacher feedback and AI feedback in cultivating students' feedback literacy. Some studies have found that AI feedback can improve students' abilities to process feedback, accept feedback, and provide content - modification suggestions, while teacher feedback can improve students' abilities to seek feedback and explain language problems. For instance, Wu Yong and Ren Peiling^[1] compared the impacts of online peer review and teacher feedback on students' second - language writing feedback literacy and found that both feedback methods can improve students' abilities to regulate learning and explain content - related problems, but teacher feedback is more effective in improving students' abilities to seek feedback and explain language - form problems.

(3) Effect of Combined Use.

Combining teacher feedback with AI feedback can give full play to the advantages of both and improve the effectiveness of writing instruction. Some studies suggest that the combined use of the two methods can significantly enhance students' writing levels. For example, teachers can first use AES (Automatic Essay Scoring) to preliminarily grade students' essays, and then combine students' essays and AES feedback for manual grading and commentary, providing students with more comprehensive and detailed feedback.

3.2.2 Research on the Combination of Online Peer Review and AI Feedback

Research on the combination of online peer review and AI feedback has been one of the new trends in this field in recent years^[8-10]. Such studies mainly explore the synergistic effects of online peer review and AI feedback in enhancing students' writing abilities.

(1) Analysis of Synergistic Effects

Online peer review and AI feedback have synergistic effects in improving students' writing abilities. Some studies have found that the combined use of the two can significantly improve students' writing levels. For example, Luo Beigang and Zhao Ling^[11] conducted a practical study on the "automatic + peer - to - peer interaction" integrated writing feedback model and found that this model can improve students' writing scores and writing abilities.

(2) Enhancement of Feedback Literacy

The combined use of online peer review and AI feedback is also conducive to enhancing students' feedback literacy. Some studies show that during the process of participating in online peer review and receiving AI feedback, students can gradually learn skills such as how to process feedback, accept feedback, and provide revision suggestions. The improvement of these skills helps students make more effective use of feedback resources in future writing.

(3) Exploration of Influencing Factors

The combined use effect of online peer review and AI feedback is affected by various factors. Some studies have found that factors such as students' writing levels, feedback literacy, and learning attitudes will affect the combined use effect of online peer review and AI feedback. Therefore, in actual teaching, teachers need to fully consider students' individual differences and feedback needs to provide more personalized and effective feedback methods.

4. Research Methods and Tools

4.1 Extensive Application of Empirical Research Methods

Empirical research methods dominate this field, with experimental research and survey research being particularly common. Liu Shujun et al.^[12] adopted a single - group pre - test and post - test quasi - experimental research method to rigorously verify the multiple positive impacts of intelligent essay feedback on middle - school writing instruction. Tian Lili and Zhou Yu^[13] used a wealth of students' essay manuscripts and feedback comments as corpus to deeply explore the absorption process of students' multiple feedback in an online course environment, providing valuable empirical evidence for optimizing the feedback mechanism of online writing instruction. The application of these empirical research methods ensures the scientificity and reliability of research results.

4.2 Diverse Data Collection Methods

To comprehensively obtain research data, researchers comprehensively use a variety of data collection methods. In addition to the traditional analysis of students' writing samples, questionnaire surveys and interviews are also widely used. Xie Bing and Gao Ying^[14] collected data by developing a scale, deeply analyzing the composition of students' online peer - feedback learning input in English writing, and providing an effective measurement tool for subsequent research. Diverse data collection methods complement each other, enabling research to deeply explore relevant issues of second - language writing feedback in the context of AI from multiple perspectives.

4.3 Comprehensive Application of Multiple Writing Feedback Tools

The research involves various types of writing feedback tools, including Pigaiwang, iWrite writing teaching and assessment system, large language models, etc. Wang Xin and Li Qinqing^[15] used the iWrite system to deeply explore the impact of the online multiple - feedback model on academic English writing, providing a useful reference for academic English writing teaching. Wei Shuang and Li Luyao^[16] took ChatGPT as the research object and analyzed its advantages and disadvantages in second - language writing feedback in detail, providing practical suggestions for teachers on the rational application of ChatGPT. The use of different feedback tools broadens the research perspective and enriches the research content.

5. Findings

Through an in - depth analysis of 25 related papers from 2014 to 2024, this study has obtained a series of valuable findings in the field of empirical research on second - language writing feedback in the context of AI.

In terms of research topics, a rich and diverse situation is presented. On the one hand, many studies focus on exploring the effectiveness of AI writing feedback tools. For example, some

studies have confirmed that the automated essay evaluation system has a positive effect on improving writing levels, and language models such as ChatGPT have shown significant advantages in grammar correction, structure optimization, and providing personalized feedback, providing strong assistance to learners and teachers. On the other hand, there are abundant research results on the comparison of different feedback methods. Researchers have widely explored the differences and complementarities between AI feedback and traditional teacher feedback and peer feedback, clarifying their unique values and effective combination models, providing key bases for the selection and integration of feedback strategies in teaching practice. At the same time, some studies have also deeply analyzed the impacts of various factors on writing abilities, covering multiple aspects such as learners' learning motivation, learning strategies, and learning environment, further revealing the complex mechanism of second - language writing ability improvement.

Regarding research methods and tools, empirical research dominates, with experimental research and survey research methods being widely applied, strongly guaranteeing the scientificity and reliability of the research. For example, through carefully designed experiments, variables are strictly controlled, and the writing performance of learners under different feedback conditions is compared to accurately evaluate the actual effects of various feedback methods. At the same time, researchers comprehensively use a variety of data collection methods, such as the analysis of students' writing samples, questionnaire surveys, and interviews, to obtain research data from multiple perspectives, avoiding the limitations of a single data source. In addition, diverse writing feedback tools, such as Pigaiwang, iWrite writing teaching and assessment system, and emerging large language models, are widely used in research, greatly expanding the breadth and depth of research.

However, the research also has certain limitations. First, some studies have design flaws. The experimental cycle is too short to comprehensively capture the long - term impact of AI writing feedback, and the sample selection lacks broad representativeness, mostly concentrating on specific age or learning - level student groups. For example, Zhang Hua^[17] pointed out that a short experimental process may lead to deviations in research results, making it impossible to accurately evaluate the long - term impact of feedback methods on writing abilities. Insufficient sample representativeness is also a common problem. Most studies focus on college or middle - school students, ignoring the differences of other age groups or learning groups, limiting the universality and generalizability of research results. Second, in terms of research tools, although AI writing feedback tools are constantly developing, there are still many deficiencies. For example, some tools have limited capabilities in understanding complex contexts and conducting in - depth logical reasoning, affecting the accuracy and effectiveness of feedback. As Wei Shuang and Li Luyao^[14] pointed out, ChatGPT has certain problems in logical reasoning, metaphor understanding, and context comprehension, affecting the accuracy and effectiveness of feedback. Some automated evaluation systems are not accurate enough in discourse content and structure analysis, unable to meet learners' needs for in - depth writing guidance. These limitations of the tools to some extent restrict the in - depth development of research and the reliability of research conclusions. Third, the lack of long - term follow - up research is also a significant issue. This makes us lack sufficient understanding of the long - term dynamic changes of AI feedback in the development process of learners' writing abilities, which is not conducive to accurately grasping its action laws, and thus it is difficult to formulate scientific and long - term teaching strategies^[18-20].

In summary, although remarkable achievements have been made in empirical research on second - language writing feedback in the context of AI in the past decade, continuous improvement is still needed in subsequent research to promote the sustainable and healthy development of this field, providing more solid theoretical support and practical guidance for second - language writing instruction.

6. Conclusion

This review deeply analyzes the empirical research on AI in the field of second - language writing feedback from 2014 to 2024, revealing the significant progress in this field over the past decade. The application and verification of AI writing feedback tools, as well as the comparative research on different feedback methods, have provided valuable references for teaching practice, and research methods have become more diverse and scientific. However, the research has limitations, including imperfect designs, tool limitations, and the lack of long - term follow - up research. Future research needs to optimize the AI feedback system, expand the research scope, deepen the collaboration between teachers and AI, and pay attention to ethical issues to promote the continuous development of AI in second - language writing feedback, support learners in improving their writing abilities, and adapt to global multicultural exchanges. This review provides researchers and educators with an overview of the research status, aiming to guide future research directions and promote the innovative development of second - language writing teaching and research in the AI era. Facing challenges such as how to integrate feedback modes, provide personalized feedback, and enhance students' feedback literacy, future research should strengthen interdisciplinary cooperation, pay attention to cultural differences, and conduct large - scale long - term empirical research to ensure the reliability and effectiveness of research results, thus enriching the application of AI in the field of second - language writing feedback.

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