Impacts of debate instruction on students’ critical thinking skills in College EFL Classes: an empirical investigation

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Abstract. In view of the absence of critical thinking skills of college students, this research is aimed at implementing the debate instruction based on Paul-Elder Model in College English teaching for the improvement of college students’ critical thinking skills, and tests its effectiveness through a semester’s experiment. The results show that the implementation of debate instruction in College English teaching can significantly improve college students’ critical thinking skills, and the debate instruction based on Paul-Elder Model contribute to the whole dimensions of students’ critical skills, including clarity, precision, accuracy, significance, relevance, completeness, logicalness, fairness, breadth and depth.

1. Introduction

College English Teaching in China focuses on language skills instruction, and there is a lack of cultivation of students’ critical skills, leading to students’ absence of critical thinking skills, that is, the phenomenon caused by the lack of analysis, synthesis, judgment, reasoning, thinking and differentiating skills [1]. Many researchers believe that debate is an effective way to improve students’ critical thinking skills. According to the American scholar Gary Rybold, through the activity of debating, learners can learn how to better analyze and evaluate thinking and how to present their ideas in organized and persuasive ways [2]. Jaya Nur Iman, an Indonesian scholar, proposed that the students should be given more exposure in relation to the debate application in the classroom which can stimulate the students to think critically [3]. David bear, who teaches in Nihon University, points out that debate as a pedagogical method is helpful both for the critical reading of texts and the critical writing of academic essays or presentations [4]. Many domestic researchers, for example Liu Hang and Jin Limin, have confirmed the positive effect of debate on the development of College Students’ critical thinking through experiments [5]. In order to verify the impacts of debate on improving college students’ critical thinking skills, this research intends to carry out a one-semester teaching experiment, implementing debate instruction into College English teaching to cultivate students’ critical thinking skills based on Paul-Elder Model. By means of quantitative and qualitative research methods, 85 non-English major sophomores in our university were tested before and after the debate instruction, questionnaire survey and interview to verify the improvement of students’ critical skills after the debate instruction based on Paul-Elder Model.

2. Paul-Elder model

Paul-Elder Model was proposed by American scholars Richard Paul and Linda Elder, which is the most representative measure of speculative skills. The model includes 8 elements of reasoning, 10 intellectual
standards and 8 intelligence characteristics. Among them, 8 thinking elements are purpose, problem, viewpoint, information, reasoning, concept, revelation and hypothesis; 10 The criteria of intelligence are clarity, precision, accuracy, significance, relevance, completeness, logicalness, fairness, breadth and depth; the eight intelligence characteristics are humility, independence, integrity, bravery, firmness, confidence, empathy and justice [6] (Figure 1).

![Figure 1. Paul-Elder Model.](image)

As shown in Figure 1, each thinking element should be measured or tested using 10 criteria. Human intelligence must develop with the development of thinking skills [3].

Based on the thinking elements and intelligence standards of Paul Edler Model, this research conducts debate instruction for students in College English teaching, and guides students to improve their critical skills through repeated measurement and test in the process of debating.

3. Design

3.1. Questions
This research attempts to examine two questions: (1) Can the debate instruction in College English teaching significantly improve students' comprehensive thinking skills? (2) Can the debate instruction based on Paul-Elder Model improve students' critical skills of clarity, precision, accuracy, significance, relevance, completeness, logicalness, fairness, breadth and depth?

3.2. Subjects
The subjects of this research are 162 non English major sophomores from four college English classes. There were 39 and 45 students in two experimental classes (Class A and class B in the data table), and 46 and 32 students in two control classes (Class C and D in the data table). The author undertakes the College English Teaching of the two experimental classes and the two control classes. In the experimental class, the debate instruction based on Paul-Elder Model is integrated into the College English Teaching of the experimental class, while the traditional teaching mode is still followed in the control class.
3.3. Implementing the debate instruction mode based on Paul-Elder Model

The teaching mode implemented in this research is a debate instruction mode based on Paul-Elder Model. The experimental period is one semester. The specific implementation idea is: in College English teaching, the author sets up debate instruction module in each unit to According to the thinking elements and intelligence standards of Paul-Elder Model, students are guided to train their own thinking and measure their critical skills in debate, and carry out targeted learning activities. At the same time, the author designed a specific model of debate instruction mode by integrating Paul-Elder Model[6] and world-style debate format [8] (Figure 2).

![Figure 2. Debate instruction mode based on Paul-Elder Model.](image)

As shown in Figure 2, the process of the debate instruction mode designed by the author is as follows: first, provide students with and let them search for background knowledge, carefully preview before the debate, then guide them to analyze the argument, clarify the concepts and problems, and determine the direction of the debate, and then guide the students to establish a complete argumentation scheme, including clarifying the status quo, establishing argumentation levels, constructing arguments and connecting logic Then, through teacher evaluation, students' mutual evaluation and self-evaluation, students' critical skills in the debate is evaluated. Finally, students are required to write reflection logs to reflect on their performance in each debate instruction comprehensively and deeply. Among them, in the three links of analyzing argumentation, establishing argumentation and evaluating critical skills, the author takes Paul-Elder Model as a reference, decomposes and interprets the thinking process of debate by using the concept of thinking elements, so that students can better understand the organic interaction between thinking elements, and at the same time, test and interpret the thinking elements in the debate one by one according to the intelligence standard. In this way, the author establishes a scientific debate instruction mode guided by Paul-Elder Model.

3.4. Data collection

3.4.1. Assessment of critical thinking skills. In this study, the pretest and posttest of critical thinking were selected from two topics of the "FLTRP Cup" National College Students' English debate contest. The subjects were asked to choose either the positive or negative positions and give a 7-minute debate statement. The pretest debate statement is arranged in the on-the-spot presentation organized before the first class of the beginning of school, and the data is collected in the form of recording. The posttest debate statement is arranged in the field presentation organized after the last class at the end of the
semester. The data are also collected in the form of recording. The scoring standard is divided into ten dimensions according to the standard in Paul-Elder Model: clarity, precision, accuracy, significance, relevance, completeness, logicalness, fairness, breadth and depth. Each dimension is scored with 5-excellent, 4-good, 3-average, 2-medium, 1-poor and 1-5 grades. Chen Ci was scored independently by the author and another senior college English teacher. The average value of the two teachers was used for statistics. According to Pearson product moment correlation coefficient, the highest reliability was 0.642 (double tailed), lower than 0.9, indicating that there was no collinearity in the questionnaire items. The results show that there is a significant correlation between the scores of the two raters in the ten dimensions, and their scores are reliable.

3.4.2. Questionnaire. The purpose of this research is to investigate the current situation of students' thinking skills and the change of their thinking skills after teaching experiments. Based on Bloom's taxonomy of educational objectives [9] and Wen Qiufang's hierarchical model of critical thinking skills[7], the questionnaire is divided into three dimensions; the questionnaire is divided into three dimensions: analysis, reasoning and evaluation. Under each dimension, a series of related questions are designed according to the author's debate teaching content. There are 20 multiple-choice questions, including analysis (1-7 questions), reasoning (8-14 questions) and evaluation (15-20 questions). There are five options for each topic. According to the Likert five level scale, the score from "completely inconsistent" to "completely consistent" is 1-5 points. The higher the score, the higher the degree of agreement. The Cronbach α value was 0.912 and kmo value was 0.837, which indicated that this questionnaire was an effective questionnaire with high reliability and validity. The pre questionnaire was completed and collected in the first class, and the post questionnaire was completed and collected in the last class at the end of the semester.

3.4.3. Interview. At the end of the semester, three students were randomly selected from two experimental classes, and a total of six students were interviewed. Each interview lasted for about 30 minutes. With the consent of the interviewers, the interview was recorded. After the interview, the author transcribed and sorted out the interview recordings, and then analyzed them. Referring to the outline of Sun Min's interview on public speaking learners [10], the interview contents are designed for this research, including the feeling of debate learning, the problems and obstacles encountered in learning, the evaluation of the development of self debate skills, the feedback of debate teaching, and the suggestions of debate teaching.

4. Findings and implications

4.1. Analysis of assessment data
In this study, the total scores of the pretest and posttest of the experimental class and the control class and the scores of each dimension were obtained through the evaluation of the critical skills. The ANOVA of the total scores of the pretest and posttest, the data analysis of the posttest (multiple comparison) analysis, the paired t-test analysis and the variance analysis of the scores of each dimension were carried out.

4.1.1. Analysis of the total scores of pretest and posttest. At the beginning and the end of the semester, the topic of the "FLTRP Cup' National College Students' English debate contest was selected as the pretest and post test questions of the critical skills. The students in the experimental class and the control class were required to choose either the positive or the negative stance, and the debate lasted for 7 minutes Analysis (Table 1).
Table 1. Variance analysis of the total scores of pretest and posttest in experimental class and control class.

| Class (Mean ± Standard Deviation) | F  | p   |
|----------------------------------|----|-----|
| A(N=39) 76.16 ± 5.64            |    |     |
| B(N=45) 75.32 ± 5.81            |    |     |
| C(N=46) 74.07 ± 6.35            | 0.763 | 0.439 |
| D(N=32) 74.82 ± 6.38            |    |     |

As shown in Table 1, before the beginning of the experiment, four classes were tested for their critical skills. The results showed that \( p = 0.439 > 0.05 \), indicating that there was no significant difference in the total score of the experimental class and the control class before the experiment. In other words, under the traditional college English teaching mode, the critical thinking skills of the students in the two classes has not been significantly developed. At the end of the semester, after the experiment, the four classes were tested again, \( P = 0.000 \), indicating that the total scores of the experimental class and the control class were significantly different after the end of the experiment.

Since the analysis of variance of the total score of the experimental class and the control class is significant, it is necessary to do the post test multiple comparison (LSD) analysis (Table 2).

Table 2. Post test (multiple comparison) analysis of the total scores of the experimental class and the control class.

| (I) Name | (I) Name | (I) Mean | (I) Mean | D-value (I-J) | p   |
|----------|----------|----------|----------|---------------|-----|
| A        | C        | 86.40    | 77.15    | 9.25          | 0.000*** |
| A        | D        | 86.40    | 77.12    | 9.28          | 0.005**  |
| A        | B        | 86.40    | 87.16    | -0.76         | 0.347   |
| C        | D        | 77.15    | 77.12    | 0.03          | 0.863   |
| C        | B        | 77.15    | 87.16    | -10.01        | 0.000*** |
| D        | B        | 77.12    | 87.16    | -10.04        | 0.007**  |

As shown in Table 2, the results of post test multiple comparison (LSD) analysis show that: the \( p \) values of experimental class A and control class C and D are 0.000 * * and 0.005 * *, respectively, and the \( p \) values of experimental class B and control class C and D are 0.000 * * and 0.007 * *, respectively, which show that the students' critical skills of the four classes has been significantly improved. The difference between the experimental class B and the control class C and D was -10.01 and -10.04, respectively, indicating that the improvement of experimental class B was the most significant.

In order to further compare the level differences between the experimental class and the control class before and after the experiment, the total scores of the pretest and posttest of the experimental class and the control class need to be paired t-test (Table 3).

Table 3. Paired t-test analysis of total scores of pretest and posttest in experimental class and control class.

| Name     | Pair Class (Mean ± SD) | D-value (P1-P2) | t    | p   |
|----------|------------------------|-----------------|------|-----|
| A pretest Pair | A posttest 76.16 ± 5.64 | -10.24       | -5.397 | 0.000*** |
| B pretest Pair | B posttest 75.32 ± 5.81 | -11.84       | -4.783 | 0.000*** |
| C pretest Pair | C posttest 74.07 ± 6.35 | -3.08        | -2.137 | 0.013*  |
| D pretest Pair | D posttest 74.82 ± 6.38 | -2.3         | -1.943 | 0.026*  |
As shown in Table 3, the results of paired t-test analysis of the total scores of the pretest and posttest of the total scores of the pretest and posttest of the speculative skills of the experimental class A and B were significantly different ($p = 0.000$), while the total scores of the pretest and posttest of the control class C and D were different ($p = 0.013, 0.026$), but they were weaker than those of class A and class B. At the same time, the difference value of class B was the highest (difference = -11.84), followed by class A (difference = -10.24), indicating that the improvement effect of class B's thinking skills was the most obvious.

From the above three analyses, we can draw the following conclusions: (1) after one semester of College English learning, the students in the experimental class and the control class have improved their thinking skills, which shows that the College English integration in the experimental class is based on Paul-Elder. The argumentation learning activities carried out under the model teaching mode and the topic discussion learning activities under the traditional college English teaching mode implemented in the control class all play a role in improving the skills of thinking. At the same time, there is another factor that can not be ignored, that is, as a teacher with outstanding skills of thinking guidance, even in the traditional topic discussion learning activities of the control class, some teaching elements of thinking skills instruction have been infiltrated; (2) although after a semester of experiment, the scores of the experimental class and the control class students' speculative skills evaluation have improved, reaching statistical significance. However, compared with the students in the control class, the improvement of critical thinking skills of the experimental class students is more significant, in which the experimental class B is the most significant, the experimental class A is the second, and the control board class C and D are less significant. This shows that after a semester of debate instruction based on Paul-Elder Model and integrated into College English teaching mode, the improvement of students' critical thinking skills in the experimental class is much higher than that in the control class under the traditional college English teaching mode, and there is an obvious gap with the latter. The most significant reason for the experimental class B is that the students' research spirit is stronger and the students in the experimental class B have stronger research spirit, the initiative and depth of the tasks of thinking and practice prescribed in the learning process are better.

### 4.1.2. Analysis of the dimensional scores of pretest and posttest

In order to test whether there are differences in the ten dimensions (clarity, precision, accuracy, significance, relevance, completeness, logicalness, fairness, breadth and depth) of the students' critical thinking skills between the experimental class and the control class, an analysis of variance (ANOVA) was conducted on each dimension of the pretest and posttest of the students in the experimental class and the control class (Table 4).

**Table 4.** Analysis of variance of the dimensional scores of pretest and posttest of experimental class and control class.

| Dimension | Critical thinking test | Class (Mean ± Standard Deviation) | F  | p     |
|-----------|-----------------------|-----------------------------------|----|-------|
|           |                       | A (N=39)                          |    |       |
| Clarity   | Pretest               | 7.53±0.6                          |    |       |
|           |                       | B (N=45)                          | 7.47±0.66 | 7.32±0.69 | 7.42±0.69 | 0.797 | 0.500 |
|           | Posttest              | 8.72±0.7                          |    |       |
|           |                       | C (N=46)                          | 8.74±0.63 | 7.87±0.78 | 7.77±0.68 | 10.762 | 0.000*** |
| Precision | Pretest               | 7.42±0.5                          |    |       |
|           |                       | D (N=32)                          | 7.39±0.55 | 7.31±0.61 | 7.35±0.63 | 0.820 | 0.472 |
|           | Posttest              | 8.21±0.5                          |    |       |
|           |                       |                                  | 8.27±0.54 | 7.59±0.69 | 7.58±0.62 | 8.752 | 0.006** |
| Accuracy  | Pretest               | 6.57±0.5                          |    |       |
|           |                       |                                  | 6.53±0.54 | 6.47±0.58 | 6.49±0.59 | 0.766 | 0.516 |
|           | Posttest              | 7.63±0.6                          |    |       |
|           |                       |                                  | 7.76±0.54 | 6.67±0.67 | 6.73±0.58 | 9.296 | 0.002** |
### Significance

| Dimension | Pretest | Posttest |
|-----------|---------|----------|
| Pretest   | 6.79 ± 0.6 4 | 8.35 ± 0.7 9 |
| Posttest  | 6.80 ± 0.69 9 | 7.11 ± 0.82 9 |

### Relevance

| Dimension | Pretest | Posttest |
|-----------|---------|----------|
| Pretest   | 7.35 ± 0.6 9 | 8.97 ± 0.8 5 |
| Posttest  | 8.37 ± 0.68 9 | 7.48 ± 0.86 9 |

### Completeness

| Dimension | Pretest | Posttest |
|-----------|---------|----------|
| Pretest   | 8.02 ± 0.6 3 | 9.42 ± 0.66 8 |
| Posttest  | 8.07 ± 0.65 7 | 8.39 ± 0.79 7 |

### Logicalness

| Dimension | Pretest | Posttest |
|-----------|---------|----------|
| Pretest   | 8.33 ± 0.6 8 | 9.78 ± 0.67 1 |
| Posttest  | 8.16 ± 0.69 8 | 8.45 ± 0.82 8 |

### Fairness

| Dimension | Pretest | Posttest |
|-----------|---------|----------|
| Pretest   | 8.77 ± 0.4 7 | 9.47 ± 0.47 1 |
| Posttest  | 8.23 ± 0.49 7 | 8.43 ± 0.55 8 |

### Breadth

| Dimension | Pretest | Posttest |
|-----------|---------|----------|
| Pretest   | 8.67 ± 0.4 5 | 9.11 ± 0.41 3 |
| Posttest  | 8.69 ± 0.41 5 | 8.49 ± 0.53 3 |

### Depth

| Dimension | Pretest | Posttest |
|-----------|---------|----------|
| Pretest   | 6.71 ± 0.3 9 | 7.28 ± 0.30 8 |
| Posttest  | 6.77 ± 0.40 8 | 6.67 ± 0.52 8 |

As shown in Table 4, there are significant differences between the experimental class and the control class in the posttest of the ten dimensions. Among them, clarity, importance, correlation, integrity and logicality were the most significant (P = 0.000), and the difference between the pretest and posttest of the experimental class students was significantly higher than that of the control class students; the accuracy (P = 0.006 < 0.01), accuracy (P = 0.002 < 0.01), justice (P = 0.003 < 0.01) were the second, while breadth (P = 0.028 < 0.05) and depth (P = 0.017 < 0.05) were the second. But the significance is not strong enough. In the ten dimensions, the students in experimental class improved significantly than those in control class, and the improvement of students in experimental class B was the most obvious. In addition to the two dimensions of breadth and depth, the difference between the scores of students in class B and class a of experimental class was small, only 0.01 and 0.03. In addition, in the other eight dimensions, the difference between the pretest and posttest was the highest, namely clarity (difference = 1.27), accuracy (difference = 0.88), correctness (difference = 1.23), correlation (difference = 1.75), logicality (difference = 1.62), justice (difference = 1.24), importance (difference = 1.57), integrity (difference = 1.35). This shows that the experimental class B students through debate learning, their critical skills to improve the effect of the most obvious, but also once again verified the above-mentioned class B students have a better learning attitude. Although the pretest and posttest of the students in class C and class D of the control class were also significant, the results of the posttest were improved, but the difference was not obvious. The students in class C and class D have the most obvious improvement in the dimension of clarity, with the difference of 0.55 and 0.35, respectively, while in the aspect of breadth, the degree of improvement is the lowest, with the difference of 0.12 and 0.09, respectively. It indicates that the control class students improve the clarity of their opinions faster than other aspects after a semester of instruction of topic discussion learning activities under the traditional teaching mode. Topic discussion is the most effective way to improve students' expression clarity. The reason why the posttest of the control class did not improve significantly compared with the pretest is that the students' reading range is not wide, which shows that the effectiveness of ordinary topic discussion learning...
activities under the traditional teaching mode is not enough to stimulate students to actively search and read a lot of background knowledge.

4.2. Analysis of questionnaire data

In this study, 148 valid questionnaires were collected in the pretest and 151 valid questionnaires were collected in the posttest. ANOVA and post test were conducted on these questionnaires from ten dimensions. In the analysis dimension, there was no significant difference in the pretest results of the four classes. The posttest results showed that there was no significant difference in the improvement degree of the students in class A and class B in the experimental class and the students in class C and class D in the control class in the first and second options involving the skills of classification and recognition, while the students of class A and class B of the experimental class were significantly better than those of the students of class A and class B in the third-seventh option involving the skills of comparison, clarification, distinction and interpretation. In the dimension of reasoning, there is no significant difference in the pretest results of the four classes. The results of the posttest show that: in the eighth option involving questioning skills, there is no significant difference between the students in class A and class B in the experimental class and the students in class C and class D in the control class. In the 9-10 options involving the skills of hypothesis and inference, the students in class A and class B in the experimental class are more controlled. The results show that the students of class C and class D in the experimental class have significantly improved compared with the students of class C and class D in the 11th-14th option involving the skills of elaboration and argumentation; in the evaluation dimension, there is no significant difference in the pretest results of the four classes, and the posttest results show that: in the 15th-16th option involving the judgment presupposition and hypothesis, class A of the experimental class has a significant improvement. The students in class A and class B are significantly improved compared with the students in class C and class D of the control class. In terms of the 17-20 options concerning the skills of elaboration and argumentation, the students in class A and class B in the experimental class have a very significant improvement compared with the students in class C and class D in the control class. These results show that: in each dimension, in the development of some abilities belonging to the lower cognitive level, students can achieve it through the topic discussion learning activities under the traditional college English teaching mode, while in the development of some abilities belonging to the higher cognitive level, it is necessary for students to integrate the argumentation learning activities in the debate teaching mode into College English Only action can be realized.

4.3. Analysis of interview results

The interview results of this research can be summarized as follows: in terms of their feelings of debate learning, the experimental class students said that debate learning was interesting and meaningful. It not only made people feel excited by the atmosphere of fierce debate, but also broadened their horizons, enlightened thinking, improved the skills of logical framework of argumentation, and improved the skills of comprehensive application of language; in terms of the problems and obstacles encountered in learning, the students in the experimental class talked about three major problems and obstacles, including the lack of their own background knowledge and information retrieval skills to make the debate simple and one-sided, the lack of analytical skills and the skills of logical construction of argumentation made the debate become absolute and confusing, the lack of language level made the debate language not professional and accurate enough, and the evaluation of the development of their own debate skills. In terms of evaluation, all the students in the experimental class think that their critical thinking skills have been developed to a certain extent after the debate instruction, and can continue to improve in the future; in terms of feedback on the debate teaching, the experimental class students are satisfied with the teaching effect of the integration of debate instruction in College English this semester, and think that the teaching of one semester is systematic, so that they can master some of the debate. In terms of suggestions for debate teaching, students in the experimental class hope to get more detailed
help from teachers in various instruction projects and instruction steps to improve their critical thinking skills.

5. Conclusions
By combining quantitative and qualitative methods, this research examines the significant effect of debate instruction based on Paul-Edler Model in College English teaching. The research shows that: the integration of debate instruction based on Paul-Edler Model in College English teaching can effectively improve students' comprehensive thinking skills, and improve students' clarity, precision, accuracy, significance, relevance, completeness, logicalness, fairness, breadth and depth.

However, students improve their own influencing factors in the ten dimensions of speculative skills. Why can't students improve in balance in the ten dimensions? How can students use these ten dimensions to repeatedly measure their thinking skills when they are carrying out analysis, reasoning, and evaluation of these three types of speculative activities, and whether they always need to be comprehensive when carrying out specific sub activities under these three categories of speculative activities. In addition, how to build a more effective teaching module of debate instruction in College English teaching, and how teachers should build more subtle scaffolding to help students improve their critical skills through debate still need further research and practice.

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