Correlation Analysis, Optimization and Computer Simulation of Teaching Efficiency and Blended Learning of Higher Vocational English Based on POA and CoI Algorithm

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Abstract. Blended learning has become a popular form of teaching. In order to study a more scientific and reasonable learning plan, this paper uses CoI theory and POA theory to design the teaching plan. First of all, the use of POA theory output, input, output of the three stages of pre-class, in-class, after-class design respectively. The main task before class is to assign output tasks, preview the contents of the class and exchange doubts with students. In class, the teacher checks the students’ study before class. According to the students’ learning situation and output results, pertinently explain the knowledge points and summarize the information involved in the students’ independent output. Review the output according to what you have learned after class. At the same time, the corresponding teaching plans are made according to the three elements of CoI theory: social existence, teaching existence and cognitive existence. After that, it analyzes the correlation between teaching efficiency and teaching methods. The experimental results show that blended learning is better than traditional teaching methods. Finally, the optimization scheme is put forward, and the summary and prospect are carried out.

Keywords: Community of Inquiry, Production-Oriented Approach, Correlation analysis

1. Introduction and Motivation
At present, electronic products such as mobile phones and computers have become an indispensable part of people’s life, which has affected the diversification of teaching forms. In the process of maximizing the efficiency of students in class, the traditional teaching methods are facing a severe test and undergoing a series of deep-seated changes.

Although the traditional offline teaching has been inherited for many years, its face-to-face teaching form strengthens students' sense of classroom experience and atmosphere. The teacher can clearly understand the class status of the students and remind the students who are not serious in class in time. However, the offline teaching method also has some inevitable defects. Due to the limitations of teaching resources such as the environment, the offline teaching method is relatively simple, full irrigation may not only lead to low absorption rate of students, but also may even dampen students' enthusiasm for learning.
COVID-19 epidemic broke out suddenly all over the world. On the premise of avoiding the large-scale gathering of personnel, in order not to affect the learning progress, many colleges and universities have adopted the online teaching method. Online learning soon became a popular way of learning. In order to test the efficiency of online teaching, it is necessary to analyze the students' learning situation and achievements. Students' final grades at the end of the semester and their usual class performance reflect that online learning has certain advantages, but it also has some limitations. Online teaching avoids line-of-sight problems caused by seating problems and is not limited by scenes and space. Students can solve the problems that they do not understand in class by watching the playback or feedback from the teacher in time. The diversity of online teaching also makes the course more interesting. However, online teaching may not be promoted when the network environment is poor, the platform bandwidth is not enough, and the compatibility is not strong. In addition, teachers can only monitor students' listening and homework by signing in homework. For students with poor self-control, there may be situations such as not listening to the video, defaulting on homework and so on.

The learning enthusiasm of students in higher vocational schools is not high, and their learning ability is poor. It is not uncommon for some students to sleep and play with their mobile phones in class. As one of the international languages, English is used more and more widely. Low-level English proficiency will have some inconvenience in paper publication, literature reading and so on. Therefore, it is very important to strengthen the efficiency of higher vocational students' English learning.

In order to give full play to the advantages of online and offline teaching and avoid disadvantages, blended learning appeared. The emergence of blended learning method is the inevitable result of the development of Internet technology and the reasonable product under the requirement of high teaching efficiency. Blended learning is not a simple transition between online and offline teaching methods, but a brand-new teaching method. The main characteristics of blended learning are: various forms, prominent students, low resource consumption and so on. The research on blended learning is helpful to make a teaching plan which is more suitable for students and to improve students' performance.

2. Related Works
With the progress of Internet technology, blended learning has gradually become a popular teaching method. The hybrid teaching method is mainly combined with the online platform. Online platforms include social software, educational software and so on [1~3]. O2O blended learning is one of the common blended learning methods. It combines the advantages of online teaching and offline teaching, and has a certain research significance.

Community of Inquiry [4] was first put forward by Randy Garrison and Terry Anderson, and its elements are consistent with the way people behave in society. The research and design of blended learning with the theory of inquiry community will make the teaching method more humane and scientific.

3. Basic Theory

3.1. Community of Inquiry (CoI)
Community of Inquiry theory is a kind of mixed learning theory [5]. In order to achieve the purpose of teaching, inquiry community theory emphasizes that through the construction of mixed inquiry community, three elements should be brought into full play, namely, teaching presence, cognitive presence and social presence. In the following, it is referred to as pedagogical existence, cognitive existence and social existence. Social existence is the perception of the existence of others. Social existence will change with different stages of learning. Social existence is closely related to students' learning satisfaction and loneliness. Cognitive existence is the process of learners' knowledge system construction and the process and achievement of forming critical thinking. In short, cognitive existence mainly describes the cognitive development of learners. Teaching existence means that
students can feel all the teaching-related elements, which is the main function of teachers. The promotion of teaching existence is related to the increase of social existence and cognitive existence.

![Col Theoretical Model Framework](image1)

**Figure 1.** Col Theoretical Model Framework

3.2. Production-Oriented Approach (POA)

The theoretical system of POA includes the following three parts: teaching hypothesis, teaching concept and teacher-led teaching process [6]. The main process of its practice is output-input-output. In the first "output" link, teachers arrange students to prepare before class and assign certain output tasks according to the teaching objectives. Let students try to complete the task independently or in groups. In the process of completing the task, you can communicate with your classmates. In the process of communication, compare the gap between yourself and others to stimulate learning motivation; in the second "input" link, teachers put forward reasonable suggestions for improvement according to students' learning situation and output results. Summarize the English vocabulary, grammar, expression, skills and other information involved in students' independent output [7]; the third "output" stage, according to the content of the class, the use of learning results to complete the output. Teachers postpone the evaluation of students' review output and transfer output. The teacher arranges the students' after-class exercises in time to consolidate and review what they learned last time. And further modify the output of the first link [10–12].

![POA Theoretical Framework](image2)

**Figure 2.** POA Theoretical Framework

4. Blended learning curriculum design

With reference to the above-mentioned theory, the blended teaching is divided into three stages: before class, during class, and after class. Before class, it is mainly for students to understand the shortcomings of their own knowledge through pre-class preview, to be interested in the content of the
class, and to learn and absorb the teaching knowledge in the class in a targeted manner. After class, it is mainly to consolidate and review the knowledge in class. The following is an explanation of the three-stage curriculum arrangement.

4.1. Before Class
According to the teaching content in the classroom, teachers release teaching tasks and course materials in advance on the platform to make clear the teaching objectives of classroom teaching. Students should preview the classroom content in advance and find out the knowledge points and key contents that are difficult for them to understand. Learning can be prepared individually or in groups. In addition, students can use the network platform for real-time communication. Put forward their own opinions and confusion according to the teaching content. Teachers can also grasp the students' knowledge weaknesses through the chat content, and correct and raise points in class. In addition, because the learning enthusiasm of higher vocational students is not high, autonomous learning ability is not strong, so teachers should deliberately enrich learning forms. Course materials are not only concise and easy to understand text, but also can be presented in the form of pictures or videos.

4.2. In Class
In order to supervise students' pre-class learning, teachers should be able to ask random questions and brief reports on pre-class tasks. In the classroom, teachers should change the "full house" way of teaching. After explaining the theoretical knowledge, students should be given some time to understand and digest. Use the classroom content to solve several representative problems as well as practical problems.

In order to improve the enthusiasm of students, teachers can hold output competitions on a regular basis. The teacher praises and rewards the students or groups of students who have the best output. Prizes can be given for some English online courses, learning software members, course points and so on.

The main task of teachers' classroom design is to make rational use of classroom time and enhance the interest of the classroom. The class time for English learning is limited, so reasonable planning of class time can maximize classroom efficiency. Class time should be scientifically allocated to students' output display, teachers and students' comments, question-and-answer time, and focus on explaining time. Improving the interest of the classroom can stimulate students' enthusiasm for learning, which is of great significance to the whole learning process.

According to the three elements of CoI theory, part of the teaching plan in the class is designed [9].

**Table 1. Specific teaching Plan under the CoI**

| Element                  | Stage            | Specific Teaching Plan                                                                 |
|--------------------------|------------------|----------------------------------------------------------------------------------------|
| Social Existence         | emotion          | collaborative exchanges between students have established deep emotions between students|
|                          | dialogue and exchange | student communication confusion, teacher-student communication, etc.                   |
|                          | team unity       | The cohesion of the team is established in the process of communication, answering each other and evaluating each other. |
| Cognitive Existence      | trigger          | In pre-class, students did not fully understand the teaching content.                   |
|                          | explore          | Exchange between students or contact the teacher for consultation.                     |
|                          | integrate        | Students sort out ideas and try to solve problems.                                     |
|                          | solve            | Students apply the knowledge learned in the course to practical problems.              |
| Teaching Existence       | education resources | In blended teaching, online and offline teaching documents and teaching environment are more flexible. |
|                          | Teacher-student exchange | Teachers and students can communicate in time through online software or face to face. |
|                          | build understanding | Teachers' teaching to students should not be limited to current problems or current knowledge points, but should pass on the ideas and ideas for solving this type of problem to students, opening up students' thinking and vision. |
4.3. After class
After class, teachers should assign homework based on the content and key points of the class. The amount of homework questions should be moderate. Too little homework cannot achieve the purpose of consolidating the content of the class. Too much homework content may cause students to resist and cope with it. After students finish their homework, they should upload the homework to the network platform, and the teacher will give suggestions for modification after consulting it. For some of the less difficult homework and output display, you can use the online platform to complete random matching of students. Paired students correct each other's homework and exchange opinions. For the output of the teacher's suggestions for revision in the classroom, students can continue to display after the revision is completed after class.

In short, the basic idea of curriculum design is:

![Curriculum Design Diagram](image)

**Figure 3. The Basic Idea of Curriculum Design**

5. Empirical analysis
In order to study the effect of blended learning methods on the learning efficiency of higher vocational students, this paper selects 40 students as experimental samples. The most intuitive manifestation of learning efficiency is test results. The mid-term exam was used as the start time of the experiment, blended learning was implemented for 20 students, and traditional teaching was implemented for 20 students. Among them, the blended learning adopts the specific scheme designed above. In order to avoid other factors from affecting the experiment, the difficulty of artificial control of the final exam is basically the same as that of the midterm exam. Count the final grades of 40 students, take the change of students' English performance as the independent variable, and whether the blended learning is carried out as the dependent variable for correlation analysis. Calculate the sample results and get the following table:
Table 2. Sample result statistics

| Sample type                                      | Grade improvement | Unchanged or declining grades | total |
|-------------------------------------------------|-------------------|-------------------------------|-------|
| One group with blended learning (treat = 1)      | 13                | 5                             | 18    |
| A group using traditional teaching methods (treat = 0) | 7                 | 15                            | 22    |
| total                                           | 20                | 20                            | 40    |

When studying the relationship between performance changes and teaching methods, the dependent variable teaching method is a categorical variable, so logistic regression is used. The results of logistic regression are shown below.

Table 3. Model Fit Test Table

| Guidelines        | Contains only constant terms | Including teaching methods |
|-------------------|------------------------------|---------------------------|
| AIC               | 15.2368                      | 10.5770                   |
| BIC               | 13.9300                      | 7.9633                    |
| -2logL            | 13.2368                      | 6.5770                    |

After the model estimation is completed, the degree to which the model matches the observed data should be evaluated. AIC, BIC, and -2logL are used to reflect the fitting effect of the model. The calculation formulas are:

\[
AIC = -2 \ln L(\hat{\beta}) + 2r
\]

\[
SC = -2 \ln L(\hat{\beta}) + r \ln(n) = SIC
\]

\[
-2 \log L = -2 \ln L(\hat{\beta})
\]

Where \( \hat{\beta} \) is the coefficient before the estimated independent variable.

The smaller the values of the above three indicators, the better the model fits the data. After that, the significance test of the regression coefficient is performed. The test method is: given a significant level, calculate the test statistic value, calculate the p-value, if the p-value is less than the test level, then the variable is considered significant to the model.

Table 4. Likelihood Ratio and Wald Test Table

| Test               | chi-square | degree of freedom | p value |
|--------------------|------------|-------------------|---------|
| likelihood ratio   | 6.6598     | 1                 | 0.0099  |
| Wald               | 6.0651     | 1                 | 0.0138  |

From the above table, we can see which teaching method is adopted, that is, the treat variable mentioned above has a significant impact on the model. After that, the parameters of the regression model are estimated. The result of parameter estimation is:

Table 5. Parameter Estimation Result

| parameter | degree of freedom | estimated value | Standard error | p value |
|-----------|-------------------|-----------------|----------------|---------|
| Constant term | 1                  | -1.0986          | 0.5164          | 0.0334  |
| treat     | 1                 | 1.7177           | 0.6975          | 0.0138  |

It can be seen from the above results that there is a strong correlation between student performance and the teaching methods adopted. In addition, blended learning methods have a positive impact on improving class efficiency and improving student performance.
6. Teaching optimization analysis

By consulting the literature [8], graded and classified teaching has a certain positive impact on improving teaching efficiency. The students in the study are divided into two types: high English proficiency and low English proficiency.

In order to explore the influence of graded and classified teaching on improving teaching efficiency, the experimental subjects were selected in this paper. The experimental subjects were divided into four groups, one group was not taught in the traditional way, and the classified teaching was not adopted. One group adopts the traditional teaching method and adopts graded and classified teaching. One group carries on the blended learning method, does not use the graded classified teaching, the other group adopts the blended learning method and the graded classified teaching. Due to the limitation of teaching resources, the time of the experiment is short.

The experimental results show that graded and classified teaching is helpful to improve teaching efficiency. In fact, due to the limitations of the current teaching conditions, there is still a certain distance to realize the classified teaching in an all-round way. However, according to this idea, teachers can purposefully carry out different teaching plans for students with higher and lower English proficiency.

The students with poor English learning ability have poor self-control, so teachers should pay more attention to the students’ homework and remind them when they begin to slack off. In addition, students with poor English can provide less ideas in the process of communication, and their enthusiasm and frequency of communication are not high. Therefore, teachers can take the initiative to communicate with these students on a certain problem in class. In the process of communication, we should pass on the ideas and methods of solving problems to them while explaining more basic knowledge so as to fill the gaps in knowledge and improve their English ability as soon as possible.

Students with strong English ability have a solid basic knowledge, and when their homework has been completed, teachers can make some learning plans for them according to their own learning experience. Including participating in competitions, participating in high-level training courses, practicing oral English and so on. Students can choose according to their own actual situation. This part of the student task is not regarded as an assessment requirement.

7. Conclusions and Prospects

7.1. Conclusions

Blended learning combines the advantages of online learning and offline learning. In this paper, the blended learning scheme designed according to CoI theory and POA theory can plan the course time scientifically and improve the classroom efficiency. Experiments show that blended learning is closely related to the improvement of class efficiency.

Graded and classified teaching can optimize students' learning efficiency, but due to the limited teaching conditions at present, there is still a certain gap in the realization of graded and classified teaching. Teachers can only make learning plans for students with low and high grades and adopt different teaching strategies to achieve graded and classified teaching to a certain extent.

7.2. Prospects

With the continuous development of Internet technology, a more reasonable and scientific teaching plan should be formulated for blended learning, including the time allocation of online learning and offline learning, and a more reasonable way to supervise online learning effects and real-time online lectures.

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