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Implementation of Cooperative Learning Method to Enhance the Students' Learning Ability and Students' Core Competencies

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Abstract

Modern society is complex and ever-changing. To adapt to this situation, the level of education must be continuously enhanced, and college students who are about to enter society are the group that needs the most attention. As a creative and effective teaching organizational form and teaching strategy, the cooperative learning method plays an important role in education and teaching. This article research aims to achieve the following two goals: 1) Compare students' learning abilities after the cooperative learning method and traditional teaching method. 2) Compare students' core competencies after the cooperative learning method and traditional teaching method. The participants in this study were students studying physics at Guangxi Normal University for Nationalities in China. It includes a control group consisting of 30 students and an experimental group consisting of 30 students. The research tool used a Likert scale question, and the data were analyzed using normal distribution and standard deviation. The research results show that students' learning ability and core competencies after the cooperative learning method are better than traditional teaching method ($P<0.01$).

Keywords: core competencies, cooperative learning method, instructional design, learning ability

1. Introduction

1.1 Introduce the Problem

According to the compulsory education curriculum plan and curriculum standards (2022 edition), we should adhere to the goal orientation, problem orientation, and innovation orientation, enhance the comprehensiveness and practicality of the curriculum, guide the transformation of the education method, and strive to improve students' learning ability and core competencies (Miao & Lili, 2022). Although the research on cooperative learning method started early, there are relatively few related studies on cooperative learning method in the "Electrical and Electronic Technology" course, and the implementation of cooperative learning method from the perspective of students to improve their learning ability and core competencies is still in the exploratory stage. In response to the above content, the following questions are raised: 1) When the cooperative learning method is implemented in the "Electrical and Electronic Technology" course, what are the characteristics of the current status of students' learning ability and core competencies? 2) How can the cooperative learning method be further applied in the "Electrical and Electronic Technology" course to help students improve their learning ability and core competencies?

1.2 Introduce the Hypotheses

The literature has shown that there is an effective cooperative learning method that can improve students' learning ability and core competencies. As a teaching model that has received much attention in the field of education and teaching, cooperative learning promotes mutual communication and cooperation among students through group cooperative learning, which is conducive to promoting students' active learning, expression ability and teamwork spirit (Yajun, 2024). Therefore, the introduction of cooperative learning has become an important way to improve students' learning ability and core abilities. This study hypothesizes that: 1) After intervening in teaching through cooperative learning, students' reading ability, comprehension ability, memory, concentration and creativity can be improved. 2) After intervening in teaching through cooperative learning, students' core abilities of humanistic background, scientific spirit, learning to learn, responsibility, practical innovation and

healthy life can be improved.

1.3 "Electrical and Electronic Technology" Course

The "Electrical and Electronic Technology" course is the "Twelfth Five-Year Plan" textbook for general higher education. It is an important professional basic course for college and technical secondary school students in non-electrical majors in engineering colleges. Its main task is to lay a good theoretical foundation and necessary basic skills training for students to learn professional knowledge and engage in engineering and technical work, focusing on cultivating students' engineering application capabilities and the ability to solve practical problems on site. The course teaching content is divided into 10 units, including: basic concepts and laws of circuits, circuit analysis, steady-state analysis of sinusoidal AC circuits, three-phase circuits, transient analysis of dynamic circuits, transformers, DC motors, three-phase asynchronous motors, modern motors, Relay contactor control (Jiangliu, 2024). For a long time, most of the experimental contents of Electrical and Electronic Technology have been verification experiments. This experimental model is far from the original intention of cultivating students' observation, hands-on, and innovative abilities (Li Ling, 2024).

1.4 Teaching Method Consisting of Two Methods

Method 1: Traditional Teaching Method

Traditional teaching methods refer to teachers explaining in a systematic and detailed manner, with a relatively simple form, and there is not much expression and communication in classroom interactions (Hyun et al., 2017). It is believed that traditional classroom teaching refers to the traditional teaching method in which teachers teach content in class and students learn through lectures and classroom activities (Goodyear, 2015). In the "Electrical and Electronic Technology" course, it refers to a teaching method in which teachers systematically explain and demonstrate theoretical knowledge in textbooks, and students master a large amount of knowledge through observation, memory, and practice to achieve learning purposes. This kind of teacher-, book- and classroom-centered, student-participated teaching focuses too much on transferring knowledge while ignoring students' participation, creativity, and initiative.

Method 2: Cooperative Learning Method

The cooperative learning method is a structured, systematic teaching strategy that can be used at any grade level and in most school subjects (Gillies, 2016). Cooperative learning method is widely recognized as a teaching practice that promotes socialization and learning for students from pre-K to higher education and across diverse subject areas (Chaoxian, 2024). Johnson and others believe that cooperative learning method must have five effective factors for successful development, namely: positive interdependence, face-to-face facilitative interaction, personal responsibility, interpersonal skills, and group processing (Johnson & Johnson, 2018). When Implementation cooperative learning method, these five factors need to be Implementation throughout the cooperation, and the cooperative learning method process must be standardized to prevent the incomplete details from affecting the efficiency of cooperative learning method.

1.5 Learning Abilities and Core Competencies of Students

Learning ability is defined as "the ability to enhance problem-solving through experience", that is, the ability to overcome obstacles and achieve goals through experience (Du, 2020). Shi Yuanhong research believes that learning ability refers to the ability to observe and participate in new experiences, integrate new knowledge into existing knowledge, and thereby change the existing knowledge structure (Yuanhong, 2024). In short, learning ability is a person's basic skill, which includes people's reading ability, comprehension ability, memory, concentration and creativity.

Many scholars have given their own opinions on core competencies: Students' core competencies are a solid foundation for implementing the educational goal of cultivating morality and building people. With the rapid development of economy and science and technology, the new era has put forward higher requirements for college students. Possessing good core competencies is an important way for college students to adapt to social development (Ting & Jie, 2024). Core literacy refers to the basic, comprehensive and sustainable development capabilities that students possess in terms of knowledge, skills, emotional attitudes and values. It includes students' independent learning ability, cooperation and communication ability, innovation and practical ability, critical thinking and other aspects (Long et al., 2024). Core literacy is not only the foundation for the all-round development of individuals, but also an important support for social progress and national development. In the current educational context, the requirements for physical education are not limited to improving health, strengthening physical fitness, teaching sports skills and knowledge, but also require the interdisciplinary integration of sports, which has become a major trend in physical education (Bingbing et al., 2014). In short,

core capabilities are divided into three aspects: cultural foundation, independent development, and social participation, and are comprehensively expressed as six qualities: Cultural heritage, scientific spirit, learning to learn, healthy living, responsibility, and practical innovation.

2. Method

2.1 Samples

This experiment uses the cluster random sampling method to select two classes. All students in Class 1 and Class 2 of the 2021 Physics Major were selected to participate in the experiment, using the random assignment method. Class 1 uses the traditional teaching method, with 30 students; Class 2 uses the cooperative learning method, with 30 students. A total of 60 students participated in the experiment, including 31 girls and 29 boys. Both classes were taught for 8 weeks, with a total of 24 class hours.

2.2 Research Instruments

2.2.1 Teaching Process Design

This study adopted two teaching methods: traditional teaching method and cooperative learning method.

(Under the premise of controlling other teaching conditions to be the same, compare the teaching situation of the experimental group and the control group)

Table 1. Teaching process design of Method 1 (traditional teaching method) and Method 2 (cooperative learning method), outlining the respective processes

Traditional teaching method process design (Control group)	Cooperative learning method process design (Experimental group)
1. Before class, teachers prepare lessons and produce courseware (PPT) based on the teaching content.	1. Before class, the teacher sets goal-oriented, problem-oriented and innovation-oriented approaches and creates scenarios based on the content of the lesson.
2. The classroom is teacher-centered in imparting knowledge and students learn passively.	2. The classroom teacher divides the students into study groups of 4-6 people based on goal orientation and problem orientation to discuss the problem.
3. The classroom teacher gives examples and students participate in the exercises.	3. Study groups work together to discuss, summarize, and record problems, and teachers supervise and guide throughout the process.
4. The teacher summarizes the class and the students take notes.	4. Each study group reports.
5. After class, teachers assign homework and students complete it.	5. The teacher and each study group make a summary together.
6. Teacher correction, evaluation and feedback after class.	6. After class, teachers assign homework and students complete it.
	7. Teacher correction, evaluation and feedback after class.

2.2.2 Questionnaire Design

This experiment used two questionnaires: The student learning ability questionnaire and the student core competency questionnaire. The same questionnaire was used for the pre- and post-experiment surveys to avoid errors due to inconsistencies. The questionnaire was designed using a Likert scale. The student learning ability questionnaire is designed to measure five items: reading ability, comprehension ability, memory, concentration and creativity. The student core competencies questionnaire is designed to measure six items: Cultural heritage, scientific spirit, learning to learn, responsibility, practical innovation and healthy living. The questionnaire uses a 5-level scale. The questionnaire design should follow the five principles of effectiveness, conciseness, personalization, scientific and innovation and finalize the theme. The five basic principles of targeting the survey group, accessing information, designing questions, enhance the questionnaire and pre-survey step. Modifications will be made based on the suggestions given by the experts. After the modifications are completed, they will be sent to the experts for review. After obtaining questionnaire review and inspection by three experts, the IOC results of the student learning ability questionnaire ranged from 0.67 to 1.00, and the IOC results of the student core competencies questionnaire ranged from 0.67 to 1.00, both of which can be used in experiments. After the experts confirmed that it was correct, the questionnaire design was completed.

2.2.3 Statistics Used in Data Analysis

Statistics for checking tool quality, SPSS version 26.0 was used for data analysis in this experiment. Determination of the quality of the student learning ability questionnaire test and determination of the quality of

the student core competencies questionnaire test. us e the following formula to determine (IOC). IOC= $\Sigma R/N$, IOC stands for acceptance index, ΣR stands for expert summation, N stands for number of experts.

Basic statistics. Average value by using the following formula $\bar{X} = \Sigma X/N$, $\bar{X}$ stand s for sample mean, ΣX stands for s um of the data in the sample, N stands for the sample size.

Standard deviation using the following formula $SD = \sqrt{\sum(X - \bar{X})^2/(N-1)}$, SD stands for the sample standard deviation, X stands for the value of each data piece, $\bar{X}$ stands for the sample mean, N stands for the sample size.

T-test formula. The T-test formula used in this article is 2 independent sample T-test formula

$$t = (\overline{X_1} - \overline{X_2})/\sqrt{S_1^2/n_1 + s_2^2/n_2}$$

$\overline{X_1}\&\overline{X_2}$ stand s for the mean of the two groups of samples respectively, $S_1^2\&S_2^2$ stand s for the variance of the two groups of samples respectively, $n_1\&n_1$ stands for the sample size.

In order to assess students' learning abilities and core competencies, the results of the questionnaire were analyzed using descriptive statistics, which included mean and standard deviation values obtained based on a five-point Likert scale. The researchers conducted T-tests and descriptive statistics on two independent samples to determine whether the differences were statistically significant at a significance level of P<0.05.

2.2.4 Data Analysis

Evaluate whether each set of data follows a normal distribution and select an appropriate data analysis method. If the data conforms to a normal distribution, the next step is to conduct a T-test. For normality, select the Shapiro-Wilk test. If the single-tail value (p-value) of each set of data is greater than 0.05, this set of data conforms to a normal distribution and the experiment can be conducted.

The paired sample T-test was used for the experimental data in this experiment. The basic principle of the paired sample T-test is to find the difference between each pair of data: if there is no difference in the difference, then the overall mean of the difference should be 0, that is, p>0.05; if there is a difference in the difference, then the overall mean of the difference should be far away from 0, that is, p<0.05.

3. Results

This study aims to achieve the following two goals: 1) To study the students' learning ability after applying cooperative learning method is higher than that of traditional teaching method. 2) Research on the core competencies of students after applying cooperative learning method is higher than that of traditional teaching method.

3.1 Analysis of Students' Learning Ability Questionnaire Data

Three research hypotheses can be proposed regarding students' learning ability:

(1) After the experiment, there was no change in the students' learning ability.

(2) After the experiment, the students' learning ability weakened. (p-value > .05)

(3) After the experiment, the students' learning ability was enhanced. (p-value < .05)

3.1.1 Pre-test of the Students' Learning Ability Questionnaire

Before the experiment, learning ability questionnaires were distributed in two classes. 60 copies of the learning ability questionnaires were distributed on site. All students participating in the learning ability questionnaire were required to complete it within the specified time and collect the 60 copies of the learning ability questionnaire in time, with a recovery rate of 100%.

Normality test of students' learning ability: From Table 2, we can see that the p values of the learning ability dimensions Reading ability, Comprehension, Memory, Concentration, and Creativity are all greater than 0.05, indicating that the pre-test of students' learning ability conforms to the normal distribution. The next step is to conduct a T-test.

Paired sample T-test of students' learning ability: From Table 3, we can see the prediction results of method 1 (traditional teaching method) and method 2 (cooperative teaching method) on students' learning ability. After the prediction significance analysis, the p-values (2-tailed) of reading ability, comprehension ability, memory, attention and creativity were 0.389, 0.719, 0.769, 0.111 and 0.522, respectively, all greater than 0.05, and the significant difference was not obvious, indicating that there was no difference in the learning ability of the two

classes of students before the experiment, and the experiment could be carried out.

Table 2. Pre-test students' learning ability between Method 1 (traditional teaching method) and Method 2 (cooperative learning method) was tested using normal distribution (Shapiro-Wilk test)

Measurement content	Teaching methods	Statistics	df	Sig.(p-value)
Reading ability	Method 1	.956	30	.238>0.05
	Method 2	.956	30	.237>0.05
Comprehension	Method 1	.967	30	.458>0.05
	Method 2	.966	30	.438>0.05
Memory	Method 1	.945	30	.126>0.05
	Method 2	.944	30	.118>0.05
Concentration	Method 1	.958	30	.272>0.05
	Method 2	.943	30	.107>0.05
Creativity	Method 1	.952	30	.192>0.05
	Method 2	.965	30	.424>0.05

Note 1: According to the data in Table 2, the significance values (p-values) obtained by Method 1 (traditional teaching method) and Method 2 (cooperative learning method) are both greater than 0.05, so we can conclude: Method 1 (traditional teaching method) The data of the learning ability measurement content of Method 2 (cooperative learning method) obeys the normal distribution with a significance level of 0.05.

Note 2: p-value<.05(rejection of experiment)

Tables 3. Pre-test students' learning ability between Method 1 (traditional teaching method) and Method 2 (cooperative learning method) was tested using paired sample T-test

Measurement content	Teaching method	N	$\bar{X}$	SD	df	t	p-value (2 -tailed test)
Reading ability	Method 1	30	-.3000	1.8781	29	-.875	. 389>0.05
	Method 2	30					
Comprehension	Method 1	30	-.1333	2.0126	29	-.363	.719>0.05
	Method 2	30					
Memory	Method 1	30	-.1000	1.8448	29	-.297	.769>0.05
	Method 2	30					
Concentration	Method 1	30	-.5333	1.7759	29	-1.645	.111>0.05
	Method 2	30					
Creativity	Method 1	30	.2000	1.6897	29	0.648	.522>0.05
	Method 2	30					

Note: From the data in Table 3, that the significance analysis of the paired sample T-test and the sig (2-tailed) values of the students' learning ability measurement content are all greater than 0.05, so we can draw the conclusion: Method 1 (traditional teaching method) and 2 (cooperative learning method) has no significant difference in learning ability.

3.1.2 Post-test of the Students' Learning Ability Questionnaire

After the experiment, a learning ability questionnaire was distributed to the experimental group and the control group. 60 copies of the questionnaire were distributed on site, and all students participating in the questionnaire survey were required to complete them within the specified time. 60 copies of the questionnaire were collected on site, and the questionnaire recovery rate was 100%.

Normality test of students' learning ability: From Table 4, We can conclude that the p values of the learning ability dimensions of the experimental group are 0.105, 0.362, 0.186, 0.269, and 0.146, respectively, and the p values of the learning ability dimensions of the control group are 0.302, 0.34, 0.321, 0.112, and 0.142, respectively. The p values of both groups are greater than 0.05, and both groups of data conform to the normal distribution.

Paired sample T-test. From the significance analysis in Table 5, it can be seen that the p (2-tailed) values of students' reading ability, comprehension ability, memory, attention, and creativity are all 0.000, all less than 0.05. This shows that there are significant differences in the learning ability measurement results between method 1 (traditional teaching method) and method 2 (cooperative learning method). This shows that the implementation

of cooperative learning method has a significant effect on improving students' learning ability.

Table 4. Post-test students' learning ability between Method 1 (traditional teaching method) and Method 2 (cooperative learning method) was tested using normal distribution (Shapiro-Wilk test)

Measurement content	Teaching methods	Statistics	df	Sig.(p-value)
Reading ability	Method 1	.960	30	.302>0.05
	Method 2	.942	30	.105>0.05
Comprehension	Method 1	.962	30	.34>0.05
	Method 2	.963	30	.362>0.05
Memory	Method 1	.960	30	.321>0.05
	Method 2	.952	30	.186>0.05
Concentration	Method 1	.943	30	.112>0.05
	Method 2	.958	30	.269>0.05
Creativity	Method 1	.947	30	.142>0.05
	Method 2	.948	30	.146>0.05

Note 1: According to the data in Table 4, the significance values (p-values) obtained by Method 1 (traditional teaching method) and Method 2 (cooperative learning method) are both greater than 0.05, so we can conclude: Method 1 (traditional teaching method) The data of the learning ability measurement content of Method 2 (cooperative learning method) obeys the normal distribution with a significance level of 0.05.

Note 2: p-value<.05(rejection of experiment)

Tables 5. Post-test students' learning ability between Method 1 (traditional teaching method) and Method 2 (cooperative learning method) was tested using paired sample T-test

Measurement content	Teaching method	N	$\bar{X}$	SD	df	t	p-value (2-tailed)
Reading ability	Method 1	30	-5.9333	2.1961	29	-14.798	. 000<0.05
	Method 2	30					
Comprehension	Method 1	30	-7.1333	2.1292	29	-18.350	. 000<0.05
	Method 2	30					
Memory	Method 1	30	-5.1000	2.4684	29	-11.316	. 000<0.05
	Method 2	30					
Concentration	Method 1	30	-5.5000	2.7761	29	-10.851	. 000<0.05
	Method 2	30					
Creativity	Method 1	30	-4.3000	2.1995	29	-10.708	. 000<0.05
	Method 2	30					

Note: From Table 5, we can see that in the significance analysis of the paired sample test, the p (2-tailed) values of the students' learning ability measurement content are all 0.000, both less than 0.05. Therefore, we can draw the conclusion: Method 1 (traditional teaching method) and method 2 (cooperative learning method) have significant differences in learning ability.

3.2 Analysis of Students' Core Competencies Questionnaire Data

Three research hypotheses can be proposed regarding students' core competencies:

(1) After the experiment, there was no change in the students' core competencies.

(2) After the experiment, the students' core competencies weakened. (p-value > .05)

(3) After the experiment, the students' core competencies was enhanced. (p-value < .05)

3.2.1 Pre-test of the Students' Core Competencies Questionnaire

Similarly, before the experiment began, core competencies questionnaires were distributed in two classes. 60 copies of the core competencies questionnaires were distributed on site. All students participating in the core competencies questionnaires were required to complete them within the specified time and collect the 60 copies of the core competencies questionnaires in a timely manner, with a recovery rate of 100%.

Normality test of students' core competencies: From Table 6, we can see that the p-values of each dimension of students' core competencies are all greater than 0.05, indicating that the Post-test of students' core competencies conforms to the normal distribution. Next, the T-test is carried out.

Paired sample T-test of students' core competence. From Table 7, we can get the prediction results of students' core competence by method 1 (traditional teaching method) and method 2 (cooperative teaching method). According to the significance analysis, the p values (2-tailed) of humanistic inheritance, scientific spirit, learning to learn, sense of responsibility, practical innovation, and healthy lifestyle are 0.917, 0.264, 0.763, 0.645, 0.349, and 0.837, respectively, which are all greater than 0.05 and significant, and the difference is not obvious, indicating that there is no difference in the core competence of the two classes of students before the experiment, and the experiment can be carried out.

Table 6. Pre-test students' core competencies between Method 1 (traditional teaching method) and Method 2 (cooperative learning method) was tested using normal distribution (Shapiro-Wilk test)

Measurement content	Teaching methods	Statistics	df	Sig.(p-value)
Cultural heritage	Method 1	.960	30	.301>0.05
	Method 2	.955	30	.236>0.05
Scientific spirit	Method 1	.951	30	.176>0.05
	Method 2	.934	30	.062>0.05
Learn to learn	Method 1	.945	30	.126>0.05
	Method 2	.950	30	.172>0.05
Responsibility	Method 1	.943	30	.109>0.05
	Method 2	.960	30	.312>0.05
Practical innovation	Method 1	.946	30	.133>0.05
	Method 2	.953	30	.199>0.05
Healthy lifestyle	Method 1	.956	30	.250>0.05
	Method 2	.957	30	.252>0.05

Note 1: From Table 6, we can see that the p values are all greater than 0.05, indicating that the data are all in line with the normal distribution. The next step is to conduct a T-test.

Note 2: p-value<.05(rejection of experiment

Tables 7. Pre-test students' core competencies between Method 1 (traditional teaching method) and Method 2 (cooperative learning method) was tested using paired sample T-test

Measurement content	Teaching methods	N	$\bar{X}$	SD	df	t	p-value (2-tailed)
Cultural heritage	Method 1	30	0.0333	1.7317	29	.105	.917>0.05
	Method 2	30					
Scientific spirit	Method 1	30	-.4000	1.9226	29	-1.140	.264>0.05
	Method 2	30					
Learn to learn	Method 1	30	-.1333	2.4031	29	-.304	.763>0.05
	Method 2	30					
Responsibility	Method 1	30	-.2000	2.3548	29	-.465	.645>0.05
	Method 2	30					
Practical innovation	Method 1	30	-.3000	1.7251	29	.953	.349>0.05
	Method 2	30					
Healthy lifestyle	Method 1	30	-.0666	1.7604	29	.207	.837>0.05
	Method 2	30					

Note 1: From Table 7, we can see that the sig (2-tailed) values of the core competence measurement content of students are 0.917, 0.264, 0.763, 0.645, 0.349 and 0.837 by the significance analysis of paired sample T-test, all of which are greater than 0.05. It can be concluded that there is no significant difference, indicating that there is no difference in the core competence of students in the two classes before the experiment, and the experiment can be carried out.

Note 2: p-value <.05(rejection of experiment)

3.2.2 Post-test of the Students' Core Competencies Questionnaire

After applying cooperative learning method methods and traditional teaching methods, the researchers conducted a core competencies questionnaire survey on the experimental group and the control group. 60 questionnaires were distributed on site, and all students participating in the questionnaire were required to complete it within the specified time. 60 questionnaires were collected on site, with a questionnaire recovery rate of 100%.

First, the core literacy of students was tested for normal distribution. The single-sample Shapiro-Wilk test was used to compare the cumulative frequency distribution of the sample data with the normal distribution. If the difference between the two is small, it indicates that the sample comes from a population that follows the normal distribution pattern. It was calculated that the p-values of the core literacy measurement content of the experimental group were 0.164, 0.147, 0.296, 0.100, 0.264, and 0.093, respectively, and the p-values of the learning ability measurement content of the control group were 0.156, 0.138, 0.138, 0.395, 0.172, and 0.211, respectively. The p-values of both groups of measurement content exceeded 0.05, confirming that the data of both groups of measurement content met the normal distribution conditions (see Table 8).

Secondly, the core literacy of students was tested for t-test. According to the significance analysis of paired sample test, the p-values (2-tailed) of students' cultural background, scientific spirit, learning to learn, sense of responsibility, practical innovation and healthy life were all 0.000, all less than 0.05 (see Table 9), indicating that there were significant differences in the results of core competency measurement between method one (traditional teaching method) and method two (cooperative learning method).

Table 8. Post-test students' core competencies between Method 1 (traditional teaching method) and Method 2 (cooperative learning method) was tested using normal distribution (Shapiro-Wilk test)

Measurement content	Teaching methods	Statistics	df	Sig.(p-value)
Cultural heritage	Method 1	.949	30	.156>0.05
	Method 2	.949	30	.164>0.05
Scientific spirit	Method 1	.947	30	.138>0.05
	Method 2	.948	30	.147>0.05
Learn to learn	Method 1	.947	30	.138>0.05
	Method 2	.959	30	.296>0.05
Responsibility	Method 1	.964	30	.395>0.05
	Method 2	.942	30	.100>0.05
Practical innovation	Method 1	.950	30	.172>0.05
	Method 2	.957	30	.264>0.05
Healthy lifestyle	Method 1	.954	30	.211>0.05
	Method 2	.940	30	.093>0.05

Note 1: From Table 8, the significant p values obtained by Method 1 (traditional teaching method) and Method 2 (cooperative learning method) are both greater than 0.05, so the measurement data obey the normal distribution.

Note 2: p-value <.05(rejection of experiment)

Table 9. Post-test students' core competencies between Method 1(traditional teaching method) and Method 2(cooperative learning method) was tested using paired sample T-test

Measurement content	Teaching methods	N	$\bar{X}$	SD	df	t	p-value (2 -tailed)
Cultural heritage	Method 1	30	-4.333	1.9357	29	-12.261	. 000<0.05
	Method 2	30					
Scientific spirit	Method 1	30	-8.667	2.5097	29	-18.914	. 000<0.05
	Method 2	30					
Learn to learn	Method 1	30	-5.967	2.7852	29	-11.734	. 000<0.05
	Method 2	30					
Responsibility	Method 1	30	-6.200	2.2652	29	-14.992	. 000<0.05
	Method 2	30					
Practical innovation	Method 1	30	-4.167	2.6272	29	-8.687	. 000<0.05
	Method 2	30					
Healthy lifestyle	Method 1	30	-4.533	2.2087	29	-11.242	. 000<0.05
	Method 2	30					

Note: From Table 9, we can see that in the significance analysis of the paired samples test, the p (2-tailed) values of the students' core competencies measurement content are all 0.000, both less than 0.05, so we can draw the conclusion: Method 1 (traditional teaching method) and Method 2 (cooperative learning method) have significant differences in the core competencies.

3.3 Pre-test and Post-test of the Student's Learning Ability Questionnaire

In the control class, the effect of using traditional teaching methods to enhance students' learning ability is not obvious. From Table 10, we can see that the p-values (2-tailed) of reading ability, comprehension ability, memory, attention and creativity are 0.803, 0.728, 0.348, 0.7221 and 0.447 respectively, all greater than 0.05, and the significant differences are not obvious.

In the experimental class, the cooperative learning method has a significant effect on enhancing students' learning ability. From Table 10, the p-values (2-tailed) of reading ability, comprehension ability, memory, attention and creativity are all 0.000, all less than 0.05, and the significant differences are obvious.

Tables 10. Pre-test and Post-test students' learning ability between Method 1 (traditional teaching method) was tested using paired sample T-test

Measurement content	**Traditional teaching method**	**N**	**$\bar{X}$**	**SD**	**df**	**t**	**p-value (2 -tailed)**
Reading ability	Control class	30	.02500	.54278	29	.252	. 803>0.05
	Experimental class	30	-1.3250	.41079	29	-17.667	.000<0.05
Comprehension	Control class	30	.02000	.31228	29	.351	.728>0.05
	Experimental class	30	-1.5200	.60935	29	-13.663	.000<0.05
Memory	Control class	30	.06667	.38245	29	.955	.348>0.05
	Experimental class	30	-1.3500	.74162	29	-9.970	.000<0.05
Concentration	Control class	30	-.03333	.50742	29	-.360	.722>0.05
	Experimental class	30	-1.3667	.70934	29	-10.553	.000<0.05
Creativity	Control class	30	-.07967	.56545	29	-.772	.447>0.05
	Experimental class	30	-1.5907	.72637	29	-11.994	.000<0.05

Note: From Table 10, we can see that in the paired sample test of significance analysis, the p (2-tailed) values of the content of measuring students' learning ability using the traditional teaching method are all greater than 0.05. The p (2-tailed) values of the content of measuring students' learning ability using the cooperative learning method are all less than 0.05.

4. Discussion

The results of this study show that the implementation of cooperative learning method effectively improves students' learning ability and core competence. In addition, compared with the control group using traditional teaching methods, the experimental group showed a high level of learning ability and core literacy using traditional teaching methods. These results confirm that the implementation of cooperative learning method can significantly improve students' learning ability and core literacy, while also improving their interest in learning, love of life, attention to health, and planning for the future. This method helps students improve their learning skills, accumulate experience in cooperative learning method, improve their enthusiasm for learning, and cultivate their ability to solve various problems encountered in society.

In China, many teachers are studying cooperative learning. Cooperative learning has many advantages in teaching practice. First of all, through group discussion and cooperative learning, students can understand and digest the knowledge they have learned more deeply, rather than simply accepting and memorizing it. This helps to enhance their learning effectiveness and academic performance (Chaoxian, 2024). Secondly, the cooperative learning method can effectively promote the cultivation of students' communication and teamwork abilities. Within groups, students need to communicate and collaborate with each other, which helps to exercise their social skills and teamwork abilities (Leilei, 2020). In addition, cooperative learning method methods can also cultivate students' critical thinking and innovation abilities. Through group discussions and joint exploration, students can apply the knowledge they have learned more flexibly and develop problem-solving abilities (Haijing, 2023). The cooperative learning method has obvious advantages in enhance students' learning abilities and core competencies, and deserves wider application and promotion in education and teaching.

In the process of applying cooperative learning methods, various factors of teachers and students are usually involved. First, cooperative learning methods require teachers and students to invest more time and resources, including teachers needing to spend more time designing and organizing cooperative learning activities during the teaching process, and schools also need to provide more support and resources to promote the implementation of cooperative learning. Secondly, cooperative learning methods require students to have a certain sense of cooperation, but some students may have individual differences, and different students have

different abilities to absorb and apply cooperative learning methods, which requires reasonable grouping. In addition, teachers may face evaluation difficulties when promoting cooperative learning methods. The use of diversified evaluation methods has obtained a comprehensive and objective evaluation of students (Abramczyk & Jurkowski, 2020).

5. Conclusion

This study implemented cooperative learning and traditional teaching methods. This study formulated relevant teaching plans and implemented cooperative learning methods in the physics major of a domestic university. The experiment was divided into an experimental group and a control group. The experimental group adopted cooperative learning methods, and the control group adopted traditional teaching methods. The results of the questionnaire on students' learning ability and core competence were collected and analyzed. The study showed that the application of cooperative learning methods is superior to traditional teaching methods in enhancing students' learning ability and core competence.

In the process of implementing cooperative learning methods, students show higher interest in learning, the learning atmosphere in the classroom is active, and they are proactive in learning. Therefore, teachers can flexibly implement cooperative learning methods according to the attributes of the subject, teaching content, characteristics of students and learning environment. In practical teaching, educators should bravely try to let students discover problems, find solutions to problems, exchange opinions with each other, constantly reflect and strengthen interaction with students. This method is not only conducive to the all-round development of students, but also improves the quality of students and the teaching ability of educators themselves.

During the implementation of cooperative learning methods. Establish goal orientation, create problem guides and problem scenarios, so that students can boldly and confidently solve problems and complete teaching tasks. When establishing goal orientation, you must understand what you need and what you get? When creating problem orientation and problem scenarios, teachers should consider the actual situation of students and design problems that meet the actual situation of each student. For example, in the "Electrical and Electronic Technology" course, cooperative learning is applied. Teachers can let students help each other find solutions based on problems encountered in life. In the process of cooperative learning, the collection of student data is an important link. Therefore, teachers must be fully prepared, provide relevant knowledge materials for students to learn, and teach students how to acquire knowledge and improve their learning skills.

When students are engaged in cooperative learning tasks, teachers should play a leading role, skillfully manage the rhythm of the class, and supervise the actual progress of students in solving problems. This includes giving students enough time to communicate, discuss, and summarize. Of course, teachers should avoid excessive intervention in students' discussions, but provide them with guidance and insights when necessary. Achieving this balance requires teachers to have solid course expertise and cooperative learning teaching skills. Only by effectively and scientifically carrying out cooperative learning methods can we better achieve teaching goals and achieve the expected results of target education.

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Authors contributions

Siyong Tang was responsible for data collection and drafted the manuscript.

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