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Development of Specific Training Programs to Improve Breaststroke Performance for Sport University Students

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Abstract
Background and Aims: Specific training programs are critical for improving breaststroke performance because they target muscle strength, flexibility, and stroke-specific technique, thereby increasing efficiency and speed in the water. Tailored drills also help to improve the timing and coordination required for optimal propulsion and smooth movement. The purpose of this study was 1) To develop a specific training program to improve breaststroke performance for sports university students. 2) To experiment with a specific training program to improve breaststroke performance for sports university students. 3) To study the effect of specific training programs to improve breaststroke performance for sports university students.
Methodology: This study was designed with a two-group experimental design. Students from the School of Physical Education of Minnan Normal University in Zhangzhou City, Fujian Province were randomly selected and divided into two groups: the experimental group and the control group. Before receiving 8 weeks of specific training, they were tested and scored for breaststroke movements and 50-meter breaststroke, and the assessment was repeated after the 4th week and the final test after 8 weeks of training. The data were analyzed using a statistical software package for mean, standard deviation, and t-test, one-way ANOVA repeated measures, and Bonferroni post hoc analysis. The statistical significance threshold was 0.05.
Results: The results showed that: 1) There were significant differences between the experimental group and the control group in the mean comparison of breaststroke movements (leg movements, hand movements, breathing timing, and whole body coordination) and 50-meter breaststroke results (*P＜0.05). 2) There were significant differences in the pairwise comparisons of the variables in the pre-test, the test after the 4th week, and the final test after 8 weeks within the experimental group (*P＜0.05).
Conclusion: The data show that specific training programs significantly improve breaststroke performance, with noticeable improvements in leg and hand movements, breathing timing, body coordination, and 50-meter results. Furthermore, continuous improvements were observed in the experimental group over 8 weeks, demonstrating the efficacy of structured training.
Keywords: Specific Training Program; Breaststroke Performance; Sport University Students

Introduction

Swimming, as a sport with a long history, has continued to evolve and develop throughout history. Swimming has been widely taught and learned as a skill as far back as ancient Greece. As time goes by, swimming not only serves as a survival skill but also becomes an important part of modern sports with its unique competitive charm. Among the many swimming strokes, breaststroke is known for its unique physical coordination and technical requirements. From early simple imitation to modern scientific training, the development of breaststroke technology has witnessed the evolution of swimming and humans' continuous exploration of physical potential. In the early development stages of swimming, training methods were mostly based on the inheritance of experience and lacked systematic theoretical guidance. With the advancement of science and technology and the development of sports disciplines, scientific concepts, and methods have begun to be introduced into swimming training. Especially after entering the 20th century, with the rise of sports physiology, sports biomechanics, and other disciplines, swimming training gradually became scientific and systematic. Training methods and means have also changed from single technical imitation to focusing on the comprehensive development of Students, including the cultivation of technology, physical fitness, psychology, and other aspects (Song et al., 2022).

In this context, breaststroke training has also experienced a transformation from traditional to modern. Early breaststroke training mostly focused on the imitation and practice of technical movements, while ignoring the consideration of individual differences and physical conditions of students. With the introduction of the concept of personalized training, training began to focus on the individual needs of students and emphasized the development of training plans based on the

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characteristics of students. In addition, the development of modern technology has also provided new perspectives and methods for breaststroke training. The application of video analysis, biomechanical testing, and other technologies makes training more accurate and efficient (Liu, 2021).

In the breaststroke training of university physical education students, how to improve their sports performance through scientific and systematic training has become an urgent problem to be solved. Students at the college level are in a critical period of technical improvement and physical development, and training during this period has an important impact on their future sports careers. Therefore, constructing a scientific and systematic breaststroke training plan is of great significance for improving the competitive level of college Students (Liu et al., 2020). In breaststroke training, in addition to the key indicators of speed testing, in-depth analysis and improvement of leg technology and coordination technology are equally vital. The leg movement of the breaststroke is the main source of promotion. The correct leg technology can effectively improve the advancement efficiency in the water. Coordination technology ensures the synchronization of the leg movement and other body parts, thereby improving the smoothness of the overall movement. And reduce resistance. Especially the kicking movements on the legs, including the bending of the knee, the exterior of the feet, and the fast and powerful kicking water. These details have a significant impact on improving the speed of swimming and overall technical performance. At the same time, coordination technology involves the synchronization of upper-body and lower-body movements, as well as the cooperation of breathing and arm movement, which is essential for maintaining a stable swimming posture and rhythm.

Through in-depth research and systematic evaluation of training plans, this study hopes to provide more scientific and effective guidance for swimming training, promote the overall development of students, and improve the scientificity and effectiveness of swimming training (Wu, 2012). In addition, this study will also focus on the effects and existing problems of the training plan in practical applications, providing a reference for the optimization and improvement of swimming training. This not only has important practical significance for improving the competitive level of students but will also provide new theoretical support and research directions for the development of the field of swimming training (Liu, 2024).

This research will provide a scientific and effective training program for the field of swimming training, which will help improve students' technical level and competitive status and promote their all-round development. Through in-depth analysis of the implementation process, effect evaluation, and possible problems of the training program, this study will provide useful reference and inspiration for the optimization and improvement of swimming training, promote the scientific development of swimming, and provide support for the overall growth of students.

Objectives

1. To develop a specific training program to improve breaststroke performance for sport university students.
2. To experiment with a specific training program to improve breaststroke performance for sports university students.
3. To study the effect of specific training programs to improve breaststroke performance for sports university students.

Literature Review

1. Breaststroke teaching

1.1 Application Research on Modern Technology in Breaststroke Technology Teaching

Liu et al (2022) discussed the application of modern technology in the teaching of breaststroke technology in their research and highlighted the important role of technology in improving the quality of teaching. They pointed out that the application of technology can not only optimize the teaching process but also provide students with a more personalized and scientific learning experience. The application of video analysis technology is an important aspect mentioned in the study.

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Capture the trainees 'swimming movements through HD cameras, coaches can carefully analyze and evaluate the students' technical movements. This technology enables coaches to discover the errors in the movement of students in time and provide targeted guidance and suggestions, to help students correct their movements and improve swimming efficiency. The application of intelligent wearable devices brings real-time data feedback to breaststroke teaching.

Equipment such as exercise bracelets, heart rate monitors can monitor key indicators such as heart rate, speed, and distance, etc., providing the coach with scientific training basis. This data not only helps the coach adjust the training plan and strength but also enables students to understand their training status more intuitively, thereby training more targeted. The application of virtual reality technology adds an immersive experience to breaststroke teaching. Through virtual reality equipment, students can practice in the simulated swimming environment. This simulation environment can not only provide real swimming feelings but also simulate various swimming scenes under security conditions. This immersive training method not only improves the fun of learning but also helps students practice and master breaststroke technology in a risky environment.

1.2 Sports School Stroke Technology Training Exploration

Lu (2021) conducted a comprehensive analysis of the training of breaststroke technology training at Guangxi Sports School in his research, revealing the systematic training plan and scientific management strategy of the sports school in cultivating breaststroke players. The Guangxi Sports School has strengthened the basic skills training of students through a carefully designed training program to ensure that each student can solidly master the basic technologies of breaststroke.

The importance of basic skills is reflected in the refined polishing of the details of the breaststroke movement, such as the coating of the legs, the coordination of the rowing route of the arm, and the overall movement. In addition, Guangxi Sports School also adopts the method of simulation practical training, allowing students to perform skill exercises in the environment of close competitions, which not only helps students adapt to the rhythm and pressure of the game but also improves their ability to strain in actual competitions in actual competitions. Essence regular technical testing provides an important basis for evaluating the technical level and progress of students for the coaching team so that the training plan can be adjusted in time according to the actual performance of the students. Lu Anwei's research further pointed out that the cultivation of psychological quality is equally important for breaststroke students. With professional psychological training, Guangxi Sports School helps students build a positive attitude, and improve their psychological tolerance in the face of high-intensity training and competition. Through the accumulation of competition experience, students can learn how to keep calm under pressure and play at the best level.

2. Specific Training Program

2.1 Targeted training of technology and physical fitness

Technical and physical fitness are indeed the two key factors in swimming competitive performance. They together constitute the foundation of student competition. (Wu, 2012)'s research has deeply explored how to effectively combine technical training and physical training to achieve the improvement of the comprehensive capabilities of breaststroke players. Through innovative training methods, Wu Yingyue proposed a series of targeted training strategies to optimize the technical and physical development of students. Simulation training is an effective way to be mentioned in Wu Yingyue's study. It helps students to experience real competition pressure through simulation competition scenes. This training method allows students to practice various situations that may encounter in the competition without actual competitions, such as jumping, turning, and sprinting. Through simulation training, students can better master technical actions and improve their physical endurance in high-intensity simulation competitions.

Video feedback analysis is another important training tool that allows coaches and students to analyze technical actions in detail through video records. By watching their performance, students can see the advantages and disadvantages of their actions, thereby improving targetedly. Video feedback analysis can not only help students improve technical accuracy but also allow them to understand their performance in physical consumption and rhythm control, to conduct more effective physical training. The personalized training plan is another key point emphasized in Wu Yingyue's research. The physical fitness, technical characteristics, and training needs of each student are unique,

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so they need to formulate personalized training plans based on individual differences. This plan can set the appropriate training intensity, frequency, and content based on the specific conditions of the students, such as physical conditions, technical grasp, and competition goals. Personalized training plans can help students improve their physical fitness levels while improving their technology.

2.2 Special technical training method and means of breaststroke

Special technical training is an indispensable part of improving breaststroke skills. The methods and means of technical training for breaststrokes on its website, emphasize the diversity and pertinence of technical training. For example, through different exercises, such as raising breaststrokes and wearing breathing breaststrokes, you can cultivate fast paddling technology and correct errors that are too large. These training methods not only help improve the technology of swimmers but also enhance the swimmer's ability to perceive and control water.

In addition, the literature provided by (Zhang (2010) also mentioned the broadness and deepness of breaststroke-related documents, covering 864 documents from 1963 to 2023. These documents include not only journal papers, and conference papers, but also patent documents, showing the richness and scientific nature of breaststroke technology training. Through the study of this literature, we can understand the various methods and means of breaststroke technology training, as well as their application effects in actual training. These research results have provided valuable guidance for swimming coaches and students and also contributed to the scientific and systematic development of swimming.

3. Impact of the results of breaststroke competition

3.1 The impact of breaststroke technology optimization and innovation on the student's performance

The influence of breaststroke technology optimization and innovation on student performance is a multi-dimensional research field. Among them, the application of fascia theory is a direction that has attracted much attention in recent years. (Zheng (2017) has provided a new perspective on the improvement of the mythos fascia theory on the results of amateur swimmers' breaststroke. Their research shows that the flexibility and elasticity of the fascia play an important role in improving the fluency and overall efficiency of the students' water. Through specific muscle fascia training, students can improve the flexibility and coordination of the body, reduce the resistance in the water, improve the effects of stroke and kick, and achieve better results in the game.

In addition, fascia training can also help students prevent sports damage and improve the safety and effectiveness of training. Through regular muscle fascia and strengthening exercises, the muscles of the students can better recover and reduce fatigue and tension, which is essential for long-term maintenance and competitive status. The research of Zheng Yan and Liu Ningning provides scientific training methods and a theoretical basis for breaststroke training, emphasizing the importance of comprehensively considering the factors of the students in the optimization of breaststroke technology and innovation. Through these innovative training methods, students can not only improve breaststroke technology but also show a higher level of competition in the game and achieve better results.

4. Breaststroke swim competition rule

4.1 Core requirements for the technical rules of breaststroke

Zhang (2015) elaborated on the core requirements of the technical rules of the breaststroke in his research, emphasizing the importance of these rules for maintaining the fairness of the competition and the accuracy of the students. Zhang Yalin pointed out that the breaststroke rules strictly specify the student's arm and leg movement. It is required that in each cycle, the streaming movements of the arm must be performed underwater, and the movement characteristics of a butterfly or free swimming must appear. At the same time, the leg movements of the breaststroke should be coherent kicking and kicking water, not a separate kick and kick. In addition, Zhang Yalin also mentioned the regulations of breathing movements in the breaststroke competition, that is, students can carry out head-up and lower pressure in each arm movement to breathe, but they must not affect the sight of other students or referees. The formulation of these technical rules aims to ensure the standardization of breaststroke and fair competition between students.

5. Breaststroke skills

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5.1 In-depth analysis of breaststroke technology training methods

As a basic and widely used swimming posture, breaststroke has always been the focus of research. According to the complete cooperation of the breaststrokes mentioned in the article published by (Wu, 2023) in the article of the People's Daily Online, we can learn that the basic movement of the breaststroke is "stroke your hands and legs. Straighten up for a while. " This formula not only emphasizes the order of action but also highlights the fluency and coordination of the action. This coordination is an extremely important part of breaststroke technology. It can help swimmers promote more effectively in the water, reduce resistance, and improve swimming efficiency.

Furthermore, Zhihu's user "Swimming Reading" put forward specific training methods in an article in 2023, such as "2 times and 1 hand-drawn exercise" and "twice and 1 kick exercise". The training method is to improve the coordination and water sense of swimmers, thereby improving the speed and stability of swimming. Through this rhythmic training, swimmers can better master the skills of breaststroke and improve their control ability in the water. In addition, by repeated exercises, swimmers can gradually form muscle memory, making breaststroke moves more natural and smooth.

Summary

As a basis for swimming skills training, the diversity of its methods and the application of modern technology are essential to improve students' swimming skills and safety in water. Teaching methods include traditional teaching methods, gaming teaching methods, and task-type teaching methods. It aims to improve the learning efficiency and skills of students. Special training plays an important role in the improvement of breaststroke skills and students' psychological quality shape, including strengthening fine control and strength, endurance, and speed at the technical level. Physical training is the core of breaststroke special training. It involves cardiopulmonary endurance, muscle strength, and flexibility training. It is combined with technical training to help improve the overall competitive performance of students. In addition, the results of the breaststroke competition are affected by many factors such as technical level, physical condition, training strategy, and psychological quality. Technical optimization and innovation, core force training, and improvement of body balance and stability have a significant effect on improving results. In college physical education courses, the choice of content and methods of breaststroke teaching has a direct impact on students' learning effects and interests. Therefore, they should pay attention to the diversity and innovation of teaching methods to meet the learning needs of different students. It provides valuable information and suggestions for improving the performance of breaststroke students and the quality of college physical education courses.

Conceptual Framework

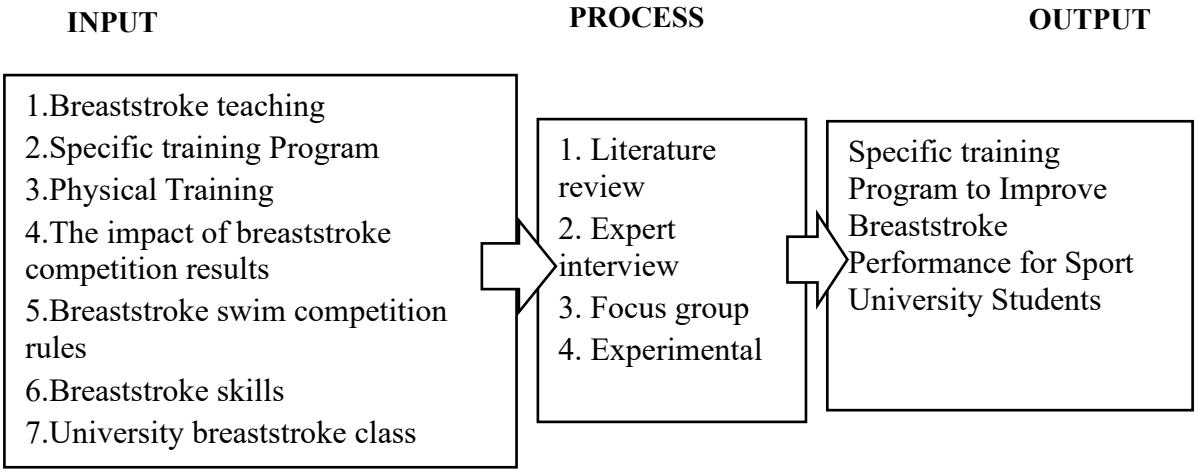

Figure 1 Conceptual Framework

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Methodology

Population and sample

Populations: Male college students from the School of Physical Education of Minnan Normal University, Zhangzhou City, Fujian Province, aged 18-22 years old, with swimming experience and breaststroke skills, a total of 389 male college students, were the population of this study.

Sample: From the 389 students aged 18-22 years old who had swimming experience and knew breaststroke the researcher has announced the recruitment of people who are interested in participating in the experiment a total of 48 students had applied, and a group of 30 students will be used, so the researcher will give 48 students a breaststroke test and choose the 30 students with the lowest scores to participate in the experiment.

Before the experiment, the basic information of 30 students and physical health were collected and counted.

Grouping method

1. After the recruitment and independent registration test, the 30 male college students were left, and the 30 students were arranged in order in order of the test results;
2. After the breaststroke swim speed was tested, a systematic method was used to divide the students into two groups.
3. The method of throwing coins is used to determine the first group as the experimental group and use the specific training program; the second group is the control group, and the traditional training program is adopted.

Research Participants

This paper uses proposing sampling to complete sample screening.

1. 5 experts used the interview method to find a way to design and consult about the composition of the specific training program, including 2 swimming coaches, 2 swimming referees, and 1 breaststroke swimming student.
2. 8 experts used a focus group to provide advice on improving the training program. Which consists of 2 sports scientists, 2 physical fitness doctors, 2 university swimming professors, and 2 provincial swimming champion students.
3. 5 experts conducted IOC value tests on the 8-week special training plan, including 1 professor, 1 associate professor, 1 head swimming coach of the provincial sports school, 1 swimming coach of the swimming pool of the Straits Olympic Sports Center in Fuzhou, Fujian Province, and 1 physical coach.
4. 3 experts (including two swimming teachers and one swimming coach) were asked to score the experimental samples during the test.

Research Design

Table 1 Experimental group and control groups training design

Group	Pre-test	Training 1	Mid-test (After 4 week)	Training 2	Post-test (After 8 week)
Experimental group N=15	O_1	T_1	O_3	T_1	O_5
Control group N=15	O_2	T_2	O_4	T_2	O_6

O_1=Experimental Pre-test; O_2=Control group Pre-test; T_1=Experimental group Training; T_2=Control group Training; O_3=Experimental Mid-test; O_4=Control group Mid-test; O_5=Experimental Post-test; O_6=Control group Post-test.

The present study compared and analyzed the lower limb explosive force, upper limb strength, and physical endurance performance of the experimental and control groups before, after, and 8 weeks of training, and whether the breaststroke performance improved significantly before and after.

Research Instrument

Interview outline: Use the question-and-answer method to interview 5 experts in related fields to come up with the components of the special training plan.

Focus group evaluation form: A group of 8 experts in related fields will improve and suggest special training plans.

Evaluation form for special training plans: After completing the special training plan, it needs to be tested by 5 experts in related fields to illustrate the feasibility of the training plan.

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Specific training program: A training plan tailored for students aims to improve their performance in specific swimming postures. They include specific training content, frequency, and recovery time.

Breaststroke performance test:

A test specifically used to evaluate the skills and performance of students; includes two following points: (1) The breaststroke speed test, the time required to swim 50 meters. (2) Swimming teachers, coaches, and students are invited to evaluate and score according to the leg, hand, and whole-body coordinated movements of each subject in the breaststroke.

Data collection

1) Collect and organize existing research results and theoretical frameworks related to the research topic through a systematic review of relevant academic papers, books, conference papers, research reports, and other literature.

2) Conduct one-on-one in-depth interviews with experts in the field. The interview content revolves around the research topic and collects experts' insights, experiences, and suggestions on related issues.

3) Organize a group of representative individuals in the field related to the research topic for collective discussion, and collect their collective opinions and feedback by guiding group members to interact and discuss specific issues.

4) All subjects participating in this experiment were required to sign a voluntary consent form. The experiment lasted for 8 weeks, with 3 training sessions per week each training session lasting approximately 1 hour. The experimental group adopted a special training plan, and the control group used traditional training methods.

5) Basic information such as height, weight, and age were collected, and the first pre-test of 50-meter breaststroke was completed.

6) Interim test data after the 4th week and experimental data after the 8th week were collected.

7) Data were processed and analyzed, systematically classified, and the accuracy of the data was checked.

Data Analysis (1) Descriptive statistical analysis: Mean, Standard Deviation, Frequency, and Percentage to summarize the basic characteristics and data distribution of the sample. (2) Qualitative data analysis: Analysis of the open answers to interviews extract themes and mode. Organize and interpret qualitative data using coding and theme analysis methods to better understand the training experience and feelings of Students. (3) The independent sample t-test was used for comparison data between groups. ($P<0.05$, which means it has a significant difference; $P>0.05$ means no significant difference). Comparison analysis within groups used One-Way repeated ANOVA and post hoc (Bonferroni).

Research Process: This study will formulate specific research steps around the research goals. The following is a detailed research process led by the research objectives:

Step 1: Build specific training plans for improving breaststroke performance for sports college students.

1) Literature and video research: By reading a large number of literature, books, and related videos, we have a comprehensive understanding of breaststroke techniques, training methods, and their application in improving sports performance. These resources provide theoretical foundations and practical cases, laying a solid theoretical basis for the development of effective training plans.

2) Expert interviews: Experts in related fields were interviewed to collect their suggestions and opinions on breaststroke training. The interviewed experts included swimming coaches, sports physiology experts, and athletes who had participated in breaststroke competitions. Their professional knowledge and experience provided important references for the design of training plans.

3) Focus group establishment: A focus group composed of students, coaches, and researchers from the School of Physical Education was established to discuss and study various aspects of the training plan. The members of the focus group ensured the comprehensiveness and pertinence of the training plan through collective discussion and communication.

4) IOC value check: The feasibility of the training plan was checked using the IOC (Index of Content Validity) value. The focus group ensured that the plan was highly scientific and practical in theory by evaluating the relevance and importance of the training content.

5) Design a training plan: Design an 8-week training plan based on the specific conditions of these students.

6) Determine the evaluation criteria: Develop a technical evaluation form and speed test form to systematically collect and evaluate the athletes' training data.

Step 2: Implement specific training plans for physical education college students to improve breaststroke performance.

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Pre-test (before training)

1) Before the training program began, basic data on arms, legs, whole body coordination, breathing time, and 50m breaststroke performance were collected.

2) A preliminary test of breaststroke skills was conducted, including technical aspects and timing, to establish a baseline of their skills.

Mid-term test (after 4 weeks)

1) At the mid-term evaluation, sports scores for arms, legs, whole body coordination, breathing time, and 50m breaststroke performance were collected to monitor progress.

2) After the training program was completed, the athletes' breaststroke performance was evaluated and improvements in technique and speed were noted.

Test (after 8 weeks)

1) The final evaluation of the athletes was to collect their arms, legs, whole body coordination, breathing time, and 50m breaststroke performance to determine the overall impact of the training program.

2) After the training program was completed, the final test of the athletes' breaststroke performance was compared with the previous test results to evaluate the effectiveness of the training intervention.

Step 3: Compare each stage of the experiment and analyze the test data of the experimental group and the control group, to conclude.

1) Data collection: Collect the basic information, physical test results, and data in the experimental process, and provide an objective evaluation basis for the training plan.

2) Data analysis: Using descriptive statistical analysis, qualitative data analysis, and independent sample t-test and repeat Anova, analyze the data of the experimental group and the control group to determine the effect of the training plan.

Step 4 Analysis of breaststroke training results and future training suggestions

According to the comparison and analysis of the test data, the conclusion of the training plan on the performance of the breaststroke of sports college students, and put forward suggestions for future training and research.

Results

By collecting and reviewing a large number of references in related fields and interviewing experts in the field of swimming, the important components of the special training plan were obtained. A focus group composed of 8 experts in related fields was established to improve and suggest the training plan. Finally, an 8-week special training plan with 3 training sessions per week was obtained. After that, it was tested by 5 experts in related fields and finally concluded that this training plan was feasible.

After 8 weeks of project experiments, various data were collected for classification statistics and analysis.

Table 2 The pre-test test was conducted by independent sample t-test on the breaststroke Performance scores and the mean values of 50-m breaststroke performance between the experimental and control groups.

Variables	Experimental group	Control group	t	df	p
	$\bar{X}$±SD	$\bar{X}$±SD			
Leg movement score (1-10)	3.80±1.32	3.80±1.08	0.00	28	1.00
Hand movement score (1-10)	3.80±1.21	3.80±0.94	0.00	28	1.00
Breathing timing score (1-10)	4.00±1.25	3.93±0.88	0.17	28	0.87
Whole body coordination score (1-10)	4.07±0.96	4.00±0.93	0.19	28	0.85
50m breaststroke results (seconds)	59.88±8.47	59.92±8.85	-0.01	28	0.99

*p＞0.05 Represents no significant difference

In the pre-test, there was no significant difference between the experimental group and the control group (P value>0.05).

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Table 3 The mean values of breaststroke Performance scores and 50-meter breaststroke results of the experimental and control groups were tested for mid-test testing using independent sample t-tests.

Variables	Experimental group	Control group	t	df	p
	$\bar{X}$±SD	$\bar{X}$±SD			
Leg movement score (1-10)	6.33±0.98	5.67±1.40	1.52	28	0.14
Hand movement score (1-10)	6.00±1.07	5.53±0.92	1.28	28	0.21
Breathing timing score (1-10)	6.20±1.15	5.67±1.11	1.29	28	0.21
Whole body coordination score (1-10)	6.07±1.10	5.60±1.40	1.01	28	0.32
50m breaststroke results (seconds)	49.36±5.41	54.35±7.15	-2.16	28	0.40

*p＞0.05 Represents no significant difference

After 4 weeks of training, although the data of various indicators of the experimental group were better than those of the control group, they still did not reach a significant difference (P value<0.05), indicating that the 4-week special training was effective, but not particularly obvious, and a larger sample size or longer training time may be needed to observe the effect.

Table 4 The post-test was conducted by independent sample t-test on the average breaststroke Performance scores and 50-meter breaststroke results of the experimental group and the control group.

Variables	Experimental group	Control group	t	df	p
	$\bar{X}$±SD	$\bar{X}$±SD			
Leg movement score (1-10)	8.13±0.83	7.07±0.89	3.40	28	0.002*
Hand movement score (1-10)	8.00±0.93	7.00±0.85	3.09	28	0.004*
Breathing timing score (1-10)	8.00±0.86	7.00±0.93	3.24	28	0.003*
Whole body coordination score (1-10)	8.13±0.74	6.93±0.80	4.26	28	0.001*
50m breaststroke results (seconds)	40.49±3.57	49.54±7.24	-4.34	28	0.001*

*p< 0.05 Represents a significant difference

Test after 8 weeks of training, the experimental group had significant differences in all data indicators (P value<0.05), indicating that this 8-week special training plan is feasible and can improve the breaststroke performance of college students majoring in physical education.

Discussion

This study showed that there was no significant difference between the experimental group and the control group in the pre-test (P value>0.05). After 8 weeks of training, the test results showed that there was a significant difference between the experimental group and the control group (P value<0.05), indicating that special training can significantly improve the athletes' sports performance. For example, in the study of the effect of functional physical training on the special ability of men's rowing athletes in Sichuan Province, the training program significantly improved the athletes' overall strength, endurance, and technical level. The post-test results showed that the rowing speed and paddling efficiency were significantly improved, laying a solid foundation for high-intensity competition. This finding echoes the progress of the "PJF Sports Performance Training Program" designed by Chengdu Sports University for basketball students. The program focuses on improving explosive power and jumping power, and the results significantly improve the athletes' vertical jump and agility, which is also confirmed by the post-test results. Both studies have confirmed that special training can not only improve the physical fitness of athletes but also significantly improve the technical level of athletes, especially in high-demand competitive scenarios that require rapid response and continuous physical exertion. (Xu, M. 2020 & Deng, 2020)

Studies have shown that specialized training can significantly improve athletes' performance, especially in the comparison before and after training. However, mid-term test results do not always show significant changes immediately. For example, in the 2023 study by Shen Lin on the impact of early specialized training on the physical fitness of children and adolescents, no significant differences were observed in the mid-term test results. The study showed that early specialized training focuses mainly on the development of techniques and skills in the initial stage, and the improvement of

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physical fitness such as speed, strength, and flexibility will only become obvious after a longer training period, usually after six to eight weeks of structured training.

Similarly, in the 2020 study on the effects of dynamic and static core strength training on trunk rotation strength and stability of adolescent badminton players by Zhang Dong et al., the mid-term test results did not show significant improvements in core strength or stability in the fourth week. The study explained that core strength, especially dynamic and static strength, requires a long adaptation period during which the muscles and neuromuscular system gradually adapt to the training requirements. Therefore, measurable improvements in core stability and rotational strength usually appear in the later stages of the training program.

Both studies showed that while specialized training programs are effective, mid-term test results may not fully reflect the extent of the improvement. Early training phases are often characterized by neuromuscular adaptations and technical improvements, while physical gains become more evident in the second half of the training cycle. Therefore, these programs must be evaluated over a longer period to understand their true impact on performance.

Recommendation

1. Recommendation for applying research result

Due to the limited conditions of this study, only students from one college in a university can be selected as experimental subjects for experiment and data collection, and physical training of athletes is not involved. In the future, we hope to expand the sample size and increase the research on the impact of physical training on breaststroke performance.

2. Recommendation for future research

After special training, it was found that the athletes' breaststroke legs, hands, breathing timing, whole-body coordination, and 50-meter breaststroke performance were better than those of the control group. After the experiment, it was found that all post-test variables were better than the pre-test. This shows that the special training plan is effective. It can be included in the breaststroke course in college and use this plan to improve the breaststroke performance of college students.

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