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Research on the Application of Virtual Assistants in Deep English Reading Instruction for Non-English Majors in Higher Vocational Colleges

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Abstract: This study aims to explore the application effect of virtual assistants in deep English reading teaching in higher vocational colleges, so as to solve the current problems in teaching, such as rigid methods, insufficient students' interest and ability, lack of resources, and flawed evaluation systems. The study constructs a four-dimensional driven English reading teaching model and systematically analyzes the application of virtual assistants through empirical research. The results show that this model significantly improves the academic performance of students in the experimental class, with a more concentrated score distribution and an increased proportion of high-scoring students; virtual assistants play a positive role in assisting vocabulary understanding, promoting preview and review, stimulating reading interest, and cultivating autonomous learning habits, with high-frequency users benefiting more significantly. However, there are problems such as unbalanced usage frequency and coverage, and insufficient functional adaptability. The study proposes hierarchical intervention strategies: expanding usage coverage, guiding autonomous learning in a hierarchical manner, and strengthening teaching intervention effects, providing an empirical basis and practical paths for virtual assistants to optimize deep English reading teaching in higher vocational colleges.

Keywords: Virtual assistants; Higher vocational English; Deep reading teaching; Teaching model

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1. Introduction

In the digital era, intelligent technology is profoundly transforming education. The Vocational Education Quality Improvement and Excellence Program clearly proposes to promote the deep integration of information technology with education and teaching; the Opinions on Accelerating the Advancement of Educational Digitalization also proposes to further implement the national educational digitalization strategy. "Artificial intelligence + education" has become an important direction of national educational development. Based on this policy orientation and national needs, this study aims to explore the practical application effect, existing

problems, and optimization strategies of virtual assistants in deep English reading teaching in higher vocational colleges. It not only provides a new perspective for enriching the theoretical research of "artificial intelligence + foreign language teaching" but also the formed practical model that can provide an innovative example for teaching reform in similar colleges and universities. Through empirical research and systematic analysis, it provides a basis for teaching reform, effectively improves students' English reading ability and comprehensive literacy, and enhances their professional competitiveness.

2. Literature review

Global research on artificial intelligence began in 1956 and has continued to develop to this day. In recent years, research enthusiasm has continued to rise, and the application of artificial intelligence has become a research hotspot. Although foreign research on artificial intelligence started earlier, China has also made remarkable progress in this field.

2.1. Foreign research on the application of virtual assistants in education

In recent years, chatbots have been increasingly widely used in the field of education. Agarwal et al. defined them as software applications that can identify patterns from input information and generate corresponding output results [1]. Such tools are called "virtual assistants" due to their core design logic of understanding user needs and responding in natural language based on artificial intelligence (AI) technology. In educational scenarios, the core goal of chatbots is to promote knowledge construction, and this field has shown significant development — their role is mainly reflected in empowering students individually with knowledge on specific topics. Han and Lee pointed out that the advanced direction of such tools is to simulate the knowledge transmission function of human teachers [2]. Currently, chatbots have been widely used as virtual assistants or agents to strengthen the two-way process of teaching and learning. The popularization of chatbot applications benefits from the breakthrough progress in natural language processing technology [3]. In addition, studies have shown that chatbots can help higher education institutions optimize existing service systems, reduce labor costs, and develop innovative service models [4]. Perez et al. divided educational chatbots into two types: service-oriented and teaching-oriented [5]. Among them, service-oriented bots mainly support students' demand response in transactional scenarios such as admission consulting and library services; teaching-oriented bots act as classroom assistants, undertaking teaching support functions such as knowledge generation, improving student participation, and providing intelligent feedback [6].

2.2. Domestic research on the application of virtual assistants in education

There are not many domestic studies on virtual assistants. At present, many schools have recognized the efficiency and convenience of the auxiliary functions of virtual assistants and are trying to use them in education and teaching. Huang Ronghuai et al. emphasized that facing the rapid development and continuous iteration of artificial intelligence technology and the wide penetration of robots in the field of education, it is necessary to track the new trends of international artificial intelligence and education development, study the typical application scenarios of educational robots, analyze the value of educational robots in school education, judge their potential risks and threats, and on this basis, propose a "people-oriented" technology governance framework [7]. Zhang Zhoutao et al. believed that AI chatbots have multiple identities: personal assistants,

social playmates, and teacher assistants. Through research, they found that interaction with AI chatbots effectively improved students' foreign language oral skills [8]. Students are generally satisfied with interacting with AI chatbots, believing that the bots answer their questions well and have human-like social and emotional abilities. Under the premise of rational, moderate, and correct use, artificial intelligence chatbots will likely have the following positive impacts [9]. Ren Mudan et al. systematically analyzed the current status of chatbot applications and evaluation at home and abroad, judged the problems and further application scenarios in chatbot evaluation work, and promoted chatbot evaluation and application activities [10].

2.3. Research review

Foreign research on the exploration of segmented scenarios and technology adaptation experience in the educational application of virtual assistants, together with domestic research's focus on "people-oriented" technology governance and the auxiliary value of specific disciplines, provides a two-way reference for this study to construct a virtual assistant application model suitable for deep English reading teaching in higher vocational colleges. It is necessary to absorb the practical framework of technology application and take into account localized teaching needs, risk prevention, and control. However, current domestic exploration on the application of virtual assistants in this specific scenario is insufficient, especially the lack of empirical models targeting the characteristics of higher vocational education. Therefore, this study constructs relevant teaching models and conducts empirical research to provide practical paths for teaching reform in similar colleges and universities and improve students' professional competitiveness.

3. Analysis of the current situation of English reading teaching in higher vocational colleges

Reading is a core link in English learning, but current English reading teaching in higher vocational colleges still has problems that need to be improved. The specific current situation is analyzed as follows:

3.1. Rigid teaching methods

English reading teaching in higher vocational colleges still generally adopts the traditional model of "teacher teaching — students passively accepting." The teacher-centered teaching orientation lacks effective teacher-student interaction and student-student cooperation mechanisms, leading students to be in a passive state of knowledge reception for a long time. The lack of heuristic strategies and interactive activities in classroom teaching not only makes it difficult to stimulate students' learning initiative and interest but also ignores the cultivation of critical thinking and innovative abilities, restricting students' thinking development and the satisfaction of personalized learning needs.

3.2. Insufficient students' reading ability and learning motivation

Limited by teaching content and methods, higher vocational students' English reading ability is generally weak, mostly staying at the level of understanding the surface meaning of texts. They lack the ability to explore and analyze deep semantics, making it difficult to accurately grasp the main idea and core viewpoints of articles, and their analytical and judgment abilities are insufficient. At the same time, the selection and presentation of reading materials are not attractive, leading to students' low learning interest, burnout towards reading tasks, and insufficient internal motivation for continuous learning.

3.3. Lack of teaching resources

Despite the acceleration of educational informatization, there are still obvious shortcomings in English reading teaching resources in higher vocational colleges: most institutions lack advanced teaching equipment and software support, which limits teachers' application of diversified teaching methods and hinders the innovation of teaching design and the era adaptation of teaching processes. In addition, students lack independent learning resources and have limited extracurricular expansion channels. They can only complete learning relying on textbooks and classroom time, which makes it difficult to meet personalized learning needs, thereby affecting reading experience and ability improvement.

3.4. Flawed evaluation system

The current evaluation of English reading teaching in higher vocational colleges mainly relies on traditional written examinations, focusing on assessing the mastery of linguistic knowledge and skills, but ignoring the comprehensive evaluation of students' comprehensive quality and abilities, making it difficult to objectively reflect their true level and development potential. At the same time, the evaluation focus deviates from the learning process and methods, which is not conducive to guiding students to cultivate autonomous learning ability and lifelong learning awareness, and there is an obvious disconnect with the goal demands of deep reading teaching.

4. Design of the deep English reading teaching model based on virtual assistants

The four-dimensional driven English reading teaching model takes teaching objectives, teaching content, teaching methods, and teaching evaluation as the core modules, forming a dynamic closed-loop system, as shown in **Figure 1**.

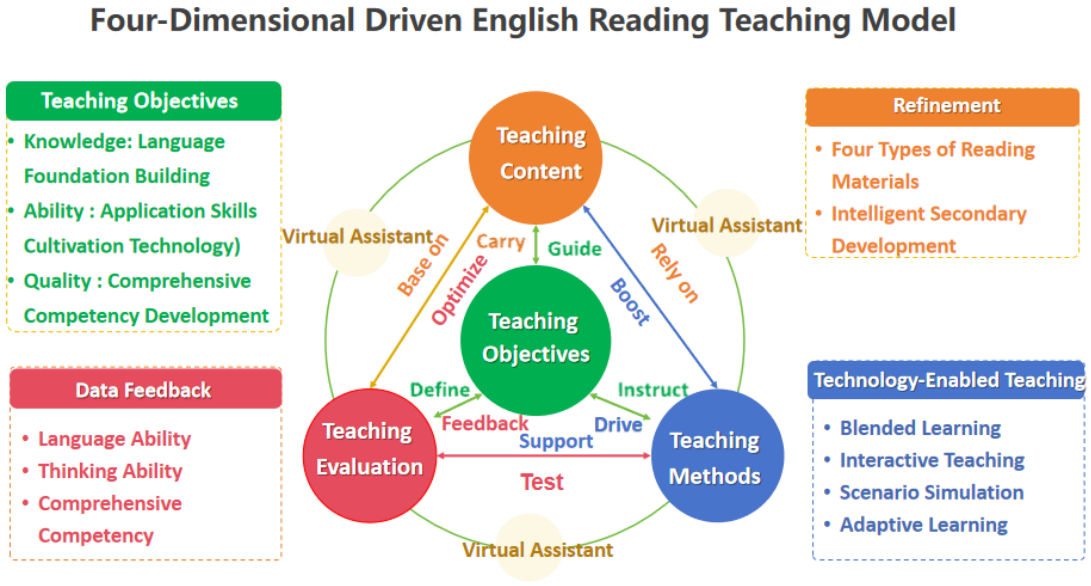

Figure 1. Four-dimensional driven English reading teaching model

Teaching objectives, as the guiding engine, are divided into a three-dimensional structure: knowledge dimension (language foundation construction, covering vocabulary/grammar/culture), ability dimension

(application ability cultivation, focusing on reading/communication/technology), and quality dimension (comprehensive literacy shaping, focusing on thinking/cooperation/lifelong habits). Teaching content is realized through a dual-track material transformation system: on the one hand, four types of reading materials (literary/professional/news/occupational) are carefully selected; on the other hand, intelligent secondary development (hierarchical difficulty processing, cultural correlation expansion, interactive form transformation) is carried out. Teaching methods are supported by a technology empowerment matrix: blended learning relies on virtual assistants to realize flipped classrooms; interactive teaching promotes real-time collaboration and shared creation; scenario simulation deepens role-based practice; adaptive learning dynamically adjusts tasks through AI. Teaching evaluation forms a three-dimensional data feedback loop: quantifying language ability (vocabulary/grammar), testing thinking ability (reasoning/refutation tasks), and tracking comprehensive literacy (cross-cultural understanding/learning motivation) [11].

Each module operates collaboratively through two-way logical connections: teaching objectives guide content design, content promotes method implementation, methods support evaluation data collection, and evaluation optimizes teaching content, feeds back goal iteration, and method optimization. Virtual assistants, as the technical core, penetrate the entire domain — providing a hierarchical resource library for content, supplying an adaptive engine for methods, collecting behavioral data for evaluation, and calibrating dynamic weights for objectives.

The core value of this model lies in constructing an intelligent closed loop of "teaching-learning-evaluation": driving goal adjustment with evaluation data (e.g., triggering special training for weak language links), connecting the entire chain of resource supply-practice support-effect verification through virtual assistants, and ultimately realizing the coordinated development of language ability, thinking literacy, and cultural awareness, providing a systematic framework for precise teaching in smart education scenarios.

5. Research on the application of virtual assistants in deep English reading in higher vocational colleges

5.1. Experimental design and result analysis

5.1.1. Research objects

This study selected freshmen of non-English majors from Guangzhou South China Business Vocational College as research objects, including four classes with a total of 256 students. Among them, the experimental class (135 students, 109 males and 26 females) adopted the four-dimensional driven English reading teaching model; the control class (121 students, 98 males and 23 females) adopted the traditional teaching model.

5.1.2. Research methods

In this study, a pre-test, mid-test, and post-test design was adopted to conduct comprehensive score tests on the experimental class and the control class. Through horizontal comparison, it aims to reveal the score differences between the experimental class and the control class in the same test stage, thereby evaluating the teaching effect of virtual assistant intervention in deep English reading in higher vocational colleges. At the same time, through vertical comparison, it tracks the score changes of the experimental class and the control class in different test stages to observe the trend and extent of their learning progress. This dual comparison and analysis method not only helps to deeply understand the effectiveness of the teaching measures in the experimental class but also provides a scientific basis and improvement direction for future teaching practice.

5.1.3. Research results

This study conducted three score tests (pre-test, mid-test, post-test) on the experimental class and the control class, respectively. Through boxplots, it was found that: the median score 1 of the experimental class was about 60 points, with a large interquartile range, indicating significant differences in students' scores; the median score 2 was about 80 points, with a relatively concentrated score distribution; the median score 3 was about 80 points, with the most concentrated scores, indicating a significant overall score improvement. The median score 1 of the control class was about 70 points, with a large interquartile range; the median score 2 was about 80 points, with an overall good performance; the median score 3 was about 80 points, with a relatively concentrated score distribution, indicating a significant overall score improvement in the control class.

Further comparison of the higher vocational English reading scores between the experimental class and the control class found that: the scores of the experimental class improved significantly, with the average score 1 being 61.24, the average score 2 increasing to 68.78 (7.54 points higher), and the average score 3 rising to 82.49 (13.71 points higher than score 2 and 21.25 points higher than score 1). This significant progress was also verified statistically. Through paired sample t-tests, it was found that there were significant differences between the three scores of the experimental class (all P-values < 0.05), and they were significantly correlated. Although the scores of the control class also improved to a certain extent, the range was relatively small. The average score 1 of the control class was 62.78, score 2 was 67.89 (5.11 points higher), and score 3 was 76.39 (8.5 points higher than score 2 and 13.61 points higher than score 1). Similarly, the three scores of the control class also passed the paired sample t-test, indicating significant differences between them. However, compared with the experimental class, the score improvement range of the control class was smaller, which confirms that the application of virtual assistants in higher vocational English reading teaching has a more significant effect on improving students' scores.

5.2. Interview analysis

5.2.1. Interview design

In this study, 5 students representing high, medium, and low-frequency users were selected for interviews. Interviews were mainly conducted via WeChat, and interviewees replied with voice or text, which were finally sorted out. The interview questions are as follows:

How often do you currently use virtual assistants for English learning? In which links does it mainly help you?

What role do you think virtual assistants play in improving English reading comprehension ability? Please give examples.

After using virtual assistants, have your autonomous learning habits or methods changed? If so, what are the changes?

In which aspects do you think virtual assistants can be further optimized to better meet your learning needs?

Overall, what do you think of the auxiliary role of virtual assistants in deep English reading teaching in higher vocational colleges?

5.2.2. Interview analysis

Students gave various answers to the application of virtual assistants in deep English reading teaching in

higher vocational colleges. Some low-frequency users said they hardly used or only occasionally used virtual assistants and failed to fully experience their help in the learning process. Medium-frequency users believed that virtual assistants were helpful in vocabulary learning and initial understanding of articles, mainly used during preview and post-class answer checking. High-frequency users highly evaluated virtual assistants, believing that they provided strong support in multiple areas such as preview, classroom learning, and post-class review, significantly improved reading comprehension ability, and cultivated autonomous learning habits and methods. At the same time, students also put forward some optimization suggestions, such as hoping that virtual assistants can be further optimized in analytical functions, resource recommendation, interactivity, and personalized learning experience. Overall, virtual assistants play a positive auxiliary role in deep English reading teaching in higher vocational colleges, but students with different usage frequencies have different evaluations and needs.

5.3. Questionnaire analysis

5.3.1. Questionnaire design

The questionnaire was designed around four dimensions: personal information, virtual assistant usage frequency, functional satisfaction, and impact on reading interest and autonomous learning ability, with a total of 27 questions. A total of 173 questionnaires were distributed to the experimental class, 154 were recovered (recovery rate 89%), 19 invalid questionnaires (too short response time) were excluded, and 135 valid questionnaires were obtained (effective rate 88%). To ensure the rigor and scientificity of this study, SPSS 25 software was used to test the reliability and validity of the questionnaire. The Cronbach's alpha coefficient of the questionnaire was 0.949, greater than 0.7, indicating good reliability of the questionnaire; the KMO value was 0.932, greater than 0.5, indicating good validity of the questionnaire.

5.3.2. Questionnaire analysis

Frequency analysis: There were more male students than female students in this survey, so the survey results focus on the views of male students. Students with weekly reading time less than 2 hours accounted for 18.5%, 2–4 hours accounted for 68.9%, 4–6 hours accounted for 6.7%, 6–8 hours accounted for 1.5%, and more than 8 hours accounted for 4.4%.

Difference test: To understand the differences of each dimension in gender, an independent sample t-test was adopted. The results confirmed that the significance test of differences in virtual assistant usage frequency between genders was 0.430, greater than 0.05, indicating that there was no difference in virtual assistant usage frequency between students of different genders. Similarly, there were no differences in virtual assistant functional satisfaction and the impact on reading interest and autonomous learning ability between genders. There were differences in the impact on reading interest and autonomous learning ability in weekly reading time, because the significance test result was 0.002, less than 0.05.

Correlation analysis: The three dimensions of virtual assistant usage frequency, functional satisfaction, and impact on reading interest and autonomous learning ability were significantly positively correlated (all correlation coefficients > 0).

6. Discussion

Through experimental, interview, and questionnaire analysis, it was found that compared with the traditional teaching model, the four-dimensional driven English reading teaching model based on virtual assistants can

more significantly improve students' English reading scores. Overall, virtual assistants play a positive role in assisting deep English reading teaching in higher vocational colleges, and their usage frequency and functional satisfaction are significantly positively correlated with students' reading interest and autonomous learning ability. However, students with different usage frequencies have different evaluations and needs. At the same time, some problems were also found: unbalanced usage frequency and coverage, with male students having higher usage frequency and related ability scores than female students, and a certain proportion of low-frequency users; unbalanced promotion of autonomous learning ability, with students with shorter weekly reading time having lower related ability scores, and low-frequency users still relying on traditional teaching; differences in score improvement effects among groups, with post-test scores of the experimental class being concentrated and having a high excellent rate, while scores of the control class being scattered and the proportion of low-scoring students still being higher than that of the experimental class.

7. Countermeasures

7.1. Expand usage coverage and reduce group differences

Targeting professional differences, combined with the current situation of students' virtual assistant usage, customizing English reading materials integrated with their professional scenarios, combining professional terminology learning with English reading, and improving the practicality of the tool for students. At the same time, regularly organize cross-professional experience sharing meetings, inviting high-frequency users to share application cases of virtual assistants in English reading, and reducing the usage threshold for low-frequency users.

Targeting gender differences: There are certain differences between female and male students in learning preferences and usage habits. Select reading materials that meet their preferences in combination with the learning fields and interest points focused on by students of different genders, to improve their interest in learning tools. In addition, carry out gender-stratified training, setting differentiated training content and methods according to the learning characteristics and needs of different genders [12].

Activate low-frequency users, design "quick start guidance" including core functions such as "one-click word lookup" and "paragraph main idea extraction" to reduce the initial usage threshold. At the same time, establish a peer mutual assistance mechanism of "high-frequency users driving low-frequency users", pairing students with weekly usage frequency ≥3 times with those with monthly usage ≤2 times. Demonstrate the tool value through one-on-one demonstrations (such as using virtual assistants to complete the preview of a text in 5 minutes), and set "collaborative learning goal rewards" to improve the participation of low-frequency users.

7.2. Guide autonomous learning in a hierarchical manner and motivate low-frequency readers

Design a stepped reading incentive mechanism. For students with weekly reading time ≤2 hours, set a "micro-goal task system": complete 1 short article of less than 100 words per day, and accumulate 7 days to obtain 7 reading points. At the same time, develop a "reading growth dashboard" to visually display the correlation trend of "weekly reading time—test score—interest score", allowing students to intuitively see the positive cycle of "more reading → improved scores → enhanced interest", and strengthen the motivation for continuous reading.

Promote the development of autonomous learning habits. Provide "template-based learning plans" for low-frequency users, such as "5 minutes before class: use virtual assistants to look up new words + generate

preview outlines; during class: mark questions and look up information with tools in real time; 10 minutes after class: review wrong questions recommended by tools + expand 1 similar article", guiding autonomous planning through fixed processes. Add a "learning community" section to encourage students to upload reading notes and wrong question analyses generated by virtual assistants, set a "high-quality content list", select "note masters" monthly and reward customized learning resources, forming a learning atmosphere of mutual assistance and sharing [13].

7.3. Strengthen teaching intervention effects and narrow the score gap

Gradually introduce virtual assistants into the control class. For the scattered post-test scores and high proportion of low-scoring students in the control class, select students with post-test score improvement of less than 10 points to carry out the "core function trial plan": prioritize the design of wrong question analysis and personalized practice recommendations, arrange 1 20-minute tool usage guidance class every week, where teachers demonstrate how to use virtual assistants to specifically overcome weak question types. Evaluate the effect after 2 months and gradually expand the usage scope to the whole class.

Establish a "score-usage" correlation analysis mechanism, regularly track students' test scores and virtual assistant usage data, and generate a "usage-effect" correlation report [14]. For students with insignificant score improvement, arrange teachers or study committee members to conduct "one-on-one function diagnosis": analyze their tool usage records (such as only using the word lookup function and not participating in extended exercises), and targetedly guide advanced functions (such as using the "text structure analysis" function to improve the ability to understand paragraph logic), ensuring that students not only "use tools" but also "use tools well", giving full play to the auxiliary role of virtual assistants in score improvement [15].

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