



The Construction of a “Six-Element Collaborative” Teaching Mode Driven by the Large Language Models: A Digital Transformation Path for Higher Vocational and Undergraduate Education English Teaching Articulation

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Abstract

Against the background of popularization and digital transformation of higher education, the English teaching cohesion of higher vocational and undergraduate education is faced with such realistic difficulties as knowledge gap, competence mismatch, and inaccurate evaluation. This paper presents a “six-element collaborative” teaching model using Large Language Models (LLMs) to address these issues. The innovation of the research is reflected in: the first proposal of a “six-elements of collaborative” theoretical framework, which systematically deconstructs the complex ecology of higher vocational and undergraduate English education articulation education; and the development of six practice scenarios for the application of the Large Language Models in education, which realizes a paradigm breakthrough from technological empowerment to the reconstruction of the educational ecology. The results provide replicable articulation education solutions for the digital transformation of education and have important reference value for the construction of a vertically integrated modern vocational education system.

Keywords

Large Language Models; Higher Vocational and Undergraduate Education English Teaching Articulation; Six-Element Collaborative; Education Digitization; Connectivism Learning Theory

1. Introduction

The popularization of higher education in China has accelerated, and the Ministry of Education’s policy of expanding the enrollment scale of higher vocational and undergraduate education has been implemented successively, making higher vocational and undergraduate education articulation a key issue in the field of education. At the same time, the emergence of large language models has brought profound changes to the field of education.

This paper focuses on the theoretical value and practical significance of large language model-driven higher vocational

and undergraduate articulation education, enriches the theoretical system of higher vocational and undergraduate English education, and provides new theoretical perspectives on the digital transformation of education through the connectivism learning theory and the theory of educational ecology, which helps to deeply understand and explore the in-depth fusion of the large language model with education and teaching. Through experimental verification, the model can effectively improve students' English proficiency, teachers' cross-level collaboration efficiency, and reuse rate of course resources, providing a successful experience for the digital transformation of education, which is of great practical significance for promoting the development of the modern vocational education system.

2. Literature Review

With the introduction of the Ministry of Education's policy related to expanding the enrollment of higher vocational and undergraduate education, how to effectively do a good job in the articulation of higher vocational and undergraduate talent cultivation has become a widespread research topic. Current research on higher vocational teaching mostly focuses on cultivating skilled talents (Li et al., 2025), and current research on English focuses on curriculum and teaching methods. Existing empirical studies on the issue of higher vocational and undergraduate articulation are limited and lack a systematic theoretical framework or practice model.

"Internet + Education" is a new service model that uses cloud computing, learning analysis, artificial intelligence, and other new technologies to provide high-quality and personalized education for individual learners (Chen et al., 2017). Connectivism learning theory is an important philosophical foundation of "Internet + education". Connectivism learning theory is a digital era learning theory proposed by George Siemens in 2004 (Siemens, 2004), which believes that learning is a process of knowledge flow and reconstruction through the construction of a dynamic network connecting nodes (Downes, 2022). Currently, we can use the Large Language Models to realize "Internet + Education", provide personalized education, and reduce the cognitive load of students.

Large Language Models (LLMs) are a natural language processing technology based on the Transformer architecture, which is used to describe the vector representation and generation probability of massive texts (Liu et al., 2023). Artificial intelligence has shown a strong ability in language services, and even better performance in assisting foreign language teaching and research (Feng & Zhang, 2024). In language teaching, LLMs can significantly improve English learners' writing ability (Liu et al., 2024) and vocabulary skills (Wang et al., 2024). In the construction of adaptive learning systems, the contextual understanding ability of LLMs supports the design of personalized teaching schemes (Liu et al., 2024).

Based on the existing literature, there are limitations in the study of higher vocational and undergraduate English articulation education; the integration of elements is fragmented and lacks a systematic framework, technology application is superficial, and lack of control mechanisms for academic integrity. In this paper, LLMs are deeply embedded into the whole teaching process, forming a closed loop of "diagnosis-generation-collaboration-evaluate". This innovation responds to the practical needs of the digital transformation of education and provides a new paradigm for the theoretical construction of articulation education.

3. Methodology

The teaching mode of "six-element collaborative" integrates cutting-edge teaching concepts and means, and realizes the collaboration of objectives, specialties, teachers, modes, courses, and evaluation. Through the LLMs-driven teaching mode, multiple teaching media and teaching resources, traditional teaching and digital teaching, teacher-oriented and student participation are combined, so as to achieve complementary advantages and help build a new mode of application-oriented and innovative talent training.

With the core objective of solving the problem of higher vocational and undergraduate English teaching articulation, the "six-element collaborative" teaching mode (Table 1) deeply integrates the technological advantages of LLMs, and reconfigures the teaching ecology and promotes the paradigm transformation of the cultivation of application-oriented and innovative talents through the systematic linkage of six dimensions: objective collaboration, specialty collaboration, teacher collaboration, mode collaboration, course collaboration, and evaluation collaboration. Its core logic is to break the linear structure of traditional teaching and realize the intelligent adaptation of resources, subjects, and scenarios by a dynamic coupling mechanism (Figure 1).

Table 1. “Six-element collaborative” model of teaching

Objective collaboration: The three-dimensional unity of knowledge, ability, and accomplishment	
Core mechanism	With student-oriented, a composite teaching goal system of “knowledge transfer (language foundation) + value guidance (cross-cultural competence) + intelligent adaptation (personalized goal)” is constructed.
Specialty collaboration: Interdisciplinary integration of general knowledge, specialty, and resources	
Core mechanism	Based on the demand for “higher vocational and undergraduate education articulation”, a three-in-one curriculum system of “general language ability + professional field skills + intelligent resource base” is constructed.
Teacher collaboration: Subject-technology-community network collaboration	
Core mechanism	Establish a collaboration network of “English teachers (language experts) + professional teachers (subject experts) + virtual teaching and research community (technical support)”.
Mode collaboration: Flexible adaptation of online-offline	
Core mechanism	Construct a blended learning framework of “teacher-oriented (offline inspiration) + student-oriented (online exploration) + LLMs support (intelligent regulation)”.
Course collaboration: Closed-loop practice of input-output scene	
Core mechanism	Through the closed-loop design of “first class (knowledge input) + second class (scene output) + intelligent platform (immersion training)”, the language application ability is strengthened.
Evaluation collaboration: Multi-dimensional feedback of process-outcome-data	
Core mechanism	Establish a multi-modal evaluation system of “process evaluation (dynamic monitoring) + terminal evaluation (comprehensive assessment) + intelligent analysis (data mining)”.

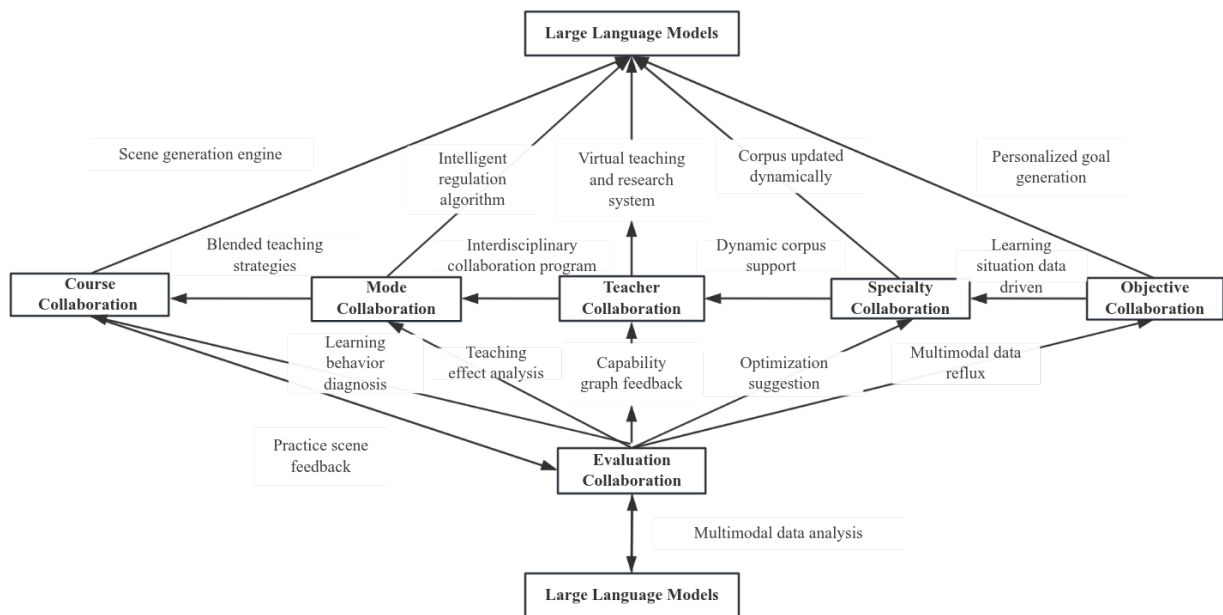


Figure 1. Dynamic coupling mechanism.

4. Research Design and Method

This paper adopts the action research method and designs a three-round iterative process (Figure 2).

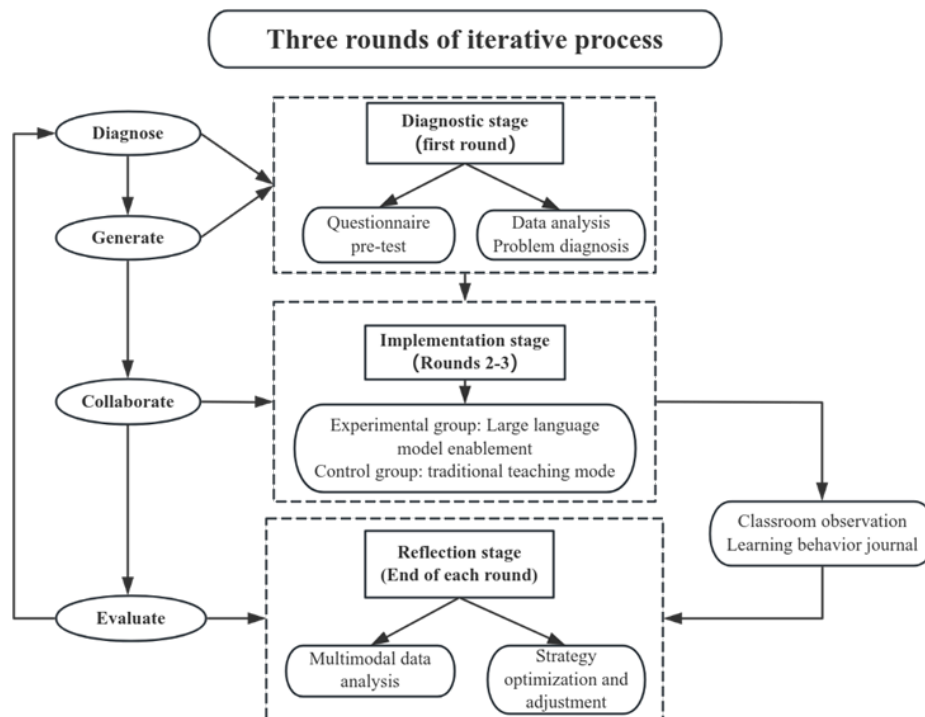


Figure 2. Three-round iterative process.

The subjects of this study were selected students and teachers of a university who participated in the upgrading of higher vocational English teaching. The subjects of the study were 87 students, divided into an experimental group (43) and a control group (44). Teachers were also grouped accordingly to ensure that teachers in the experimental and control groups were comparable in terms of teaching experience and professional background. When designing the questionnaire, questions were designed around four aspects: writing, translation, listening, and reading comprehension.

In the pre-test stage, 87 students were tested with a full score of 100 points, using College English Test Band 4 (CET-4) difficult questions, including four parts: writing, translation, listening, and reading. CET-4 is a national English test sponsored by the Ministry of Education, which is scientific, fair, and comprehensive in ability assessment. The pre-test provides a comprehensive understanding of the students' initial level of English proficiency, clarifies the students' strengths and weaknesses in each English skill area, and verifies the effectiveness of the "six-element collaborative" teaching model.

In the practical stage of the research, the LLMs learning platform was used to record students' learning time, course clicks, homework completion, and other learning process data, and analyze students' learning habits and knowledge mastery based on the collected data. During the teaching period, observers with rich teaching experience are arranged to enter the classroom to observe the teaching process from multiple perspectives and record the teaching activities in detail. The collected data and questionnaires were statistically analyzed using SPSS 27.0, and the differences between the experimental group and the control group were compared to verify the effectiveness of the teaching model.

5. Results and Discussion

There are differences between higher vocational and undergraduate English teaching in terms of academic writing, translation, listening, and reading comprehension, which make it difficult for students to adapt.

5.1 Diagnostic Stage

A total of 87 questionnaires were distributed, and 87 valid questionnaires were recovered. In the questions about academic writing, about 55.1% (48) of the students indicated that they had difficulties in constructing the logical structure of an essay; about 41.3% (36) of the students thought that they were not proficient in the use of professional vocabulary. For

the survey on professional terminology, 50.5% (44) of the students gave feedback that it was difficult to memorize professional English terminology, especially in specialized fields such as medicine and computer. In terms of dictation, about 64.3% (56) of the students reported that they had difficulties in recording long and difficult sentences and specialized vocabulary. In terms of reading comprehension, about 36.7% (32) of the students found it difficult to comprehend specialized articles (Table 2).

Table 2. Questionnaire

Diagnostic dimensions	Specific questions	Findings
Academic writing	Difficulty in constructing the logical structure of the article	55.1%
	Not proficient in the use of professional vocabulary	41.3%
Technical term	Difficulty remembering technical terms	50.5%
Auditory dictation	Difficulties in recording long, difficult sentences and specialized vocabulary	64.3%
Reading comprehension	Difficulty understanding professional articles	36.7%
Overall	Lack of comprehensive ability	

A pre-test was administered to 87 students out of 100. The results showed an overall average score of 55. Among them, the average score in the listening section was 20 out of 30, reflecting that students’ listening comprehension and dictation skills were generally weak; the average score in the writing section was 18 out of 30, reflecting that students had more problems with grammatical accuracy, vocabulary use, and article logic; the average scores in the reading and translation sections were 12 out of 20 and 5 out of 20, indicating that students were also deficient in their ability to read and comprehension of specialized articles and translation of specialized content are also deficient (Table 3).

Table 3. Pre-test score

Pre-test score (out of 100)	Average score
Writing section	18/30
Translation section	5/20
Listening section	20/30
Reading section	12/20
Overall	55/100

5.2 Implementation Stage

In this stage, the study formally enters into the practical operation, based on the data obtained in the diagnostic stage and the results of the problem analysis, different teaching modes will be implemented with different teaching modes respectively, in order to verify the effectiveness of the “six-element collaborative” teaching mode.

Eighty-seven students participating in English teaching were randomly divided into the experimental group (43 students) and the control group (44 students). Teachers were grouped accordingly to ensure that the two groups were comparable in terms of teaching experience and professional background. In the experimental group, the LLMs-driven “six-elements of collaborative” teaching model was implemented, and teaching activities were carried out according to it. The control group adopted the traditional teaching mode, taught according to the conventional teaching syllabus and teaching methods, and carried out a unified teaching arrangement without the assistance of LLMs. The teaching period was set for one semester, with a fixed number of English teaching hours per week to ensure that students in both groups received the same number of hours of English teaching.

In the experimental group, the “six-element collaborative” teaching model with LLMs was adopted. In objective collaboration, teachers use LLMs to analyze data for personalized goals and cross-cultural practice. In specialty collaboration, majors update knowledge and create integrated courses. Teacher collaboration builds a virtual community with LLMs-generated plans. Mode collaboration adjusts online and offline teaching via big data. Course collaboration coordinates teaching and activities for immersive learning. Evaluation collaboration constructs a multi-modal system. Overall, this

model uses LLMs to comprehensively enhance teaching and learning in various aspects, aiming to improve students' language and professional skills. The control group continued to adopt the traditional teaching mode, in which teachers mainly taught in the classroom and teaching activities were carried out in accordance with the established syllabus and teaching methods.

Student achievement data is one of the key indicators to show the effectiveness of the “six-element collaborative” teaching model. In order to ensure the scientific and fairness of the tests, the four tests of writing, translation, listening, and reading are conducted in strict accordance with the scoring standards, which are closely related to the problems shown by the students in the questionnaires and pre-tests.

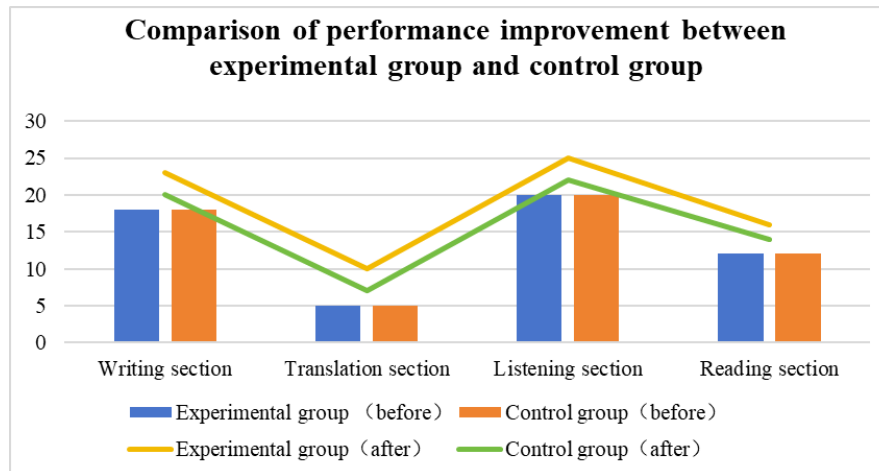


Figure 3. Comparison of performance improvement between the experimental group and the control group.

Writing scores: end-of-semester writing test out of 30 points. The average score of the experimental group improved from 18 to 23, with an increase of 2 points in the score of grammatical accuracy, 2 points in the score of vocabulary use, and 3 points in the score of logical writing. The mean score of the control group improved from 18 to 20, with an increase of 1 point each in grammatical accuracy score, vocabulary use, and essay logic score.

Translation scores: the translation test is out of 20 points. The average score of the experimental group increased from 5 to 10, the accuracy score of professional content translation increased by 3 points, and the fluency score of language expression increased by 2 points. The average score of the control group increased from 5 to 7, with an increase of 1 point in the accuracy of professional content translation and 1 point in the fluency of language expression.

Listening scores: the listening test was out of 30 points. The average score of the experimental group increased from 20 to 25, with a 3-point increase in the listening comprehension score and a 2-point increase in the dictation score. The average score of the control group improved from 20 to 22, with a 1-point increase in listening comprehension score and a 1-point increase in dictation score.

Reading scores: the reading test was out of 20 points. The mean score of the experimental group improved from 12 to 16, the specialized article comprehension score improved by 3 points, and the reading speed score improved by 1 point. The control group's mean score improved from 12 to 14, the specialized article comprehension score improved by 1 point, and the reading speed score improved by 1 point.

Students in the experimental group studied English for an average of 2 hours more per week than those in the control group, of which 1.5 hours more were spent on online learning, mainly for using LLMs to assist learning, such as participating in virtual classrooms and completing personalized exercises generated by LLMs. The completion rate of homework in the experimental group reached 95%, including 30% of active extended learning tasks; the completion rate of homework in the control group was 85%, and the completion rate of active extended learning tasks was 10%. Students in the experimental group clicked on English course resources 15 times a week on average, while the control group clicked on them 10 times. The number of collaborations between English teachers and professional teachers in the experimental group was 8 times per month, which was carried out through the Virtual Teaching and Research Community support system, involving teaching program design, course content discussion, etc.; the number of collaborations between teachers in the control group was 3 times per month, mostly ad hoc exchanges. The number of shared teaching resources in the experimental group was 50, and the reuse rate of resources was 70%; the number of shared teaching resources in the control group was 30, and the reuse rate of resources was 50%.

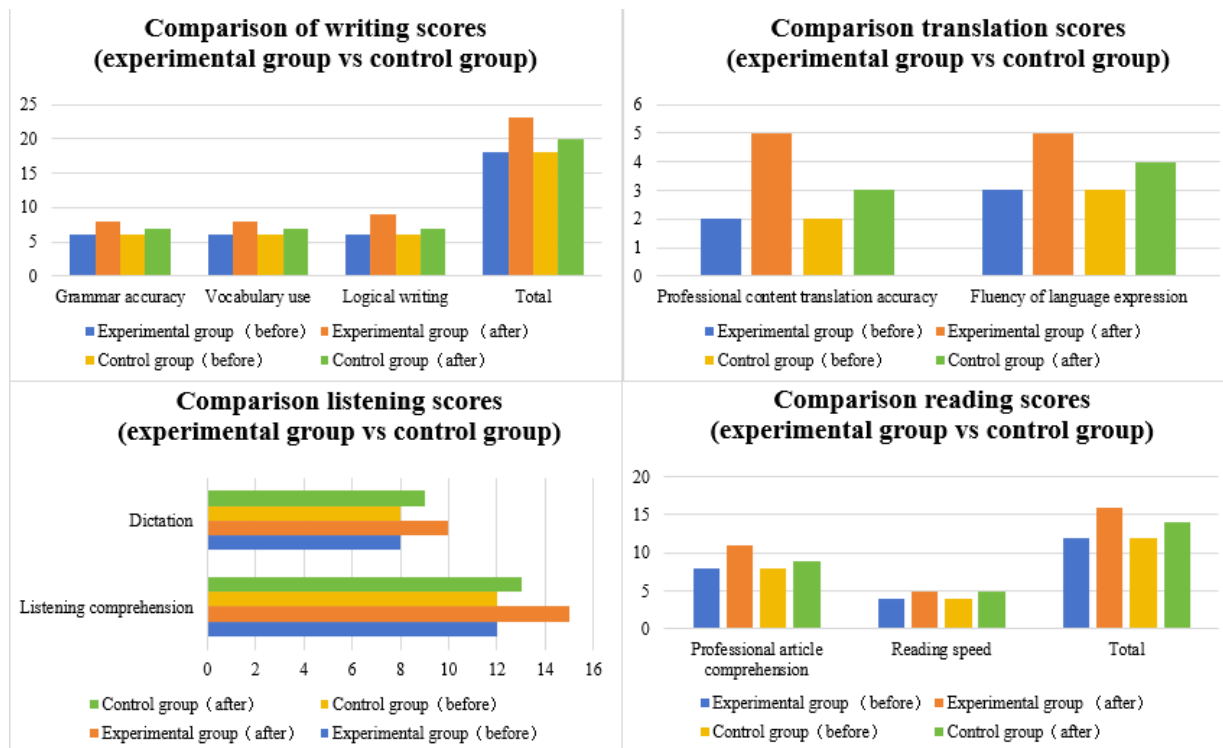


Figure 4. Comparison of writing, translation, listening, and reading scores.

5.3 Reflection Stage

At the end of the teaching practice, the teacher team conducted a comprehensive and in-depth reflection according to the teaching process and results, providing a solid basis for the optimization of the subsequent teaching strategies. From the dimension of students' performance improvement, the experimental group's performance improvement in writing, translation, listening, and reading is better than that of the control group. This data fully proves the effectiveness of the "six-elements collaborative" teaching model combined with LLMs. Some problems were found. Some students show an over-reliance phenomenon when using LLMs, which is manifested in the face of challenging difficulties the first time to use LLMs to answer, long-term will lead to a lack of students' ability to think actively. In follow-up teaching, teachers need to take measures to guide students to use LLMs rationally.

Although the "six-element collaborative" teaching model has achieved certain results, there is still room for improvement. Constantly reflect on and adjust our teaching strategies, optimize the application of LLMs in teaching, further improve the quality of higher vocational and undergraduate English articulation education, better meet the learning needs of students, and promote the development of the vertical integration of the modern vocational education system.

6. Conclusion

In the process of teaching digital transformation, the LLMs-driven "six-element collaborative" teaching model has successfully revealed the dynamic coupling mechanism among six key elements: objective, specialty, teacher, mode, course, and evaluation. With the data processing capability of LLMs, we arrive at the scientific teaching cycle mechanism of "diagnosis-generation-collaboration-evaluate".

The role of LLMs in the field of teaching has been upgraded from an auxiliary teaching tool to a rebuilder of educational ecology, and there is a close symbiotic relationship between the two. This symbiotic relationship breaks through the limitations of technology application in previous studies and strongly verifies the paradigm shift of intelligent technology from "tool assistance" to "ecological reconstruction".

Three iterations of the LLMs-driven "six-elements of collaborative" model have yielded significant results. Students in the experimental group outperformed the control group on several key dimensions of English language learning. Writing scores improved by 27.8%, translation scores by 100%, listening scores by 25%, and reading scores by 33.3%, all of

which were statistically significant ($p < 0.01$). This result fully validates the effectiveness of the “six-elements collaborative” teaching model on the English language articulation between higher vocational and undergraduate programs.

The practical validation of the LLMs-driven “six-element collaborative” teaching model provides an articulated education solution for the digital transformation of education. Subsequent research can further expand the sample scope and provide stronger support for the construction of a vertically integrated modern vocational education system.

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