



Exploration and Practice of Formative Assessment Mechanism in College English Empowered by Artificial Intelligence

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Abstract. This paper explores the application and effectiveness of an AI-empowered formative assessment mechanism in college English education. It examines the theoretical foundations of formative assessment and AI applications, emphasizing the integration of constructivist learning theory and data-driven decision-making. A comprehensive literature review highlights global research trends and technological advancements in AI-based educational assessment. The study analyzes experimental data from student self-assessments, teacher interviews, and performance evaluations over two semesters, demonstrating significant improvements in learning outcomes, teaching efficiency, and classroom interaction. Key challenges such as technical infrastructure, teacher training, data privacy, and interdisciplinary collaboration are identified. Recommendations for optimizing AI-powered assessment include enhancing technical infrastructure, strengthening teacher training, improving data protection, and promoting cross-disciplinary collaboration. The findings provide valuable insights for developing sustainable AI-integrated formative assessment systems in higher education.

Keywords: AI-empowered assessment, college English education, personalized learning, teacher training

1 Introduction

Amid the continuous advancement of informatization in higher education, optimizing formative assessment in college English through artificial intelligence (AI) has become a research hotspot. Traditional assessment models face challenges such as high subjectivity and low feedback efficiency. The introduction of AI technology offers new solutions to these problems (Dimitriadou, E.et al., 2023)¹.

Formative assessment, a dynamic and continuous evaluation method, aims to enhance students' learning outcomes by providing real-time monitoring and feedback on their learning processes. However, traditional formative assessment often relies on

teachers' subjective judgments, constrained by time and energy, making large-scale, high-efficiency evaluation difficult (Buyukkarci, K. et al., 2021)².

With the rapid development of AI, particularly in natural language processing, machine learning, and big data analytics, robust technical support has emerged for educational assessment. AI can enhance assessment objectivity and efficiency through automated data processing and intelligent analysis. It also provides personalized learning feedback to students, fostering their autonomous learning abilities (Agustini, N. P. O, 2023)³. Thus, exploring the AI-empowered formative assessment mechanism in college English has both theoretical significance and practical application value.

This paper aims to systematically explore the application status, theoretical foundation, and practical pathways of AI in college English formative assessment through literature review. It analyzes the application effects and proposes corresponding optimization suggestions, hoping to provide valuable references for the reform of English teaching evaluation mechanisms in higher education.

2 Theoretical Foundation

2.1 Concept and Significance of Formative Assessment

Formative assessment, also known as process-oriented assessment, refers to using various evaluation methods during the teaching process to dynamically monitor and provide feedback on students' learning processes and outcomes. This approach aims to enhance students' learning and improve teachers' instructional methods (Morris, R. et al., 2021)⁴. Compared to summative assessment, formative assessment focuses more on immediate feedback and continuous improvement throughout the learning process, effectively stimulating students' learning motivation and autonomy.

2.2 Application of Artificial Intelligence in Education

AI applications in education span intelligent tutoring systems, personalized learning platforms, and smart evaluation tools. By leveraging natural language processing, machine learning, and big data analytics, AI can deeply analyze students' learning behaviors and outcomes, providing precise learning recommendations and feedback (Wang, Y. M. et al., 2024)⁵. In the field of language learning, AI technologies enable automated speech recognition, grammar correction, and writing evaluation, offering students real-time language learning support.

2.3 Theoretical Foundation of AI-empowered Formative Assessment

The theoretical foundation of AI-empowered formative assessment is mainly based on constructivist learning theory and data-driven decision-making theory. Constructivist theory emphasizes learners' active knowledge construction and highlights the importance of interaction and feedback (Hein, G. E., 1991)⁶. AI technologies support students' self-directed learning and knowledge construction by providing real-time

feedback and personalized learning resources. Data-driven decision-making theory emphasizes evidence-based analysis and decision-making. Through big data analytics, AI can provide scientific and objective support for educational evaluation, enhancing its effectiveness and fairness.

Artificial Intelligence (AI) enabled tools promote an active learning environment through real-time adaptive feedback, aligning with constructivist learning theories. For instance, automated writing evaluation systems allow learners to independently identify and correct grammatical or logical errors. Furthermore, data-driven dashboards enhance self-regulatory capabilities, enabling students to monitor their progress against benchmarks. Collaborative learning is facilitated through AI platforms, such as intelligent tutoring systems, which foster interaction among peers and between teachers and students.

3 Literature Review

3.1 Current State of Research Abroad

Foreign scholars have taken an early lead in integrating AI with educational assessment, conducting research with considerable depth and breadth. As early as 1998, Black and Wiliam systematically expounded the theoretical foundation of formative assessment in their seminal work *Inside the Black Box: Raising Standards Through Classroom Assessment*, emphasizing the critical role of classroom assessment in improving teaching quality (Black & Wiliam, 1998)⁷. This research laid a theoretical foundation for applying AI technologies to educational assessment.

With technological advancements, AI applications in education have become more sophisticated. Mousavinasab, E.et al. (2013)⁸ proposed design principles for intelligent tutoring systems in *Building Intelligent Interactive Tutors: Student-Centered Strategies for Revolutionizing E-Learning*, highlighting the importance of personalized learning and real-time feedback. These design concepts have driven the development of intelligent interactive tutoring systems, facilitating e-learning innovations (Mousavinasab, E.et al., 2021).

In recent years, breakthroughs in natural language processing (NLP) and deep learning have further advanced AI applications in language learning. Foltz et al. (2019)⁹ discussed the latest progress in automated essay scoring powered by NLP technologies in *Automated Scoring of Essays: Advances in Natural Language Processing*, assessing its accuracy and practicality. They highlighted AI's considerable advantages in enhancing writing evaluation efficiency and consistency (Foltz et al., 2019).

Additionally, Kumar and Rose (2019)¹⁰ conducted a comprehensive review of current automated writing evaluation systems in education. Their work, *The State of Automated Writing Evaluation Systems in Education: A Review of the Field*, analyzed technological developments and application outcomes, emphasizing the systems' pivotal role in educational assessment (Kumar & Rose, 2019).

Buşu, A. F (2024)¹¹ systematically discussed the potential and applications of AI in education in their work *Intelligence Unleashed: An Argument for AI in Education*.

They covered various aspects, including personalized learning and intelligent assessment, proposing specific pathways for deep integration of AI in the educational sector (Buşu, A. F, 2024).

Additionally, Vashishth et al. (2024)¹² examined the impact of AI-based personalized feedback on student learning outcomes in English language courses. Their findings revealed that AI-powered feedback significantly enhanced students' learning performance, underscoring the critical role of personalized feedback in promoting learning effectiveness (Vashishth et al., 2024).

These studies collectively highlight the vast potential of AI in enhancing the efficiency, objectivity, and personalized feedback of educational assessments. However, they also point out the need to address related challenges such as technological ethics and data privacy to ensure sustainable and responsible AI integration in education.

3.2 Case Study of AI-based educational project

3.2.1 Automatic Writing Evaluation.

Link et al.(2019)¹³ have emphasized the significance of automatic writing evaluation in the field of education. This system, powered by natural language processing technologies, is capable of rapidly analyzing and scoring a large volume of student essays, thereby reducing the time and workload required for teachers to manually correct and grade assignments. Additionally, its scalable capacity ensures consistency and fairness in assessment, minimizing biases that can arise from subjective factors in traditional evaluation methods. Moreover, automatic writing evaluation not only provides grammatical corrections but also identifies issues in sentence structure and logic, offering suggestions for improvement to help students continuously enhance their writing skills.

3.2.2 FIF English Speaking Platform.

Zhao, M. (2022)¹⁴explained The IF English Speaking Platform leverages artificial intelligence technology to conduct a comprehensive evaluation of students' pronunciation, fluency, and grammatical accuracy. This platform is not only capable of providing instant feedback on students' pronunciation issues but also offers specific recommendations for improvement, allowing students to practice targetedly. Furthermore, the platform supports simulated real-life conversation scenarios, assisting students in enhancing their spoken English skills during interactive sessions. Through continuous use, students experience a significant boost in their confidence in language expression, making the platform an essential tool for language learners aiming to improve their spoken English.

4 Practical Pathways for AI-empowered Formative Assessment

4.1 Data-driven Learning Analytics

By collecting and analyzing students' learning data, such as learning behaviors, assignment scores, and online interaction records, AI can identify learning patterns and problems, offering targeted teaching recommendations and support. For example, learning analytics tools can monitor students' learning progress in real time, detect learning bottlenecks, and enable timely adjustments to teaching strategies.

4.2 Intelligent Feedback Systems

Using natural language processing and machine learning technologies, intelligent feedback systems can automatically generate personalized learning feedback. These systems help students understand their strengths and weaknesses, guiding them toward improved learning methods. For instance, AI-powered writing evaluation platforms can automatically detect grammar errors, logical inconsistencies, and sentence structure issues. They provide scores based on fluency and accuracy and offer detailed revision suggestions.

4.3 Personalized Learning Resource Recommendations

AI can analyze students' learning interests and proficiency levels to recommend suitable learning resources and learning paths, supporting personalized learning. For example, KIMI's AI system suggests reading materials and practice exercises based on individual vocabulary mastery, enhancing learning effectiveness.

4.4 Automated Assessment Tools

Automated assessment tools utilize AI technologies to automatically grade assignments and exams, reducing teachers' workload while improving assessment efficiency and consistency. For example, the FIF oral English platform uses AI features to evaluate students' oral proficiency by scoring fluency and accuracy, offering constructive feedback to help both teachers and students enhance oral communication skills.

5 Application Effect Analysis

After two semesters of experimentation, the AI-empowered formative assessment mechanism for college English has shown significant effectiveness in enhancing students' learning abilities and optimizing teaching outcomes. A comprehensive analysis based on multi-dimensional data, including student self-assessment, teacher interviews, and student performance, yielded the following experimental results:

5.1 Student Self-assessment Analysis

5.1.1 Survey Design and Implementation.

In order to fully understand the students' experience and feedback on the formative evaluation mechanism of AI empowerment, a detailed self-assessment questionnaire was designed in this study. The questionnaire covers learning attitude, including learning interest, learning motivation and classroom participation; learning strategies, including the adjustment of learning methods, time management and self-directed learning ability; learning effectiveness, including self-evaluation of English listening, speaking, reading, and writing skills; and cognition and satisfaction with the AI evaluation system, including system ease of use, feedback timeliness and feedback pertinence. The questionnaire was graded using a five-point Likert scale (1-5 points) to quantify the students' subjective feelings. The study object was 200 students of college English courses in two classes of a university, and 180 valid questionnaires were collected, and the effective recovery rate was 90%.The questionnaire employed a five-point Likert scale (1-5) to quantify students' subjective experiences. The study participants included 200 college English students from two classes, with 180 valid questionnaires collected, resulting in a 90% effective response rate.

5.1.2 Data Statistics and Analysis.

The statistical analysis of the 180 valid questionnaires is presented in Table 1.

Table 1. Statistical Results of Student Self-assessment Survey

Evaluation Dimension	Item	Average Score (Out of 5)	Standard Deviation
Learning Attitudes	Learning Interest	4.3	0.6
	Learning Motivation	4.1	0.7
	Class Participation	4.0	0.8
Learning Strategies	Study Method Adjustment	3.8	0.9
	Time Management	3.7	0.8
	Self-directed Learning Ability	3.9	0.7
Learning Outcomes	English Listening	4.0	0.7
	English Speaking	3.9	0.8
	English Reading	4.1	0.6
	English Writing	4.2	0.5
AI System Perception and Satisfaction	System Usability	4.3	0.6
	Feedback Timeliness	4.4	0.5
	Feedback Relevance	4.2	0.7
Overall Satisfaction	Overall Satisfaction with AI-powered Assessment Mechanism	4.3	0.5

The table shows that students generally provided positive feedback across all evaluation dimensions, with high scores in system usability (4.3), feedback timeliness (4.4), and learning interest (4.3). The lowest scores appeared in time management (3.7) and study method adjustment (3.8), indicating potential areas for further improvement. The overall satisfaction score of 4.3 highlights the effectiveness and acceptance of the AI-powered formative assessment mechanism among students.

5.1.3 Discussion of Self-assessment Results.

The self-evaluation data show that students generally hold a highly recognized attitude towards the formative evaluation mechanism of AI empowerment. The specific performance is the improvement of learning attitude, The average score is above 4 points, In particular, learning interest (4.3 points) and learning motivation (4.1 points) have improved significantly, It shows that the AI evaluation mechanism effectively stimulates students' enthusiasm for learning; Optimization of the learning strategies, Students have improved in the adjustment of learning methods (3.8 points) and independent learning ability (3.9 points), It shows that AI feedback helps students to better develop and adjust their learning strategies; The enhancement of learning effectiveness, The average self-assessment score of all English skills is around 4 points, In particular, the writing ability (4.2 points) has been significantly improved, Reflecting the effectiveness of AI evaluation in specific skill improvement; And the high level of satisfaction with the AI system, System ease of use, feedback timeliness and feedback pertinence all received high scores (all above 4.2), It shows the good performance of the AI evaluation system in terms of user experience. The overall satisfaction rate was as high as 4.3 points, indicating that the students had a high acceptance and recognition of the evaluation mechanism.

5.2 Teacher Interview Analysis

5.2.1 Interview Subjects and Methods.

In this study, 15 college English teachers who actively applied the AI enabling formative evaluation mechanism in teaching were selected as interviewees. The semi-structured interview method is adopted to deeply understand the teachers' views of the mechanism, the problems encountered in the implementation process and their impact on the teaching practice through the open questions.

5.2.2 Interview Content and Result Discussion.

Through the coding and thematic analysis of the interviews of 15 teachers, the following main points are summarized. First of all, teaching efficiency has been significantly improved. 80% of teachers report that the AI system automatically corrects homework and provides feedback, which greatly reduces the time investment of teachers in homework correction. Meanwhile, 70% of teachers believe that the student learning data generated by AI helps them prepare course content and teaching resources more efficiently. Secondly, in terms of data-driven precision teaching, 75% of teachers accurately grasp students' learning progress and weak links through the detailed

learning data provided by the AI system, and 65% of teachers make more targeted teaching plans based on data analysis to meet the learning needs of different students. In addition, the AI system enhances classroom interaction and feedback. 85% of teachers believe that the immediate feedback mechanism promotes timely communication between teachers and students and improves classroom interaction. Meanwhile, 80% of teachers observe that students more actively participate in classroom discussion and learning activities after obtaining immediate feedback. In terms of the overall improvement of teaching quality, 90% of teachers believe that the evaluation mechanism of AI enabled has improved the teaching quality, and the learning effect of students is more significant, and 60% of teachers say that through the interaction with AI system, their ability to apply new technologies has promoted their professional development. Finally, in terms of existing challenges and improvement suggestions, 50% of teachers report that the existing AI system is still deficient in handling complex grammar and context understanding, and suggest to further improve its intelligence level; 40% of teachers indicate that they lack sufficient training and support in the initial application of AI system, and suggest the school to strengthen relevant training; and 30% of teachers pay attention to the privacy protection of student data and suggest to improve relevant data security measures.

The results of teacher interviews show that the formative evaluation mechanism of AI empowerment has played a positive role in improving teaching efficiency, optimizing teaching strategies and enhancing classroom interaction. Specifically, the automatic evaluation function of AI system significantly reduces the repetitive work of teachers, enables teachers to put more energy into teaching design and personalized guidance; through the detailed data provided by AI, teachers can more accurately identify students' learning problems, formulate targeted teaching plans, improves the effectiveness of teaching; the immediate feedback mechanism promotes the interaction between teachers and students, stimulates students' interest and participation in learning, and helps to create a positive learning atmosphere. In addition, on the whole, teachers believe that the AI evaluation mechanism improves the teaching quality and students' learning effect, and reflects its application value in practical teaching. Of course, teachers also pointed out the shortcomings of AI system in intelligence level and teacher training, emphasizing the need to further optimize the system function and strengthen the technical training of teachers, so as to give full play to the potential of the formative evaluation mechanism of AI empowerment.

5.3 Student Performance Analysis

5.3.1 Data Source and Processing.

To evaluate the impact of the AI-powered formative assessment mechanism on students' English performance, English course scores from two semesters before and after implementation were collected from two classes comprising 180 students at a university. Performance indicators included midterm exams, final exams, and overall scores. Comparative evaluation was performed, and SPSS T-test tool was used. A paired-sample t-test was used to compare the differences in scores before and after implementation to examine the significance of performance improvement.

5.3.2 Statistical Results and Data Analysis

Table 2. Comparison of Student Performance

Performance Indicator	Average Score Before Implementation	Average Score After Implementation	Average Score Difference	t-value	p-value
Midterm Exam	75.4	82.3	+6.9	5.67	<0.01
Final Exam	73.8	80.5	+6.7	6.12	<0.01
Overall Score	74.6	81.4	+6.8	6.00	<0.01

Table 2 presents the comparison of students' performance before and after the implementation of the AI-powered formative assessment mechanism. The comparison results indicate significant improvements in students' midterm exam scores, final exam scores, and overall scores after implementing the AI-powered formative assessment mechanism ($p < 0.01$). The average midterm exam score increased from 75.4 to 82.3, reflecting a gain of 6.9 points, demonstrating the AI assessment mechanism's positive impact on students' learning outcomes in the short term. Similarly, the final exam average score rose from 73.8 to 80.5, with an increase of 6.7 points, confirming the mechanism's long-term effectiveness. The overall score also improved from 74.6 to 81.4, with a gain of 6.8 points, indicating the AI mechanism's comprehensive evaluation effectiveness.

These improvements can be attributed to the personalized feedback provided by the AI system, helping students identify and correct learning deficiencies in a timely manner, thus promoting knowledge consolidation and application. Additionally, students' autonomous learning ability improved as they could better manage their study time and strategies independently with AI assistance, leading to enhanced learning efficiency. Moreover, the instant feedback and positive reinforcement embedded in the AI assessment mechanism continuously stimulated students' learning motivation and interest, thereby boosting learning outcomes. In summary, the performance analysis data strongly supports the effectiveness of the AI-powered formative assessment mechanism in enhancing students' English learning performance.

6 Recommendations for Optimization

Based on the effectiveness and limitations identified in the experimental study, the following optimization mechanisms are proposed:

6.1 Improving Technical Infrastructure

Universities should increase investment in artificial intelligence technology, improve relevant technical infrastructure, and ensure the stable operation of AI systems and efficient data processing. Additionally, a comprehensive data management and analysis platform should be established to support multidimensional data integration and application.

6.2 Enhancing Teacher Training

Teachers are key participants in AI-powered formative assessment. It is essential to strengthen their technical training, improve their proficiency in using AI tools, and enhance their ability to interpret data analysis results. Regular training sessions and workshops should be organized to improve teachers' digital literacy and teaching innovation capabilities.

6.3 Improving Data Privacy Protection

In the application of AI technology, great importance must be attached to the privacy protection and security management of student data. A sound data usage and protection mechanism should be established to ensure that students' personal information is not misused. At the same time, relevant laws and regulations must be followed to ensure the lawful and compliant use of data.

6.4 Promoting Interdisciplinary Collaboration

AI-powered educational assessment requires interdisciplinary collaboration. Cross-disciplinary research among education, computer science, psychology, and other fields should be encouraged to promote the deep integration of technology and educational theory. Collaboration within interdisciplinary teams can enhance the intelligence level and educational adaptability of AI systems.

7 Conclusion

Through literature research, this paper explored the theoretical foundation, practical pathways, and application effects of AI-powered formative assessment in college English. The study shows that AI technology can effectively enhance assessment efficiency and fairness, provide personalized feedback, and promote students' overall learning ability improvement. However, challenges still exist in areas such as technical infrastructure, teacher training, and data privacy in practical applications. In the future, efforts should focus on further improving technical infrastructure, strengthening teacher training, enhancing data protection mechanisms, and promoting interdisciplinary collaboration to achieve comprehensive optimization and sustainable development of AI-powered formative assessment.

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Reference

1. Dimitriadou, E., & Lanitis, A. (2023). A critical evaluation, challenges, and future perspectives of using artificial intelligence and emerging technologies in smart classrooms. *Smart Learning Environments*, 10(1), 12.
2. Buyukkarci, K., & Sahinkarakas, S. (2021). The impact of formative assessment on students' assessment preferences. *The Reading Matrix: An International Online Journal*, 21(1), 142-161.
3. Agustini, N. P. O. (2023). Examining the role of ChatGPT as a learning tool in promoting students' English language learning autonomy relevant to Kurikulum Merdeka Belajar. *Edukasia: Jurnal Pendidikan Dan Pembelajaran*, 4(2), 921-934.
4. Morris, R., Perry, T., & Wardle, L. (2021). Formative assessment and feedback for learning in higher education: A systematic review. *Review of Education*, 9(3), e3292.
5. Wang, Y. M., Wei, C. L., Lin, H. H., Wang, S. C., & Wang, Y. S. (2024). What drives students' AI learning behavior: A perspective of AI anxiety. *Interactive Learning Environments*, 32(6), 2584-2600.
6. Hein, G. E. (1991). *Constructivist learning theory*. Institute for Inquiry.
7. Black, P., & Wiliam, D. (1998). Inside the Black Box: Raising Standards Through Classroom Assessment. *Phi Delta Kappan*, 80(2), 139-148.
8. Mousavinasab, E., Zarifsanaiey, N., R. Niakan Kalhori, S., Rakhshan, M., Keikha, L., & Ghazi Saeedi, M. (2021). Intelligent tutoring systems: a systematic review of characteristics, applications, and evaluation methods. *Interactive Learning Environments*, 29(1), 142-163.
9. Foltz, P. W., VanderPlas, J., & Burstein, J. (2019). Automated Scoring of Essays: Advances in Natural Language Processing. *Educational Technology Research and Development*, 67(1), 35-54.
10. Kumar, V., & Rose, C. (2019). The State of Automated Writing Evaluation Systems in Education: A Review of the Field. *Journal of Educational Computing Research*, 57(2), 380-408.
11. Buşu, A. F. (2024). Unleashing the Potential of AI in Classrooms. *Revista de Stiinte Politice/Revue des Sciences Politiques*, (81).
12. Vashishth, T. K., Sharma, V., Sharma, K. K., Kumar, B., Panwar, R., & Chaudhary, S. (2024). AI-driven learning analytics for personalized feedback and assessment in higher education. In *Using traditional design methods to enhance AI-driven decision making*, 206-230.
13. Link, S., Mehrzad, M., & Rahimi, M. (2022). Impact of automated writing evaluation on teacher feedback, student revision, and writing improvement. *Computer Assisted Language Learning*, 35(4), 605-634.
14. Zhao, M. (2022). The Application of iFLYTEK FiF Speaking Training System in Language Learning. In *Proceedings of the 2022 5th International Conference on Machine Learning and Natural Language Processing* (pp. 175-178).

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