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Transformation of English Language Teaching Models Driven by Digital Technology and the Far-reaching Impact on Acquisition Effectiveness

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Abstract The innovation of English teaching mode in the digital era has become the focus of attention in the education sector. New technologies such as AI, big data, and virtual reality provide intelligent and personalized learning experiences for English language teaching and promote the development of the teaching mode in the direction of more flexibility and efficiency. This study explores the transformation of the English language teaching mode driven by digital technology and its impact on the acquisition effect. The study adopts a variety of methods to design and implement an AI-enabled BOPPPS teaching model. Two classes of 70 students in the first year of senior high school in K High School in Kelamayi City were selected as the research subjects, and the experimental group adopted the AI+BOPPPS teaching model, while the control group adopted the traditional teaching model for a 15-week experimental study. Changes in English learning attitudes and vocabulary knowledge breadth before and after the experiment were analyzed by paired-samples t-test. The results show that the mean value of the post-test of students' English learning attitude in the experimental group is 14.451, and that of the control group is 11.232, with a difference of 3.219 ($P=0.000<0.05$), which is a significant difference; and the post-test of vocabulary knowledge breadth in the experimental group is 69.17, which is higher than that of the control group is 60.24, with a difference of 8.93 ($P=0.016<0.05$), which is a significant difference. The study shows that the AI-enabled BOPPPS teaching model effectively enhances students' learning interest, engagement and knowledge mastery through the integration of AI technology in the introduction, pre-test, participatory learning and post-test, and significantly promotes the cultivation of students' attitudes toward English language learning and the improvement of vocabulary knowledge breadth.

Index Terms Digital technology, AI empowerment, BOPPPS teaching model, English language teaching, learning attitude, vocabulary knowledge breadth

I. Introduction

In the digital era, the innovation of English teaching mode has become the focus of extensive attention in the academic and educational circles. With the rapid development of information technology, the traditional English teaching methods gradually appear to be lagging behind, unable to fully meet the language learning needs of students in the context of diversified disciplines and globalization [1], [2]. The popularization of digital technology has led to an unprecedented shift in educational methods, and how to make full use of these technological means to improve the quality of English teaching is an urgent problem that needs to be solved at present [3]. The changes brought about by the digital era are not only updates on the technical level, but also challenges to the traditional English teaching concepts and methods [4], [5]. Students' subject backgrounds are becoming more and more diversified, and society's demand for English application ability is also more complex and diverse, which requires English teaching mode to be more adaptable and innovative [6], [7]. Therefore, in-depth research on the English teaching mode in the digital era is imperative in order to provide more targeted educational programs and promote the overall development of students in terms of language proficiency, comprehensive literacy and other aspects [8].

As a public basic course with both humanistic and instrumental qualities, English can not only help students master language skills, but also cultivate composite talents with an international perspective and cross-cultural communication ability [9]. This plays an important role in promoting understanding and respect among different cultures, as well as promoting Chinese culture to the world stage. Therefore, the quality and effectiveness of English teaching are directly related to the comprehensive quality and international competitiveness of students [10]-[12]. Under the background of digital education, by means of innovative teaching methods, optimized teaching resources, and personalized learning path design, college English can better meet students' learning needs and improve the

effect and quality of English teaching [13], [14]. At the same time, the popularization and application of digital technology will also promote the communication and cooperation of English education on a global scale, and promote the development of English teaching in the direction of internationalization and diversification.

New technologies such as artificial intelligence, big data, and virtual reality further provide intelligent and personalized learning experiences for English teaching [15]-[17]. Literature [18] embedded artificial intelligence technologies, including deep learning and decision tree algorithms, into the development of an online intelligent English teaching platform to help provide students with personalized learning paths based on their knowledge mastery levels, thus improving the efficiency of English learning. Literature [19] proposes an artificial intelligence-based English teaching method (AI-ETM) that uses associated intelligent algorithms to dynamically adjust teaching strategies and learning materials to suit students' individualized needs, thereby improving the efficiency and effectiveness of university English education. Literature [20] utilizes big data and AI to construct a new approach to the English teaching ecosystem in order to improve student learning and English proficiency. Literature [21] investigated different immersive virtual reality (iVR) technology methods for teaching English as a foreign language (EFL), which has a significant teaching effect compared to the traditional audio-only listening practice method. The digitalization of education and the innovation of teaching modes complement each other to build a new ecology of modern education that is flexible, efficient and interactive.

The popularization of digital technology is profoundly changing the face of the education field, and the innovation of English teaching mode has become the focus of extensive attention in both academic and educational circles. The traditional way of teaching English appears to be incompetent in the face of students' diversified subject backgrounds and globalized development needs. The application of new technologies such as artificial intelligence, big data, virtual reality and so on provides unprecedented possibilities for English teaching, which is not only an update of the technical level, but also a fundamental challenge to the traditional teaching concepts and methods. As a public basic course with both humanistic and instrumental qualities, English undertakes the important mission of cultivating composite talents with international vision and intercultural communication ability. Under the background of globalization, English communication ability has become a bridge connecting cultures and economies of different countries, and the quality of its teaching is directly related to the comprehensive quality and international competitiveness of students. Digital education can better meet students' learning needs and improve teaching effects through innovative teaching methods, optimized teaching resources and personalized learning path design. The application of artificial intelligence technology, especially deep learning and decision tree algorithms, makes the design of personalized learning paths possible, and students can get a customized learning experience according to their knowledge mastery level.

The BOPPPS model, as a student-centered instructional design framework that emphasizes student participation, interaction, and feedback, combined with digital technology provides a new path for the transformation and upgrading of the English teaching model. This study will explore how to combine AI technology with the BOPPPS teaching model to construct an AI-enabled instructional design strategy. The personalization and automation of the teaching process will be achieved through the integration of AI technology in key aspects such as introduction, clarification of learning objectives, pre-test, participatory learning, post-test and summary. The study will select a high school English teaching class as the research object by way of experimental comparison to systematically analyze the impact of AI+BOPPPS teaching mode on the effect of students' English language acquisition, paying special attention to the changes in students' attitude towards English learning and the breadth of vocabulary knowledge, with a view to providing theoretical support and practical guidance for the innovation of English teaching mode in the digital era.

II. BOPPPS English Language Teaching Model Based on AI Empowerment

In the wave of globalization, the importance of English language education has been rising, which has become a bridge connecting cultures and economies of different countries, and has put forward higher requirements for cultivating students' English communication skills. With the rapid development of digital technology, its application in the field of education provides new possibilities for improving teaching effectiveness [22]. BOPPPS model, as a student-centered instructional design framework, the model is designed to be student-centered, focusing on student participation, interaction and feedback. This chapter will aim to explore how to combine digital technology with the transformation and upgrading of the English language teaching model to design an AI technology-enabled BOPPPS teaching model [23].

II. A.AI+BOPPPS Instructional Design Strategies

The AI+BOPPPS instructional design strategy is shown in Fig. 1. The AI+BOPPPS instructional design strategy effectively enhances students' learning interest, goal clarity, engagement, and knowledge mastery through the

integration of AI technology in the key instructional links such as introduction, pre-testing, participatory learning, and post-testing, and ultimately realizes personalized teaching and a significant increase in learning effectiveness [24].

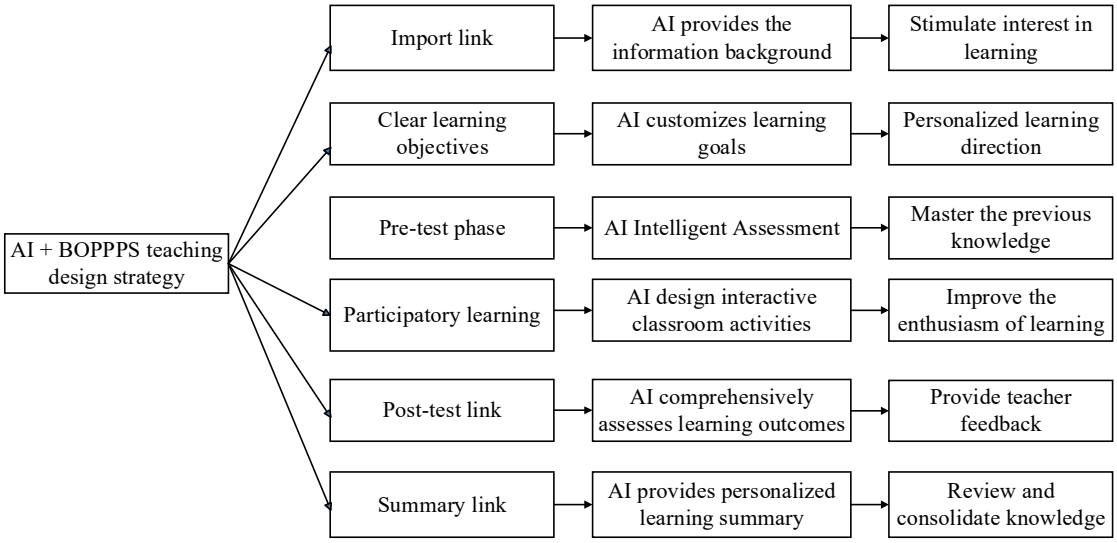


Figure 1: AI + BOPPPS teaching design strategy

II. B.AI+BOPPPS design for English language courses

In the introductory session, AI is used to assist in the introduction, through AI-generated short videos or interactive multimedia presentations to attract students' attention.

In the learning objective clarification session, by analyzing students' learning history and ability level, AI can personalize and recommend learning objectives suitable for each student.

In the pre-testing stage, AI designed questionnaires or quizzes are used to understand students' current level of knowledge about corporate culture, and AI can dynamically adjust the difficulty and direction of the questions based on the students' answers, and provide personalized feedback and learning suggestions.

In the participatory learning session, the application of AI technology greatly enriches students' interactive experience and learning depth. First, AI-assisted interactive activities are designed to let students experience the operation of different corporate cultures through simulation games and role-plays.

In the post-test session, AI-designed post-test questions are used to test students' mastery of corporate culture knowledge and provide detailed feedback and suggestions for improvement; AI can instantly analyze the results of students' post-tests and provide personalized feedback and learning resources.

In the summary session, the summary report generated by AI summarizes the students' learning results and improvement points, and helps students to sort out the knowledge points, generate personalized learning summaries, and then recommend future learning directions and resources according to the students' learning situation.

Through this AI+BOPPPS teaching design, the English language teaching process becomes more personalized and interactive, and the application of AI technology makes English language teaching more flexible and efficient, while providing students with a richer and more personalized learning experience. This design not only improves students' participation, but also promotes students' deep understanding of corporate culture.

II. C.Innovative applications of AI technology in the BOPPPS model

The AI+BOPPPS teaching model has realized significant pedagogical improvements compared with the traditional BOPPPS model. In the traditional teaching model, teaching activities are often led by teachers, whose experience and available teaching resources are the main basis for designing the curriculum, and this approach often leads to a lack of personalization of teaching activities. With the introduction of AI technology, the teaching process becomes more personalized and automated.

AI technology is able to analyze students' learning histories and interests before the course begins and provide them with customized prep materials. This personalized approach not only attracts students' interest, but also lays a solid foundation for classroom learning that would be difficult to achieve with uniform prep materials in the traditional model.

In the classroom discussion, the application of AI chatbots greatly enhances classroom interaction, guiding students to explore topics such as corporate culture in depth and understand complex concepts from multiple perspectives, which is difficult to compare with traditional teaching models.

The AI tool ensures that all students understand and agree with the learning objectives by dynamically presenting them. This dynamic presentation is more intuitive and easier to understand than the static presentation of objectives in traditional models.

In the classroom, AI-assisted text analysis tools help students dig deeper into the text, facilitating critical thinking and classroom discussion, which is much more efficient than the traditional model that relies on instructor-led and student-directed learning.

The rapid reading strategies provided by AI enable students to acquire and process information more efficiently, which is often not systematically provided in traditional models and requires students to figure out on their own.

In listening and speaking exercises, the AI's speech recognition technology provides students with real-time feedback to help them improve their pronunciation and communication skills. This real-time feedback mechanism is usually provided manually by the teacher in the traditional model, which is less efficient.

At the end of the lesson, the AI tool helps students consolidate what they have learned and understand their progress through personalized post-test questions and timely feedback. This kind of personalized testing and feedback mechanism in the traditional model usually adopts a unified test, which lacks personalization.

Finally, AI technology is also involved in students' writing training, providing writing guidance and real-time feedback to help students improve their writing skills. This is more timely and effective than the traditional model in which teachers manually correct essays and provide feedback.

III. BOPPPS English Language Teaching Model Acquisition Effectiveness Research Design

III. A. Subjects of study

In this study, the researcher chose 70 students from two classes, the fifth and the sixth class of the senior year in K High School in Kelamayi City, as the subjects of the study according to the principle of convenience, in which 35 students from the sixth class of the senior year were the subjects of the experimental group and 35 students from the fifth class of the senior year were the subjects of the control group. Both groups of subjects are under the same teacher, and the teacher's progress of listening to English language teaching is the same. The experimental class will adopt the AI-enabled BOPPPS English language teaching model proposed in this paper for English language teaching, while the control class will maintain the traditional English language teaching model.

III. B. Research methodology

The research methods used in this experiment are literature research method, educational experiment, questionnaire, hypothesis testing with paired samples t-test.

III. B. 1) Literature research method

In this study, the researcher searched for the required literature through multiple channels, including Wanfang Database, Baidu Academic and China Knowledge Network, etc. On the basis of collecting, organizing and analyzing the literature about multimodal teaching and vocabulary acquisition, the researcher understood the current scholars' concerns in these two research directions, and this process laid a solid foundation for the preparation of the theoretical part of the preliminary part of the study.

III. B. 2) Educational experimentation

Educational experiment is in order to solve the real educational problems put forward a certain answer to the hypothesis (or theoretical concept) and scientific proof of planned intervention in the teaching and education process of the experimental subjects (students) to impose a new educational impact (including the creation of conditions, control of irrelevant variables, manipulation of the independent variable) from which the collection and organization of experimental data for qualitative and quantitative analysis to determine the causal relationship between the independent variable and the dependent variable and A comprehensive educational research method to make theoretical and practical value judgment on the verification (conclusion) and effect of the hypothesis.

Educational experimentation is the core research method of this study, and the researcher mainly relies on this method to investigate the effect of the AI-enabled BOPPPS English language teaching model on students' English language acquisition.

III. B. 3) Questionnaire method

Questionnaire survey belongs to a type of survey research, which is a method in which the researcher collects written information through a specially designed questionnaire, which is self-administered by the respondents.

In this study, a questionnaire was used to investigate the effects of multimodal teaching on the subjects' attitudes toward English language learning and the breadth of their English vocabulary knowledge through the use of questionnaires on English language teaching.

III. B. 4) Hypothesis testing

Hypothesis testing, also called “significance testing”, is an important test in statistics. Hypothesis testing by a series of hypothesized conditions through the sample inferred overall characteristics. Specific practice is: first to analyze the overall to make some reasonable assumptions, and then through the sample sampling, analysis and inference is to affirm or deny the previous hypothesis. Hypothesis testing according to whether the overall distribution is known, can be divided into parametric and non-parametric tests.

In the case where the overall distribution is known (e.g., normal distribution), the problem of making inferences about the parameters included in the overall is called parametric testing. When the overall distribution is unknown, non-parametric tests are usually used.

III. B. 5) Paired-sample t-tests

The paired samples T test is an effective way of parametric testing in statistics, which can be used to test whether two sets of correlated sample data originate from a normally distributed population with the same mean, i.e., to infer whether there is a significant difference in the means of two correlated sample populations. The original hypothesis is $H_0:\mu_1-\mu_2=0$, where μ_1 and μ_2 are the means of the first and the second aggregate respectively. A paired pair means that there is a one-to-one correspondence between each sample value in two sets of sample data, there is a correspondence, and the two sets of samples have the same capacity. The so-called paired samples, can be a material attribute of the “before” and “after” two states, can also be a description of a thing two different sides or aspects, in short, these two attributes or aspects of the inevitable intrinsic connection.

1) Paired samples T test of mathematical ideas

Paired samples T test is by finding the difference between the corresponding values of each group of samples, so that the difference between the corresponding samples of the difference in the observed value of a new single sample, if the two samples do not have a significant difference in the mean value of the sample value of the difference in the mean value of the sample value should be approximated as zero, through this method of the two to be analyzed in the overall test is transformed into a single sample T test. Therefore, the paired-sample T test is a test of whether the mean of the population from which the difference comes is zero. This requires that the population from which the difference comes follows a normal distribution.

2) Test statistic of the paired samples T test

In the paired samples T test, let $x_{1i}, x_{2i}\ (i=1,\cdots,n)$ be the paired samples, respectively. Its sample difference $d_i=x_{1i}-x_{2i}$, at this point the test statistic:

$$t=\frac{\bar{d}-(\mu_1-\mu_2)}{S/\sqrt{N}} \tag{1}$$

where $\bar{d}$ is the mean of d_i; S is the standard deviation of d_i; and N is the sample size. When $\mu_1-\mu_2=0$, the t statistic obeys the T distribution with $N-1$ degrees of freedom.

The difference between the two sets of samples can be calculated in the statistical analysis software SPSS, and the corresponding data can be substituted into the formula for calculating the T test statistic in the above equation to calculate the observed value of the T statistic and the corresponding probability of P value.

III. C. Experimental Procedures

The experimental period of this study is the first academic year of 2024 The researcher conducted a fifteen-week experimental study in the first grade of K High School in Kelamayi City. According to the English language curriculum of the school, the researcher referred to the topic of each unit of the subject textbook. The experimental process of this study was divided into three stages: pre-experimental, experimental implementation and post-experimental, and the specific process of each stage is described as follows.

1) Pre-experimental stage

In this stage before the experiment, the researcher's main work is to choose two classes of students with similar English learning levels as the subjects according to the research questions. Secondly, on the basis of literature organization, the research method of this study is selected.

2) Experimental implementation stage

In the experimental implementation stage, the researcher's main task is to design the English language teaching, based on the subjects' learning content and progress, the experimental group utilizes the AI-enabled BOPPPS English language teaching model proposed in this paper to carry out the teaching, while the control group continues to carry out the regular teaching in the same way as in the original way.

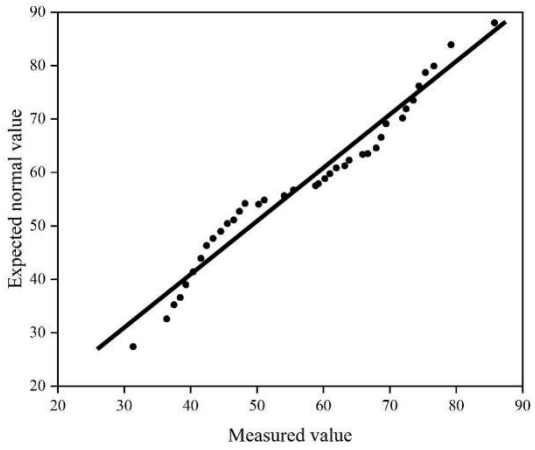
3) Post-experiment stage

After the end of the experiment, the researcher carries out the work of organizing and analyzing the experimental data, obtaining the results of the study, and drawing the conclusions of the study. Specifically, the researcher needs to record and organize the results of the post-test questionnaire on attitudes toward English language learning and breadth of knowledge of English vocabulary after the subjects have completed all the tests, compare the changes before and after the experiment by using the statistical analysis software SPSS23.0. And the organized data were analyzed to obtain the research results of this study.

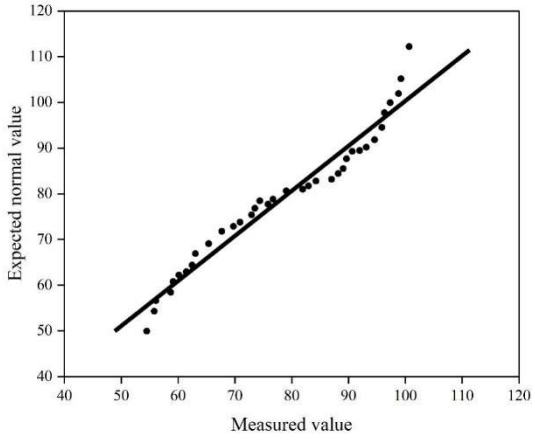
IV. Analysis of the Acquisition Effect of the BOPPPS English Language Teaching Model

IV. A. Test Data Examination

In order to investigate whether the research hypothesis is valid or not, the paired samples t-test is used to test the confirmation, first of all, it is necessary to carry out the normal distribution test of the data to determine the suitability of the data for the paired samples t-test. The normal Q-Q plots of the data of the students in the experimental and control classes are specifically shown in Figure 2, with plots (a) and (b) corresponding to the experimental and control classes, respectively. From the figure, it can be seen that most of the data can fall on the diagonal line, indicating that the quiz scores are normally distributed, which meets the requirements of the test model.



(a)Experimental class



(b)Control class

Figure 2: Normal Q-Q graph

IV. B. Analysis of experimental results

IV. B. 1) Attitudes toward English Language Learning

1) Analysis of Learning Attitude in Experimental and Control Classes Pre-tests

In this paper, the pre-test of English language learning attitude was conducted in the first week before the experiment started. To categorize English learning attitudes, a questionnaire was used to explore the impact of this paper's AI-enabled BOPPPS English language teaching model on students' English language learning attitudes. The English language learning attitude pre-test of the two classes is specifically shown in Table 1. It can be seen that the p-value of the experimental class and the control class is 0.846, which is greater than 0.05 and does not show a significant difference.

Table 1: Pre-test of English language learning attitude

Class	Mean	Standard deviation	T	P
Experimental class	10.975	3.852	2.951	0.846
Control class	9.912	3.869		

2) Analysis of Post-test Affective Attitude of Experimental and Control Classes

In order to further understand the changes in the attitudes towards English language learning between the experimental and control classes, the researcher analyzed the scores of the pre and post-tests of affective attitudes of the experimental and control classes with the paired samples t-test, and the results of the data analysis are shown in Table 2. It can be seen that the mean value of the post-test of students' attitudes toward English language learning in the experimental class is 14.451, while that of the control class is 11.232, which is a difference of 3.219, and the p-value is 0.000, which is less than 0.05, so it can be seen that there is a significant difference in the attitudes toward English language learning in the two classes.

Table 2: Post-test of learning attitude between experimental class and control class

Class	Mean	Standard deviation	T	P
Experimental class	14.451	3.468	4.065	0.000
Control class	11.232	3.872		

3) Comparative Analysis of Pre- and Post-tests of Affective Attitude between Experimental and Control Classes

In order to further understand the changes of affective attitudes in the attitudes towards English language learning between the experimental class and the control class, the researcher analyzed the pre and post-test scores of affective attitudes of the experimental class and the control class with the paired samples t-test, and the results of the data analysis are shown in Table 3. As can be seen from the table, the mean value of the pre-test of affective attitude of the experimental class is 10.975, and the mean value of the post-test is 14.451, and the score of their affective attitude has risen by 3.476 points, which shows a significant difference (P=0.000<0.05). In contrast, the mean value of the pre-survey questionnaire in the control class was 9.912 points, and the mean value of the post-survey questionnaire was 11.232 points, which was only an increase of 1.32 points, and there was no significant difference (P=0.652>0.05). Obviously, the AI-enabled BOPPPS English language teaching model proposed in this paper has a significant contributing effect in terms of cultivating students' attitudes towards English language learning.

Table 3: The pre-test and post-test results of the learning attitude

Class	Testing	Mean	Standard deviation	T	P
Experimental class	Pre-test	10.975	3.852	-6.801	0.000
	Post-test	14.451	3.468		
Control class	Pre-test	9.912	3.869	-0.059	0.652
	Post-test	11.232	3.872		

IV. B. 2) Breadth of knowledge of English vocabulary

In this section, the differences in English vocabulary breadth between the two classes will be examined by comparing the vocabulary breadth pre-test scores of the experimental and control classes, as shown in Table 4. It can be seen that the difference between the pretest scores of the experimental class and the control class is 0.24, with a p-value of 0.781, which is greater than 0.05 and for presenting a significant difference. As for the post-test scores, the experimental class's English vocabulary knowledge breadth test score is higher than that of the control

class by 8.93, and the p-value is 0.016, which is less than 0.05, indicating that the difference between the experimental class and the control class's post-test vocabulary breadth is significant.

Table 4: Comparison of English vocabulary knowledge

Test	Class	Mean	Standard deviation	T	P
Pre-test	Experimental class	52.46	11.561	0.252	0.781
	Control class	52.22	11.951		
Post-test	Experimental class	69.17	14.902	2.536	0.016
	Control class	60.24	15.914		

Overall, the AI-enabled BOPPPS English language teaching model proposed in this paper has a positive impact on students' attitudes toward English language learning and the breadth of knowledge of English vocabulary.

V. Conclusion

The integration of digital technology and the BOPPPS teaching model has brought revolutionary changes to English language teaching. The AI technology analyzes students' learning history and interests before class and provides personalized pre-study materials; guides in-depth discussions and dynamically displays learning objectives through the AI chatbot during the class; and conducts personalized tests and instant feedback using AI tools after class, which enhances the teaching effect in an all-round manner. The experimental data fully proved the effectiveness of this innovative model: students' attitude towards English learning increased from 10.975 points in the pre-test to 14.451 points in the post-test, an increase of 3.476 points ($P=0.000<0.05$); the score of the vocabulary breadth-of-knowledge test increased from 52.46 points to 69.17 points, an increase of 16.71 points. In contrast, the control group under the traditional teaching mode improved learning attitude by only 1.32 points ($P=0.652>0.05$) and vocabulary breadth by only 8.02 points.The AI-enabled BOPPPS teaching mode has successfully stimulated students' interest in learning, enhanced classroom participation, and significantly improved English language acquisition through intelligent instructional design and personalized learning support. This model not only improves the quality of teaching, but also lays a solid foundation for cultivating high-quality talents adapted to the needs of globalization, and provides a feasible path for the digital transformation of English teaching in the future.

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