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Design and Application of College English Teaching Based on Human-Machine Collaboration

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Abstract: With the deep integration of artificial intelligence in education, vocational college English teaching has embraced new opportunities empowered by technology, yet faces practical challenges such as insufficient teachers 'technical adaptability and the absence of human-machine collaboration mechanisms. Based on Gagne's Nine Teaching Events Theory, this study constructs a tripartite collaborative teaching model involving "teachers-AI-learningers" and conducts teaching practices through the "XuexiTong" platform. A total of 171 students from four parallel classes of the 2024 cohort were selected as research subjects, with comprehensive evaluations conducted using Flanders Classroom Interaction Analysis, pre-post test score comparisons, and in-depth interviews. The results demonstrate that human-machine collaborative teaching effectively clarifies role boundaries among teachers, students, and technology, significantly enhances classroom teaching efficiency and academic performance, while boosting students' learning autonomy and sense of achievement. This study provides theoretical support and practical experience for the comprehensive reform of College English teaching in vocational colleges.

Keywords: Human-Computer Collaboration; Higher Vocational English; Teaching Activities

1. Introduction

Under the background of global education digitalization, the advantages of artificial intelligence in data processing, personalized recommendation, and intelligent interaction have become an important force driving the reform of English teaching. The college English curriculum in vocational colleges is a key vehicle for cultivating vocational students' professional qualities and intercultural communication abilities, emphasizing practical, vocational, and targeted teaching objectives. However, the current traditional teaching model, due to factors such as class size, delayed feedback, and insufficient personalized support, struggles to meet the demands of cultivating high-quality technical and skilled talents in the new era.

In recent years, artificial intelligence technology has been progressively integrated into English instruction at vocational colleges, providing technological support for enhancing teaching efficiency. However, current practices reveal several challenges: some educators perceive AI merely as a "supportive tool," while others over-rely on technology to the detriment of their instructional autonomy. Human-computer collaboration transcends mere machine integration—it demands a deep fusion of pedagogical expertise and AI capabilities. Therefore, developing effective activity designs and implementation strategies for such collaboration in vocational English education not only addresses the practical needs of intelligent education development but also represents an essential approach to elevating teaching quality in this field.

2. Literature Review

2.1 Foreign Research

The foreign countries started the research on the man-machine cooperation and foreign language teaching earlier, focusing on the application of technology, the transformation of the teacher's role and the exploration of the teaching mode, and achieved the formation of systematic research results.

2.1.1 Technology empowers personalized teaching research. Stanford University in the United States has developed intelligent language models based on large-scale models,

demonstrating that human-computer collaboration can effectively enhance the personalization and efficiency of language learning. MickSailer et al. emphasized integrating AI literacy into German school education content, establishing clear policy guidelines and teacher training systems[1]. Margarida Romero et al. compiled a white paper showcasing practical explorations of AI integration in education. AI technologies optimize teaching processes through personalized learning support and automated feedback, simultaneously improving learners' efficiency and self-directed learning capabilities [2].

2.1.2 Exploring the Transformation of Teachers' Roles and Competency Development. Younis established an AI competency framework for educators, categorizing teachers' AI literacy into multiple core dimensions[3]. Drawing on the 2024 UNESCO "Teacher AI Competency Framework", the study introduced human-centered principles, specifying five essential competency areas: AI ethics, instructional integration, and professional development. The EU's Horizon and Erasmus+programs fund AI teaching tools, emphasizing teachers' proficiency in digital technology application and evaluation. Additionally, Ayanwale et al. developed a four-dimensional framework for pre-service teachers'AI competencies, including modules on AI cognition, practical application, ethical considerations, and technology identification [4].

2.1.3 Exploring cross-scenario collaborative teaching models. European research institutions are investigating the application of large language models in ubiquitous language learning to establish a collaborative learning ecosystem free from spatiotemporal constraints. France has adopted the "Five Pillars Approach"and intelligent technologies to develop the "Artificial Intelligence and Intelligence" MOOC course, creating an innovative paradigm that deeply integrates technology with teaching. Such research generally emphasizes that human-computer collaboration should simultaneously optimize both technical efficiency and learning experience.

2.2 Domestic Research

The researches in China are closely combined with the local characteristics and policy orientation, and focus on the construction of teaching mode, the effect of practice application and the development of teachers' ability.

2.2.1 Development of Collaborative English Teaching Models. Chen developed an AI-enhanced human-machine collaborative teaching model for vocational college English, which significantly outperforms traditional multimedia teaching in improving students' listening, speaking, reading, and writing skills[5]. Kong proposed that foreign language classrooms in the AI era should feature cognitive challenges, progressive skill development, and "human-machine-interactive" collaboration, advocating the use of AI technology to create student-centered collaborative learning environments[6].

2.2.2 Policy-driven applied research. These studies are strongly policy-guided, emphasizing the practical implementation of technological applications. Wang and Zhou noted that under the impetus of policies like the "New Generation Artificial Intelligence Development Plan", English teaching is accelerating the deep integration of AI with pedagogy, forming localized innovative pathways guided by curriculum standards.[7] Wang et al. proposed AI literacy indicators for university teachers, including human-computer collaborative teaching capabilities, providing a clear framework for the professional development of English educators.[8]

2.2.3 Instructional Activity Design and Effectiveness Evaluation. Zhao developed an innovative teaching model featuring pre-class analysis of student learning profiles and adaptive modalities, in-class integration of multimodal and collaborative learning, and post-class collaborative assessment with dynamic feedback. [9] Zhang demonstrated the significant potential of generative AI in assisting teachers to establish learning objectives and design corresponding evaluation tasks through an "teach-learn-evaluate" integrated approach based on reverse instructional design principles. [10]

In conclusion, both domestic and international studies have established the core value of "human-computer collaboration" in foreign language teaching. While foreign research emphasizes theoretical frameworks and cross-cultural applications, domestic studies focus on localized practices and innovative teaching models. However, existing research still has limitations, particularly in its lack of

vocational education specificity. Therefore, this study aims to develop a "human-computer collaborative" instructional design for the College English course in higher vocational colleges, employing a mixed-method research approach to comprehensively evaluate its implementation effects. The goal is to provide theoretical and practical references for other higher vocational colleges and foreign language teaching research.

3. Research Design

3.1 Theoretical Framework: Gagne's Nine Teaching Events

This study adopts Gagne's (Gagne R. M.) nine-step instructional event theory as its core framework. The theory correlates internal learning processes with external instructional support events, with the nine steps being: attention capture, goal presentation, recall stimulation, material delivery, guidance provision, behavior elicitation, feedback delivery, performance evaluation, and retention/transfer facilitation [11]. The framework's "external support" attribute inherently facilitates collaborative design between human and machine, ensuring instructional activities align with cognitive learning principles while maximizing the strengths of both participants.

3.2 Construction of the Model of Human-Machine Collaborative Teaching Activities

Building upon Gagne's theory, this study developed a "Human-Machine Collaborative Model for College English Teaching Activities" (Figure 1). The model, based on the "Higher Vocational Education College English Curriculum Standards (2021 Edition)", identifies three key participants: English teachers, AI, and learners. It restructures nine teaching events into a closed-loop collaborative process, with specific task allocations detailed in Table 1 and Figure 1.

Table 1. Division of Labor for Human-Machine Collaborative Teaching Tasks

Teaching incident	AI role	Teacher role
attention	Push related short videos, trending topics, or fun content	Start a discussion or ask a question, and guide the conversation with emotional cues
Notify the target	Show Knowledge Graph and Skill Objectives	Interpret the goal, highlighting its importance and practicality
stimulus recall	Push the prerequisite knowledge quiz.	On the Guidance of Test Errors and the Connection of New and Old Knowledge
Presenting materials	Provide graded, multimodal learning materials	Filter and integrate materials, focus on explanations and cultural background exploration
Provide guidance	Provide pronunciation demonstrations, grammar analysis, and a question bank	Provide learning strategies and thinking guidance, one-on-one tutoring
induced behavior	Create simulated conversations and gamified exercises	Collaborative learning activities such as design group projects, role-playing, and debates
Provide feedback	Provide instant, accurate feedback	Provide delayed and developmental evaluation
assessment behavior	Take a unit test and generate a learning data report	Carry out formative and summative evaluation and give emotional encouragement
Promoting retention and transfer	Push personalized review plans and recommend additional resources	Design project-based learning tasks to guide comprehensive application

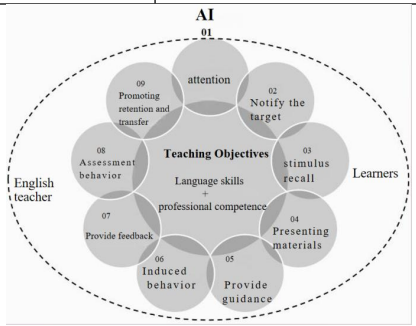

Figure 1. A Model of College English Teaching Based on Human-Machine Collaboration

3.3 Research Subjects and Methods

This study employed a mixed-method research design, randomly selecting 4 parallel classes (totaling 171 students) from the 2024 cohort of non-English majors at a vocational college. The experimental group (2 classes, 84 students) received human-computer collaborative instruction, while the control group (2 classes, 87 students) used traditional multimedia teaching. No significant differences were observed in the students' initial English proficiency scores

between the two groups.

The study implemented teaching based on the "Xuexitong" platform, used the Flanders Interactive Analysis System (FIAS) to quantify the classroom structure, combined with the pre-and post-test papers (with information and validity tests) to evaluate academic performance, and conducted semi-structured interviews with 12 students and 2 teachers after the experiment to obtain qualitative data.

4. The Process of Research

To ensure the systematic and practical nature of the study, the teaching experiment was designed for a full semester (16 weeks). Both the experimental and control groups used the unified textbook *Growth English* published by Higher Education Press. Taking the "Unit 10: Job Interview" as an example, the specific teaching process is as follows.

4.1 The Teaching Process of Human-Computer Collaboration in the Experimental Group

The experimental group adopted the "Human-Machine Collaborative Teaching Activity Model", using Gagne's nine instructional events as the logical framework, and integrated the "Xuexingtong" intelligent teaching platform with relevant AI tools.

4.1.1 Pre-class stage (self-study and assessment)

The AI system first presents students with real-life video clips of corporate English interviews as contextual introduction (to capture attention). It then outlines the unit's core objective: "to independently deliver a 5-minute English self-introduction that meets basic interview requirements" (goal announcement). Students complete an AI-provided pre-test questionnaire on "common self-introduction sentence patterns" to recall prior knowledge, while the system simultaneously collects initial learning data (stimulating recall).

4.1.2 In-class phase (layered guidance and interactive practice)

First, the teacher conducts a focused analysis of the AI-based pre-test data report, addressing high-frequency errors to reinforce the connection between new and existing knowledge (enhancing recall). Next, the AI provides students with standardized self-introduction templates and audio demonstrations (presented materials). Through the built-in AI speech recognition system, students practice reading and imitation, receiving real-time feedback on pronunciation and fluency. This completes the initial behavioral induction process (providing guidance, initiating behavior, and offering feedback).

During the skill internalization phase, the teacher organizes a "mock interview" activity where students work in pairs, with one acting as the interviewer and the other as the job seeker. They complete the interview dialogue using learned sentence patterns (introducing behavioral skills). The teacher patrols the classroom, providing personalized guidance, and selects exemplary performances for feedback after the activity.

4.1.3 Post-class phase (consolidation, reinforcement, and application)

AI generates and delivers personalized practice packages to address students 'weaknesses based on their classroom exercises and simulation data, including targeted phonetic drills and sentence restructuring tasks (assessing performance and fostering retention). Teachers assign authentic project-based tasks like "creating a 5-minute English self-introduction video for your ideal job position and submitting it to the platform," which facilitates knowledge transfer to real-world professional scenarios, enhancing students' comprehensive language application skills and career identity (promoting transfer).

4.2 The Traditional Teaching Model in the Control Group

To establish an effective contrast, the control group adopted a traditional teaching model primarily guided by instructors and supplemented with multimedia courseware. The process typically followed this sequence: "Instructors explain model text structures and key linguistic elements in class-students collectively imitate through recitation-teachers assign written tasks (e.g., composing self-introduction essays)." This approach emphasized uniform knowledge delivery and mechanical drills, lacking personalized support and contextualized practical components.

4.3 Teaching Implementation Support and Process Documentation

To ensure experimental standardization and data comparability, both teaching groups were conducted by the same faculty team using standardized teaching materials and schedules. Teachers in the experimental group strictly followed the predefined teaching procedures. All

classroom activities were recorded and coded in real-time using the Flanders Interactive Analysis System (FIAS) for subsequent quantitative analysis. Student learning behaviors, AI feedback records, and task completion status were comprehensively logged on the "Xuexi Tong" platform, providing multi-dimensional data support for the research.

5. Research Results and Analysis

5.1 Quantitative Data Analysis

5.1.1 Changes in the structure of the classroom: an interactive analysis of frands

The coding analysis of the regular classes in the experimental and control groups yielded the following comparative data table (as shown in Table 2):

Table 2. Comparison of Data between the Experimental Group and the Control Group

Class	experimental group (%)	control group (%)	Difference value (Experimental group-control group)
The proportion of speech by teachers	45.2	68.5	-23.3
Percentage of speech from students	35.8	20.1	+15.7
Proportion of technical intervention	15.3	8.5	+6.8
Quiet/chaotic ratio	3.7	2.9	+0.8
Indirect to Direct Ratio (I:D)	1.2:1	0.6:1	+0.6:1

Note: All percentages are calculated based on total interaction time per session, with N=171 (experimental group n=84, control group n=87).

The analysis reveals that the human-computer collaborative teaching model has significantly transformed classroom dynamics through three key dimensions. First, the restructuring of discourse power has shifted from teacher-dominated instruction to teacher-student co-creation. In the experimental group, teachers 'verbal contributions (45.2%) decreased by 23.3 percentage points compared to the control group's 68.5%, while students 'verbal participation (35.8%) and technology integration (15.3%) increased by 15.7 and 6.8 percentage points respectively. This demonstrates that the collaborative model effectively breaks the traditional "one-man show" scenario, establishing a new discourse framework of "teacher guidance – student agency – technology support." Teachers transition from being one-way knowledge transmitters to becoming designers and organizers of learning activities, allocating more classroom time for personalized learning and interactive training. Second, teaching styles have evolved from direct control to indirect guidance. The experimental group's indirect-to-direct influence ratio reached 1.2:1, significantly higher than the control group's 0.6, reflecting increased use of questioning, encouraging critical thinking, and incorporating student feedback. This approach replaces traditional direct methods like lecturing, issuing commands, and criticism, fostering a more democratic and egalitarian classroom atmosphere that enhances two-way interaction and cultivates higher-order thinking skills. Third, technology integration has deepened from auxiliary tools to core teaching elements. The substantial increase in technology integration rate (+6.8%) further illustrates this transformation. AI has evolved from a peripheral aid in traditional education to a pivotal participant in classroom instruction. Beyond delivering personalized content and real-time feedback, it now employs technologies like speech recognition and AI-assisted assessment to deeply engage students in their learning journey, fostering a new human-machine collaborative teaching ecosystem.

5.1.2. Comparison of academic performance

The independent samples t-test was performed on the pre-test and post-test scores of the two groups, and the results are shown in Table 3:

Table 3. Academic Performance Comparison Between Experimental and Control Groups (M±SD)

Group	number of people	Pretest mean score (M±SD)	Post-test mean score (M±SD)	Average increase
experimental group	84	72.5±8.1	82.3±7.2	9.8
control group	87	71.8±7.9	76.4±8.5	4.6

Analysis: Independent samples t - test results show the experimental group's post - test scores are significantly better than the control group's ($t = 4.87$, $p < 0.01$). The experimental group's average improvement (9.8 points) is 2.13 times that of the control group (4.6 points), indicating

the human - machine collaborative teaching mode has obvious advantages in promoting students' academic performance.

Effect Attribution Analysis: This significant difference mainly comes from the human-machine collaborative teaching model achieving three-level instructional optimization. First, it enables personalized learning. In traditional teaching, teachers can't easily provide customized training. The AI system in the collaborative model identifies students' knowledge gaps through preliminary diagnostics and provides targeted training. For example, in English self- introductions, it reinforces weak pronunciation and provides sentence pattern exercises. This “one-person-one-plan” support creates an instant feedback and reinforcement mechanism. While the control group’s feedback is mainly from teachers with delays, experimental group students get real - time feedback through the AI system, shortening the learning cycle. Teachers can identify common issues through data analysis and conduct focused instruction, combining machine and teacher feedback to stimulate deep learning. Second, the human - machine collaborative model transforms language learning from passive reception to active skill development. By creating authentic scenarios, gamified learning, and project - based tasks, students consolidate knowledge and gain a sense of achievement, stimulating intrinsic motivation and improving academic performance.

5.2 Qualitative Data Analysis

To understand the mechanism of the influence of the "human-machine collaboration" teaching mode on the college English teaching, this study conducted semi-structured interviews with 12 students and 2 college English teachers, and then carried out systematic coding and thematic analysis on the interview recordings, and extracted the following core themes:

5.2.1 Student level: dual improvement of learning autonomy and achievement

Theme 1: Differentiated Learning Experience

Two-thirds of the surveyed students reported that AI integration has made their learning process more targeted and secure. Student S3 shared: "The AI-generated practice questions specifically address my frequent errors in virtual mood and linking weak readings, making my learning more focused." This demonstrates AI's advantage in delivering precise content through data analysis. Student S7 added from an emotional perspective: "I used to fear speaking English in front of classmates, but now I can practice anytime. Even if I make mistakes, the system provides clear guidance on corrections, eliminating anxiety about errors." This highlights how technology-created "low-anxiety environments" effectively alleviate psychological pressure and boost language output motivation.

Theme 2: Role Identity and Learning Achievement

Through simulated real-world workplace environments, students experienced the role transition from 'learners' to 'practitioners.' Student S10 described: 'During the mock interview phase, I felt like a genuine job seeker rather than just a student, realizing that what I learned could be applied immediately.' This demonstrates the effectiveness of situational learning in boosting learning motivation. Student S5 highlighted the value of teacher feedback: ‘The final evaluation revealed my strengths and areas for improvement, clarifying my direction.’ This reflects the depth and developmental nature of teacher feedback in human-computer collaboration.

5.2.2 Teacher level: reorganization of teaching role and test of professional ability

Theme 1: Transitioning from “Knowledge Presenter” to “Learning Designer” and "Process Facilitator". The teaching focus has undergone a significant shift. Teacher T1 remarked: “My current lesson preparation is no longer about ‘what to teach’ but ‘designing activities that engage students comprehensively’, and ‘how to leverage AI-generated learning to optimize teaching decisions through data’. This reflects the transformation of teachers into instructional designers and analysts. Teacher T2 further added:" Technology handles repetitive tasks like grading assignments and correcting pronunciation, allowing me to focus more on students with ‘special needs’ and engage in deep dialogue with them. This demonstrates how technology can free teachers from tedious tasks, enabling them to concentrate on the core mission of education.”

Theme 2: Professional Competence Faces New Demands and Systemic Challenges. Teachers openly acknowledge emerging challenges. Teacher T1 noted: “Initially, we had to invest significant time mastering platform functionalities and redesigning teaching

processes, which raised the bar for information literacy". Teacher T2 then discussed data application: "Interpreting data reports accurately and translating them into effective teaching strategies has become a new challenge. This requires not only teaching expertise but also data analysis and interpretation skills. The "Human-Machine Collaboration Model" supported by AI for personalized training and enhanced by teachers' advanced guidance, has improved students' learning experiences and outcomes while fostering teachers' professional development.

6. Discussion and Reflection

This study has constructed and practiced the teaching model of "human-computer collaboration" in college English teaching, and verified the effectiveness of the model in optimizing the classroom structure, improving academic performance, enhancing students 'learning experience and promoting the transformation of teachers' role.

6.1 Core Value: Role Reconstruction and Teaching Efficiency

This model is built upon Gagne's Nine-Step Instructional Event Theory, employing systematic task decomposition to establish and dynamically complement three roles: teacher, student, and technology. AI does not replace teachers but handles standardized, data-driven, and repetitive teaching tasks-such as personalized content delivery, real-time feedback, and learning data tracking. By freeing teachers from traditional knowledge transmission and assignment grading, AI enables them to focus on higher-order tasks like emotional guidance, cognitive stimulation, cultural immersion, and complex scenario construction-areas where AI struggles.

6.2 Practice Reflection: Realistic Challenges and Development Paths

While this study confirms the positive effects of human-machine collaborative models, three practical challenges remain:

Firstly, vocational college English teachers need to further enhance their ICT literacy and collaborative instructional design capabilities. Educators should evolve from traditional "technology users" to "technology masters" and "activity designers". This transformation requires systematic training mechanisms and ongoing professional support. Secondly, existing AI teaching tools still have limitations in handling open-ended and creative language output. AI feedback primarily focuses on linguistic forms, lacking humanistic evaluations of semantic content, communicative effects, and emotional expression. It cannot fully replace teachers 'professional judgment and guidance in complex contexts. Thirdly, the implementation of human-computer interactive teaching models heavily relies on the school's information infrastructure, including stable network conditions and smart terminal devices, which to some extent undermines the feasibility of large-scale promotion of this teaching model.

The research and practice of "human-machine collaboration" in education can be further advanced in three key areas: First, developing AI teaching assistants with emotional intelligence and contextual understanding to enhance interactive performance in open-ended tasks. Second, establishing school-based English teaching resource libraries that integrate vocational contexts, bridging academic content with professional competencies. Third, creating sustainable mechanisms for vocational college English teachers' professional development, including training systems, collaborative platforms, and incentive policies, to facilitate continuous growth in the context of technological integration.

7. Conclusion

This study builds a systematic model for human-computer collaborative teaching activities in vocational college English education, grounded in Gagne R. M. 's nine instructional events theory. Empirical research validates the model's effectiveness, demonstrating how precise human-machine division of labor restructures and optimizes teaching processes. It not only enhances both teachers' instructional efficacy and students' learning outcomes, but also reinforces educators' irreplaceable role as empathetic designers, guides, and enablers in the digital age. Moving forward, human-computer collaboration will be the inevitable path to advancing vocational English education toward personalized, intelligent, and high-quality standards.

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