

# Study on the Influence of PBL Teaching Method on Students Majoring in Navigation in the Post-epidemic Era

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**Abstract:** The COVID-19 outbreak has made people rethink the health of students. In order to strengthen physical education and enhance students' physical fitness in the post-epidemic era, and based on the special training requirements of nautical colleges, this paper explores the possibility of PBL model in Marine physical education. Through the study of the influence of 10-week PBL physical education on the physical fitness of navigation major students, this paper analyzes and discusses the influence of PBL physical education on the physical fitness of male navigation major students, which is of great value for improving the physical health of male navigation major students in the post-epidemic era. It also has certain reference significance for domestic navigation colleges to carry out the reform of navigation physical education.

**Keywords:** PBL; Nautical Sports; College Students; Post-epidemic Era.

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## 1. Introduction

In recent years, the outbreak of COVID-19 has significantly impacted the health of students. As young intellectuals and key contributors to social development, greater attention should be given to the well-being of college students. In the post-pandemic era, college students are confronted with various health challenges including deteriorating physical fitness, increasing obesity rates, and susceptibility to depression during public health crises [1]. This has raised widespread concern within society. Being at the forefront of China's construction and development, college students bear the historical responsibility for national prosperity, rejuvenation, and people's happiness. Their health is pivotal in implementing China's talent strategy [2]. Consequently, government departments have begun prioritizing student health by implementing a series of policies and measures [3] aimed at enhancing their physical well-being. Furthermore, colleges and universities have started focusing on student health with an aim to improve their overall fitness through physical education programs. Considering the unique nature of nautical colleges and universities in China [4], maritime professionals must possess not only extensive professional knowledge but also excellent physical capabilities. Since 2023 when the National Maritime Administration issued a notice regarding optimizing quality assessment in maritime education and training as well as onboard training management; it became evident that educational courses offered by maritime institutions require significant improvements. Physical education courses play an indispensable role in this reform process within maritime colleges and universities [5]. Given the substantial impact of the COVID-19 pandemic on student health; both physical fitness levels and professional skills among navigation majors have been affected. Therefore, navigation sports teaching must be improved and optimized. In recent years, a teaching method called Project-based Learning (PBL) has been widely adopted in the world. It is a teaching mode in which students

take the initiative to collect information, explore and solve problems by means of group cooperation or independent learning around questions raised by teachers in the teaching process [6]. The research on the teaching practice of internationally renowned navigation colleges shows that currently, the navigation sports teaching of international excellent navigation colleges generally follows the basic principle of student-oriented, and further gives students more space for independent learning on the premise of meeting students' individual learning needs, so as to fully mobilize students' learning autonomy [7]. This coincides with the idea of PBL teaching model. Based on this, project-based learning model (PBL) began to try to be used in the physical education teaching of Marine professional colleges. This paper combines PBL model teaching with Marine sports teaching, and uses the methods of literature, mathematical statistics and experimental testing to explore, and finally draws the following conclusion: The teaching model combined with PBL and Marine sports can effectively improve the physical quality and professional skills of students in Marine colleges and universities.

The purpose of Marine sports teaching is to enhance students' physical fitness, improve students' physical quality, and promote students' all-round development, so as to achieve full performance. To meet the standard needs of professional talents in the field of navigation. It is mainly on the basis of traditional physical education, in order to meet the special needs of the navigation industry, pay attention to training anti-seasickness ability and body balance force, and require students to learn swimming, diving, and other practical skills, improve the physical quality and special skills of students in navigation colleges and universities, and finally cultivate in line with the needs of China's navigation industry, high efficiency, high-quality navigation talents. [8] In recent years, due to the great impact and impact of the COVID-19 pandemic on the physical health of students, students' physical fitness has declined year by year, which has become a major problem plaguing society, schools, parents and

students themselves. This paper mainly studies and analyzes the physical function, physical fitness and special skills of male college students majoring in navigation, so as to explore whether the application of PBL teaching mode in the teaching of navigation sports in the post-epidemic era will have a positive impact on the physical fitness of students majoring in navigation. Through PBL teaching research on students majoring in navigation, a series of data indicators related to physical fitness were obtained and analyzed before and after the test, which is of great value for improving and enhancing the physical health of students majoring in navigation in the post-epidemic era. It also has certain reference significance for other professional colleges and universities of navigation to carry out the reform of navigation physical education. At the same time, in the process of experimental exploration, some teaching methods and course contents of Marine sports courses carried out by other domestic and foreign Marine colleges and universities are analyzed for reference, so as to find the existing problems and give feasible suggestions, providing a new perspective for the further reform and development of Marine sports teaching in the future.

## 2. Methods and Materials

In this paper, the influence of the combined teaching mode of PBL and Marine sports on the physical fitness of students majoring in navigation is taken as the research direction, and 80 students (including Department of navigation and Marine Engineering) majoring in navigation who have not received PBL teaching in class 2022 of Shanghai Maritime University are selected as the research object. It should be noted here that due to the influence of traditional concepts, enrollment policies and other factors, the students majoring in navigation are mostly male, and few female students are studying in navigation majors. Therefore, only male students majoring in navigation are selected as the experimental objects in this study. The subjects were divided into experimental group and control group by class. The experimental group of 40 people, PBL teaching mode intervention strategy; Control group 40 people, the implementation of traditional physical education teaching mode, the two groups of the experiment period is 10 weeks, 10 weeks later, respectively measure the physical function of each group of students, physical quality and special skills and other related indicators and analysis of the results.

### 2.1. Literature Data Method

CNKI, PubMed, Google Academic and other electronic retrieval methods were used to search with keywords such as "Marine sports", "PBL model teaching" and "post-epidemic era", and relevant literature and materials were reasonably sorted out and analyzed, thus providing theoretical and methodological basis for this paper.

### 2.2. Mathematical Statistics Method

This study mainly uses Office Excel 2019 and SPSS software for statistical analysis of relevant indicators after each experiment. Independent sample T test was used to compare the data of the control group and the experimental group, and paired sample T test was used to compare the data of each group before and after the experiment. The standard of significant difference was  $P < 0.05$ , and the standard of highly significant difference was  $P < 0.01$ . The data were obtained by mathematical statistics, and the experimental group and the control group were compared and analyzed, so

as to draw further conclusions.

## 2.3. Experimental Testing Method

This study mainly implemented the intervention strategy of PBL mode teaching in physical education class, and conducted teaching intervention for the experimental group once a week. While the control group was taught according to the traditional physical education teaching mode, and the teaching times were the same as the experimental group. The physical indexes of the students were tested in the same way before and after the experiment, and the results of each group were compared longitudinally before and after the experiment, and the results of the experimental group and the control group were compared laterally after the experiment, so as to understand the influence of the intervention strategy of PBL teaching on the physical fitness of male college students. The experimental observation lasted for 10 weeks.

## 3. Results and Discussion

### 3.1. The Influence of the Teaching Method Combining PBL Model and Marine Sports on the Physical Function of Students Majoring in Navigation

In this experiment, the change of physical function of students majoring in navigation was reflected by measuring the index of vital capacity. Vital capacity refers to the total amount of gas exhaled by the maximum exhalation after inhaling as much as possible. It is an important index to test individual cardiopulmonary function and reflect the physiological function of students. It is also the most intuitive index to detect lung function. The study found that compared with before the outbreak of the novel coronavirus, the vital capacity of college students showed a downward trend. The main reason is that college students lack physical activity in a closed environment during the epidemic period. [9] According to the comparison of the data of the experimental group and the control group before and after the experiment, the average measured value of students in the experimental group before the experiment was 4163.39ml; The average spirometer of the students in the control group before the experiment was 4131.17ml. All of them were within the normal range of national physical health standards for college students (the value of college boys' failure was 2300-2940, the value of passing was 3100-4180, the value of good was 4300-4550, and the value of excellent was 4800-5040).

Through the analysis of the above data, it can be seen that there is no significant difference between the experimental group before the experiment and the control group before the experiment ( $P > 0.05$ ), and there is a significant difference between the experimental group after the experiment and the control group after the experiment ( $P < 0.05$ ). In the comparison before and after the experimental data of the experimental group, there was a highly significant difference in the vital capacity  $P < 0.01$ . And in the comparison of experimental data before and after the control group, the vital capacity also had a significant difference  $P < 0.05$ . In the comparison of the data before and after the experiment, it was found that the lung capacity of the experimental group was significantly increased after the experiment compared with that before the experiment, with a highly significant difference  $P < 0.01$ . And the control group also improved after the experiment compared with before the experiment, with a significant difference  $P < 0.05$ . The above results indicate that

physical education courses of different teaching modes have positive effects on the improvement of vital capacity, but the combination of PBL mode and Marine sports has a more obvious impact on the impact of students' vital capacity.

**Table 1.** Comparison between the experimental and the control group before and after the experiment

Time/Group	Experimental Group (N=40)	Control group (N=40)	T	P
Before the Experiment(ml)	4163.39±743.7	4131.17±593.2	0.428	0.669
After the Experiment(ml)	4345.40±792.0	4181.20±626.9	5.054	0.004
T	7.738	2.300		
P	0.000	0.023		

### 3.2. The Influence of the Combination of PBL Mode and Marine Sports Teaching Mode on the Physical Fitness of Students Majoring in Navigation

In this experimental study, the physical fitness level is mainly reflected through 50M running, 1000M running, standing long jump and pull-up and other indicators. The results of 50m run can comprehensively reflect the students' physical coordination level, nerve flexibility level, and muscle strength and flexibility level. 1000M running results can reflect the speed, endurance, physical strength and other indicators of students, not only have high requirements for students' physical distribution, but also need students to have a strong core strength. [10] Standing long jump performance can reflect students' lower limb explosive power level, pull-up performance can reflect students' upper limb endurance development level, upper limb muscle strength development level, and body coordination. Through the measurement of these indicators, it can be more intuitive and objective to reflect the changes of students after different teaching modes.

#### 3.2.1. The Influence of the Teaching Mode Combining PBL and Marine Sports on the Explosive Power of Students Majoring in Navigation

**Table 2.** Comparison between the experimental group and the control group before and after the experiment

Time/Group	Experimental Group (N=40)	Control group (N=40)	T	P
Before the experiment(s)	7.32± 0.53	7.24 ±0.47	1.484	0.139
After the experiment(s)	7.23 ±0.50	7.22± 0.50	0.259	0.796
T	3.368	0.823		
P	0.001	0.412		

50m running belongs to the category of sprint, which can develop and assess students' speed, strength, agility and other qualities. [11] To a large extent, it represents a student's level of explosive power. According to the data of 50M running test of the experimental group and the control group before and after the experiment, the average measured score of students in the experimental group before the experiment is 7.32S, and

the average measured score of students in the control group before the experiment is 7.24S. The data of the two groups are compared with the "National Standards for Students' Physical Health". Within the normal range (for male students, the value of failing is 9.3-10.1, the value of passing is 7.3-9.2, the value of good is 7.0-7.2, and the value of excellent is 6.7-6.9).

From the experimental results, after 10 weeks of PBL teaching, the average value of students in the experimental group after the experiment is 7.23S, an increase of 0.09S. The index of 50M running is a highly significant difference,  $P < 0.01$ ; In the control group, after 10 weeks of traditional physical training, the average score of 50M after the experiment is 7.22S, an increase of 0.02S, and the index of 50M running is no significant difference,  $P > 0.05$ . This indicates that PBL mode of physical education has a positive impact on the explosive power of male college students majoring in navigation.

#### 3.2.2. The Influence of PBL Model Combined with Marine Sports Teaching on the Endurance of Nautical Students

1000m running is an event that students need to reach the standard in the examination from middle school to university. The results of 1000 meters can directly reflect the students' endurance level. According to the test data of the experimental group and the control group before and after the experiment, the average measured score of the experimental group before the experiment was 253.03s (4' 13"03), and the average measured score of the students in the control group before the experiment was 249.75s(4'09"75). The two groups of data are compared with the "National Physical Health Standard for Students". Were within the normal range (college boys failed value of 5'12"-6'12", pass value of 3'47"-4'32", good value of 3'34"-3'42", excellent value of 3'17"-3'27").

**Table 3.** Comparison between the experimental group and the control group before and after the experiment

Time/Group	Experimental group (N=40)	Control group (N=40)	T	P
Before the experiment(s)	253.03 ±33.53	249.75±29.21	0.934	0.353
After the experiment(s)	238.74 ±22.79	245.63±27.46	2.435	0.015
T	4.810	2.285		
P	0.003	0.014		

#### 3.2.3. Influence of PBL Mode Combined with Marine Sports Teaching Mode on Lower Extremity Explosive Power of Students Majoring in Navigation

The results of standing long jump can objectively reflect the explosive level of lower limbs and the dexterity of the body. From Table 3-4 data comparison between the two groups before and after the experiment, it can be seen that the average measured score of the experimental group before the experiment was 230.30cm; The average score of the students in the control group before the experiment was 227.10cm, and the data of the two groups were both within the normal range compared with the "National Standard of Physical Health of Students" (the value of college boys' failing grade was 183-203, the value of passing grade was 208-244, and the value of good grade was 248-256. Excellent scores were 263-273).

**Table 4.** Comparison between the experimental group and the control group before and after the experiment

Time/Group	Experimental group (N=40)	Control group (N=40)	T	P
Before experiment(cm)	230.30±19.08	227.10±19.95	1.833	0.365
After experiment(cm)	234.57±18.71	229.95±19.40	2.912	0.000
T	5.616	2.167		
P	0.000	0.064		

According to the comparison of data before and after the experiment in Table 3-4, compared with the experimental group and the control group, there is no significant difference in the standing long jump index of the experimental group and the control group before the experiment,  $P>0.05$ , while there is a highly significant difference in the standing long jump index of the experimental group and the control group after the experiment,  $P<0.01$ . In the intra-group comparison of each group, the performance of the experimental group after the experiment was significantly improved than that before the experiment, and the index of standing long jump had a highly significant difference ( $P<0.01$ ), while the performance of the control group before and after the experiment was little different, and the index of standing long jump had no significant difference ( $P>0.05$ ). This indicates that PBL mode of physical education has a positive impact on the lower limb explosive power and strength of male college students majoring in navigation.

### 3.2.4. Influence of the Combination of PBL Mode and Marine Sports Teaching on Upper Body Strength of Navigation Major Students

**Table 5.** Comparison between the experimental group and the control group before and after the experiment

Time/Group	Experimental Group (N=40)	Control group (N=40)	T	P
Before experiment (times)	4.38±4.10	5.31±4.96	1.792	0.074
After experiment (times)	6.98±5.76	5.60±5.09	2.249	0.025
T	7.446	1.298		
P	0.000	0.196		

Pull-up is a traditional project to test the development level of students' upper limb muscle strength, which can effectively reflect students' grip strength, arm strength and shoulder strap strength [12]. According to the comparison of pull-up data between the experimental group and the control group before and after the experiment, it can be seen from Table 3-5 that the average score of the experimental group before the experiment was 4.38. The average score of the students in the

control group before the experiment was 5.31 times. Compared with the "National Physical Health Standard for Students", the two groups of data were both within the range of failing (the value of failing for college boys was 5-9, the value of passing was 10-14, the value of good was 15-16, and the value of excellent was 17-19). It should be noted here that due to the current physical quality of most of the students themselves is not high, most of the students can only do single-digit pull-ups, almost fail. Individual students can't even complete a standard pull-up, so this experiment focuses on the analysis of the changes in grades before and after the experiment.

According to the data in Table 3-5, after 10 weeks of PBL teaching, the average measured value of students in the experimental group was 6.98times, 2.60times higher than before the experiment, and the pull-up index showed a highly significant difference,  $P<0.01$ ; In the control group, after 10 weeks of traditional physical education course learning, the average score of pull-up was 5.60times, an increase of 0.29 times, and there was no significant difference in pull-up index,  $P>0.05$ . Before the experiment, there was no significant difference in the pull-up index between the experimental group and the control group,  $P>0.05$ ; After the experiment, the pull-up index of the experimental group and the control group showed a significant difference  $P<0.05$ , which indicates that PBL mode of physical education can improve the upper body strength of male college students majoring in navigation.

### 3.3. The Influence of PBL Model Combined with Marine Sports Teaching Mode on the Special Skills of Nautical Students

Swimming is the earliest and most distinctive course for navigation majors, and it is also a basic skill that students in navigation colleges and universities must master [13]. Therefore, this study selects the representative 500-meter swimming test of Shanghai Maritime University as an indicator to explore the influence of PBL teaching mode on the special skills of students majoring in navigation.

As can be seen from the data in Table 3-6, after 10 weeks of PBL teaching, the average measured value of students in the experimental group was higher than that before the experiment, and the 500-meter swimming index showed a highly significant difference,  $P<0.01$ ; In the control group, after 10 weeks of learning the traditional physical education course, the average score of 500-meter swimming was 938.90S, improved 34.8S, and the index of 500meter swimming showed no significant difference,  $P>0.05$ . Before the experiment, there was no significant difference between the experimental group and the control group in 500-meter swimming index ( $P>0.05$ ); After the experiment, the index of 500-meter swimming between the experimental group and the control group showed a significant difference  $P<0.05$ , which indicates that PBL mode of physical education can effectively improve the level of specialized skills of male college students majoring in navigation.

**Table 6.** Comparison between the experimental group and the control group before and after the experiment

Time/Group	Experimental group (N=40)	Control Group (N=40)	T	P
Before experiment (s)	991.70±58.98	973.70±58.45	-0.592	0.568
After experiment (s)	916.90±41.01	938.90±38.21	1.198	0.261
T	8.623	3.614		
P	0.000	0.006		

### 3.4. Conclusion and Suggestions

(1) After a 10-week training of PBL combined with Marine sports teaching mode and traditional physical education teaching mode, The physical function of the students in the experimental group was significantly improved. From the relevant test indicators of vital capacity, the experimental group has significantly improved the vital capacity after the experiment, which strongly proves that PBL teaching has a significant effect on improving the physical function of male college students who major in navigation.

(2) After the implementation of PBL mode intervention teaching strategy, the physical fitness indicators of male college students majoring in navigation have been improved in different degrees. Among them, speed, explosive power, endurance, strength and other indicators have been significantly improved. It shows that the interv

(3) Through the analysis of 500-meter swimming performance, it can be seen that the 500meter swimming performance of the experimental group after the experiment is significantly improved compared with that of the control group after the experiment, with a highly significant difference, which verifies the effectiveness of PBL teaching mode in improving students' special skills.

(4) PBL model teaching is of great significance to enhance the physical fitness of male college students majoring in navigation, and it is suggested to carry out PBL teaching in the physical education process of navigation colleges.

(5) Due to the particularity of Marine sports courses, teachers should guide students to prepare for physical education, improve safety awareness, and ensure students' life safety.

(6) The successful application of PBL teaching mode in Marine sports courses provides a new idea for the reform of physical education in Marine colleges and universities. The case of PBL teaching mode can be used to promote the reform of physical education in Marine colleges and universities. Compared with traditional PE teaching, PBL mode has shown remarkable advantages in promoting students' physical function, physical quality and special skills. Compared with traditional physical education, the teaching mode combining PBL and Marine sports is more suitable for the teaching of Marine sports in the current post-epidemic era, and is more in line with the characteristics and overall needs of students of Marine majors under the current environment. It is suggested that major colleges and universities of navigation should carry out new curriculum reform of Marine sports. Gradually introduce PBL teaching mode into the daily navigation sports teaching process, so as to improve the physical quality and professional skills of students majoring in navigation. At the same time, physical education teachers in colleges and universities of navigation should constantly improve their teaching level, strengthen their theoretical quality, adjust and improve the teaching process according to the actual learning

situation of students of navigation major, so as to continuously improve and develop the physical education of navigation in practice, so as to lay a solid foundation for training professionals in the field of navigation to adapt to the current environment.

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