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Enhancing ESL Writing through Artificial Intelligence: Improving Linguistic Complexity and Integrated Skill Development

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Abstract: In recent years, with the in-depth development of globalization, the importance of English as an international language has become increasingly prominent. However, those who learn English as a second language (ESL), often face challenges such as lack of language complexity and difficulty in improving their language and writing ability simultaneously. To solve this problem, this study focuses on applying artificial intelligence (AI) technology in ESL writing teaching. It discusses its potential to improve learners' language complexity and realize comprehensive ability development. Through a systematic review of existing research, this study analyzes the role of AI tools in ESL writing teaching. The research object is ESL learners, and the research data comes from academic literature in related fields. The theoretical framework includes language complexity definition and interactive feedback theory. The results show that artificial intelligence technology effectively improves learners' syntactic complexity and lexical diversity through personalized feedback and language template support. In addition, the mixed teaching mode combined with teacher guidance can optimize the learning effect and promote the common development of language ability and writing ability. The significance of this study is to provide theoretical support for ESL writing teaching and practical enlightenment for the application of artificial intelligence in the field of education. This achievement not only helps to enhance learners' academic and professional competitiveness but also promotes the innovative development of language teaching.

Keywords: ESL Writing, Artificial Intelligence, Linguistic Complexity, Blended Teaching Model

1. Introduction

In the context of globalization, English, as the global language of communication, has gradually become the key to personal development. It can not only help individuals obtain more educational and career opportunities but also promote cross-cultural understanding, making people more competitive and influential in a diversified society and a rapidly changing world. However, current ESL learners are faced with many challenges in second language writing, including the difficulty of improving their language ability and writing ability simultaneously, and the limitation of language complexity. Research shows that in China, the real problem of second language learners is "one hand hard and one hand soft", which is manifested in the ability to know all the questions in grammar tests

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and make every sentence wrong in compositions [1]. In addition, students' linguistic complexity, such as syntactic and global complexity, is influenced by their first language (L1) cultural background. For example, the overall complexity of ESL learners' performance in English writing is between that of native speakers (NS) and EFL learners, which may be due to their high emphasis on English education and diverse practices to enhance the use of English [2].

Effective feedback, such as teacher feedback, can ameliorate this problem. And plays a key role in the teaching of writing. However, at present, most of the feedback focuses on grammar correction, ignoring the need for the common development of writing ability and language ability in genre learning. This deficiency prevents students from improving their language ability in real contexts. In addition, with the rapid development of technology, the potential of artificial intelligence (AI) in personalized learning support is receiving increasing attention. AI technology can help overcome barriers to traditional teaching by providing students with customized instruction based on their abilities and needs through intelligent writing tools or automated feedback systems.

Therefore, this study takes the practical difficulties ESL learners face in writing as the starting point, systematically combs the relevant theoretical and practical achievements, and discusses two key issues in the application of artificial intelligence technology to ESL writing teaching: (1) How does artificial intelligence help ESL learners improve the language complexity in writing? This question focuses on the role of AI technology in identifying and correcting students' language errors, and optimizing syntactic structures and vocabulary use. At the same time, it explores how AI can enhance the level of language complexity by providing high-level language expression templates and supporting students to imitate and internalize complex language structures. (2) How does artificial intelligence technology help ESL learners achieve the common development of language ability and writing ability?

This problem focuses on how the combination of AI technology and teacher feedback can meet the individual needs of students through a mixed teaching model. The study will evaluate AI's contribution to instant feedback, interactive learning, and automated scoring, and analyze its effect on improving the overall development of language and writing skills. Before the discussion, it is necessary to establish a common understanding with the reader that the so-called "key" questions are the research questions that can participate in the academic conversation. The significance of this study is that it can not only provide theoretical support for ESL writing teaching but also provide more enlightenment for the application of artificial intelligence in the field of education. This will lay the foundation for enhancing learners' academic and professional competitiveness while promoting the innovation and development of language teaching methods.

2. Theoretical Basis

With the application of artificial intelligence in the field of second language acquisition as the theoretical core, this study combined the relevant theories of language complexity and writing ability development to explore how to improve ESL learners' language performance in writing through artificial intelligence technology. Firstly, Kolmogorov's definition of language complexity is proposed, that is, the length of the shortest description that can reproduce the sample text [2], because its metric has a significant effect in distinguishing the level of learners [3]. Secondly, the interactive feedback theory points out that feedback is the key to learning and teaching [4], and the learning effect can be significantly improved through instant and personalized feedback, which is exactly the field where AI technology has advantages in language teaching. Thirdly, by combining genre-based teaching methods and TBLT, we study how AI can promote the co-development of language ability and writing ability. These theoretical frameworks not only lay the analytical foundation for this study but also provide a multi-layered perspective for exploring the potential of AI technology in education. By systematically reviewing the existing literature, this study will reveal how AI technology plays a

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role in enhancing language complexity, providing efficient feedback, promoting comprehensive development of competence, and providing theoretical support for innovation in second language writing teaching.

3. Analysis of the Support and Influence of AI on ESL Learners in the Learning.

3.1. Increase Language Complexity

Linguistic complexity is generally considered to consist of a series of substructures, including vocabulary, interaction, proposition, and various types of grammatical complexity [5], of which syntactic complexity is the focus of researchers [6]. This is because a large number of cross-sectional studies have confirmed that the overall level and writing quality of second language learners can be largely reflected by syntactic complexity measures [7]. According to the 14 measures provided in the L2 Syntactic Complexity Analyzer (L2SCA) [8], you can start with the length of the production unit, amount of subordination, amount of coordination, degree of phrasal sophistication, and overall sentence complexity as five dimensions to measure syntactic complexity [9].

Artificial intelligence technology has significant advantages in improving the language complexity of ESL learners' writing. First, AI tools can efficiently identify and correct learners' language errors. For example, Grammarly, founded in 2009 by Alex Shevchenko, Max Lytvyn, and Dmytro Lider, analyzes a learner's writing using natural language processing (NLP) techniques to provide suggestions on spelling, grammar, and style. In this way, syntactic and lexical complexity can be improved [10]. Not only that, but also through immediate feedback, learners can strengthen the correct use of language in repeated practice. Second, AI systems provide opportunities for learners to imitate and internalize by demonstrating high-level language expressions within a given situation. Research has shown that ChatGPT can provide a wide range of context-specific writing aids, such as idea generation, overview, content improvement, organization, editing, proofreading, and post-writing reflection [11]. This approach not only helps learners understand complex structures but also gradually develops their ability to use them. Furthermore, studies have shown that learners can significantly improve their language complexity when practicing with AI-assisted language input and output. Automated scoring systems such as ETS Criterion assess the quality of learners' compositions in multiple dimensions, providing feedback on syntactic complexity, lexical diversity, and content organization [12], which can help learners improve their writing skills in an all-round way. Finally, AI can analyze historical data of learners to identify weaknesses in their language learning and provide targeted support. For example, AI tools can dynamically adjust the difficulty of language tasks to ensure effective learning within the "zone of proximal development" (ZPD) [13]. It is worth mentioning that the improvement of language complexity is not only reflected in the improvement of individual writing ability but also has a profound impact on the cultivation of cross-cultural communication ability. By mastering a more complex syntax and vocabulary, learners can express ideas more accurately and be more competitive in academic and professional fields. This also provides a new research direction for combining AI technology with cultural teaching in the future.

To sum up, the core position of language complexity in writing teaching is further highlighted, and artificial intelligence technology provides unprecedented possibilities for improving the language complexity of ESL learners. Future research and teaching practices could explore in greater depth how AI tools can be used to design personalized learning paths to achieve comprehensive development of language ability and writing ability.

3.2. Achieve the Common Development of Language Ability and Writing Ability

Artificial intelligence technology has significant advantages in the co-development of ESL learners' language ability and writing ability. In contrast, traditional methods of teaching English writing, such

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as classroom explanation and teacher correction, help students develop basic writing skills but often fail to meet individual needs. These approaches are difficult to meet students' unique needs and subtle differences in writing development [13]. This limitation creates favorable conditions for AI to be combined with the guidance of English teachers, by providing timely technical support as well as interactive feedback to improve students' writing ability and language ability co-development. This kind of collaborative development is not only reflected in the improvement of language skills but also reflected in the learners' overall grasp of the writing task.

First of all. The combination of artificial intelligence and English teacher guidance can realize the common development of students' language ability and writing ability. Research shows that artificial intelligence (AI) is able to provide detailed and clear feedback quickly, while English teachers can further answer students' questions and provide personalized guidance through interactive tutoring. This hybrid model not only leverages the technical advantages of AI feedback, such as precision and efficiency, but also combines the emotional support of teacher interaction and the opportunity for oral practice, thus creating a comprehensive learning experience for students [14]. Secondly, artificial intelligence technology promotes the co-development of learners' language ability and writing ability by setting a scoring system. Studies have shown that automated systems that provide instructional feedback along multiple dimensions of essay quality, such as criterion have also begun to emerge [12]. In addition, AI technology has great advantages and popularity in simulating real situations, improving learners' ability in language application. For example, AI-driven writing platforms can provide learners with rich writing topics and real communicative situations, thus helping them practice language expression in real contexts [3]. Finally, the immediacy of AI technology combined with the deep guidance of teachers can comprehensively improve learners' language ability and writing ability. By interpreting the language patterns in AI feedback, teachers can help learners understand the cultural and pragmatic background of the language, thus enhancing their intercultural communication ability [12].

To sum up, artificial intelligence technology provides strong support for the simultaneous development of English learners' language ability and writing abilities. By combining teacher guidance with technological advantages, AI can accelerate the feedback process, enhance the personalized learning experience of students, and promote the use of language in real-world situations and cross-cultural communication skills. This organic combination of technology and traditional teaching methods promotes the overall progress of language education from efficiency to effect and also provides more possibilities for future teaching model innovation.

4. Implications for Teaching and Learning

Based on existing research and practice, this study suggests the following implications for teaching and learning:

First, in teaching practice, teachers should make full use of artificial intelligence technology to provide personalized writing feedback, especially in terms of language complexity and syntactic diversity. AI tools can quickly diagnose student weaknesses, saving teachers time while giving students real-time, multi-dimensional guidance. Teachers can combine these tools to design student-centered task-based teaching activities that help learners consolidate and apply complex language structures.

Second, AI technologies should complement, not replace, teachers' teaching strategies. In mixed-mode teaching, teachers can use AI to provide initial feedback, and then further guide students through face-to-face tutoring to solve complex problems. For example, teachers can help students understand the cultural and pragmatic meaning behind AI-suggested language expressions to enhance the situational applicability of writing. In addition, educational institutions should focus on developing students' ability to use AI technology, including how to interpret and apply AI feedback,

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to avoid over-reliance on technology. At the same time, students should develop critical thinking and be good at distinguishing whether the suggestions provided by AI are reasonable, ensuring the effectiveness and autonomy of the learning process.

Finally, future curriculum design can incorporate the use of AI tools to promote personalized and diversified language teaching. For example, by combining AI with genre-based teaching methods, students can practice writing in different contexts, thus improving the adaptability of language skills. This innovative approach not only improves the learning outcomes of students but also brings more flexibility and creativity to teachers' teaching.

5. Conclusion

Through literature review and theoretical analysis, this study discusses the role of artificial intelligence technology in improving ESL learners' writing ability, especially two research questions are discussed and summarized. First, in response to the question "How can AI help ESL learners improve linguistic complexity in writing", the study found that AI can provide learners with highly personalized guidance through instant feedback and diverse language suggestions, significantly improving syntactic complexity and lexical diversity. AI tools such as intelligent writing assistants and automated feedback systems can quickly identify learner weaknesses, optimize language structure, and reinforce learning through repetition and feedback.

Secondly, regarding the question "How artificial intelligence technology help ESL learners achieve co-development of language ability and writing ability", this research shows that the blended teaching model combining artificial intelligence and teacher guidance is the most effective. AI technology provides instant feedback to accurately identify problems, while teachers further deepen students' understanding and application through personalized tutoring. In addition, the scoring system and multi-dimensional feedback function of AI tools help students enhance the collaborative development of language and writing skills in real contexts.

The significance of this study is not only to provide theoretical support for ESL writing teaching but also to provide a direction for the practical application of artificial intelligence in the field of education. By combining AI technology with genre pedagogy, the research provides new possibilities for the personalization and diversification of language teaching in the future, which is of great value in enhancing students' academic competitiveness and career ability. However, there are still some limitations in this study. First, most of the analyses are based on theories and existing literature and lack empirical data support for real classroom applications. Second, the object of study is mainly English learners, and the applicability to learners of other languages has not been discussed. In addition, the evaluation of the effects of long-term use of AI technology still needs further research. To compensate for these shortcomings, future research could conduct experiments in real teaching environments to verify the actual impact of AI technology on learning outcomes. At the same time, research should focus on the applicability of AI technology in cross-lingual contexts and explore its potential in multicultural education. Future research could also further explore how to optimize the way AI technology is combined with teacher guidance, such as developing more interactive and contextualized AI feedback systems to meet the needs of different learners. This will provide a richer perspective and solution for the theoretical development and practical innovation of second language writing teaching.

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