

A Study on the Influence of Multi Ball Training Method on the Sensitivity Quality of Undergraduate Elective Course Students

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Abstract: As an important sport in China's national fitness, badminton plays an important role in enhancing physical fitness and cultivating active participation in sports. More and more people are participating in this sport, and the multi ball training method is the most commonly used training method in badminton training. It has been applied to teaching and training by many coaches. By consulting relevant literature and books on sensitive qualities, it has been determined that the testing indicators for this study include Illinois run, 8 low center of gravity corner runs, and Nebraska sensitivity test. The research conclusion is: (1) After the experiment, the experimental group of students ran in Illinois, 8 low center of gravity corner runs, and Nebraska sensitivity test Nebraska's sensitivity scores have significantly improved, and there is a significant difference compared to the control group of students, indicating that the multi ball training method has a positive effect on improving students' sensitivity quality. (2) After the experiment, there was a slight improvement in the Illinois run, 8 low center of gravity corner runs, and Nebraska sensitivity scores of the control group students, but there was no significant difference compared to before the experiment. In terms of improving students' sensitivity, the teaching effect of multi ball training method was better than traditional teaching methods.

Keywords: Multi ball training method; Undergraduate elective course students; Sensitivity quality

1. Introduction

Sensitivity refers to the ability of human nerves and muscles to quickly overcome or resist resistance during work, which is the foundation of coordination, balance, speed, and other qualities^[1]. It is also one of the extremely important physical qualities in badminton, directly affecting step movement; In badminton training, the method of using multiple balls for training is called the multi ball training method^[2]. The specialized technique of training athletes by changing ball speed, frequency, route, etc. during training is called multi ball training. The use of multi ball training method in subjects for badminton training should start from reality, and different training methods should be adopted based on the physical fitness and badminton level of the subjects^[3]. Most undergraduate elective students are at an entry-level level and require the use of multi ball training methods to stabilize their foundation while enhancing their skills and various qualities.

2. Research Object and Methods

2.1 Research Object

The research object of this article is the effect of multi ball training method on the lower limb sensitivity of undergraduate elective course students.

2.2 Research Methods

2.2.1 Literature review method

We searched for relevant information through platforms such as CNKI and Wanfang Database, and based on the relevant health standards for subjects issued by the General Administration of Sport of China and the content related to our research topic, it serves as a reference and theoretical basis for this study.

2.2.2 Experimental method

During the course teaching process, two classes were randomly selected and divided into an experimental class (group) and a control class (group) for a period of 3 months of intervention. The experimental class was given 3 multi ball training sessions per week, while the control class was not given multi ball training and focused on single ball training. The specific exercise method is shown in Table 1, where one multi ball training session lasts for 30 minutes. Three months later, conduct a sensitivity test on students in two classes to see how the class with multi ball training affects their sensitivity^[4].

Table 1: Practice Content of Multi Ball Training Method

Practice content	mainly deal with the ball path	practice techniques
Multi ball training in the front court	with a focus on playing in front of the net.	Forehand picking, rubbing, and forehand release in front of the net
Forecourt ball In midfield,	multiple goals are mainly limited	with high balls, dribbling in front of the net, and dribbling
Backcourt multiple shots	mainly practice the player's attacking ability coordinated footwork training throughout the field, combined with the smoothness of the play	including forehand hitting backcourt high and long shots etc
Multi ball	Training object's technical steps, technical coordination and stability	Mastery of skills and practicality in combining the entire field of

2.2.3 Observation method

During the 3-month experiment, by observing the attendance of participants in multi ball training, their interest in multi ball training, and observing the effects of multi ball training on students' self-esteem, teamwork, communication, coordination, and other abilities, the subjects could obtain a more comprehensive understanding of the physical and mental impact of participating in sports activities on participants, especially through more obvious changes in sensitivity qualities.

2.2.4 Mathematical Statistics

The subjects summarized and organized the experimental data by using Excel and SPSS 26.0. They analyzed the differences between the two sets of data, identified the changes in the impact of multi ball training on the sensitivity of subjects, and provided good suggestions for developing the sensitivity of subjects.

(1) Experimental time, location, and equipment: March June 2024; Location: Guangzhou Sports Institute Ball Arena.

(2) Experimental process: Firstly, a large amount of information was read before the implementation of the study to fully understand the significance of multi ball training on the physical fitness development of the subjects. In addition, by conducting on-site inspections of the venue and understanding the sports environment, in order to ensure the accuracy of the research data, the basic information of the subjects was first statistically analyzed, and students who were higher or lower than the average were excluded. The excluded students did not participate in this study. And develop the same dietary plan for the students participating in this study. The experimental class's multi ball training method arranges the course content as a multi ball training method, and the control class does not receive special intervention.

(3) Experimental subjects: 30 undergraduate elective classes from Guangzhou University of Physical Education were selected as the experimental subjects, with 15 students in each class (see Table 2).

Table 2: Basic information comparison between experimental group and control group by group

	N/Person	Age	Height	Weight/kg	BMI Index
Experimental	15	19.20±0.616	1.78±0.513	71.25±5.447	22.43±1.647
Control	15	19.30±0.571	1.77±0.433	69.40±6.460	22.15±1.545
T/Z		-0.263 (Z)	0.899	-1.155 (Z)	0.554
P-value		0.793	0.374	0.248	0.583

After basic information statistics before the experiment, there was no significant difference in height, weight, and BMI index between the experimental group and the control group of boys and girls, indicating that the basic information of the two groups of students was not significantly different.

3. Results and Analysis

Before the intervention experiment, pretests were conducted on the participating students, and after a 3-month intervention experiment using the multi ball training method, post tests were conducted. The test indicators included Illinois run, 8 low center of gravity corner runs, and Nebraska sensitivity test. The following are the specific details of the test.

3.1 Illinois Run Results and Analysis

3.1.1 Illinois Run

Comparison of test results between two groups of students before and after the experiment. After the experiment, the two groups of students were tested again, and the results of the two tests were compared. According to Table 3, the average score of the experimental group before the experiment was 18.59 seconds, and the average score of the experimental group's male students after the experiment was 18.19 seconds. After intervention, the overall improvement was 0.40 seconds, $P < 0.01$, indicating a significant improvement in Illinois running performance after the multi ball experiment intervention; The average score before the experiment was 22.25 seconds, and the average score of the female experimental group after the experiment was 21.57 seconds. After intervention, the score improved by 0.68 seconds, with $P < 0.01$, indicating that the difference in this indicator among the experimental group students through multi ball training is very significant. The results of the control group of male and female students after the experiment were 19.19s and 22.18s, respectively, with an increase of 0.13s and 0.16s. The P-values were 0.081 and 0.349, both greater than 0.05, indicating that there was no difference in this indicator among the control group students.

Table 3: Illinois Run Test Results of Two Groups of Male and Female Students Before and After the Experiment ($n=30$)

Gender	Experimental group		control group	
	male	female	male	female
Before the experiment	18.59±1.604	22.25±1.532	19.32 ± 1.298	22.34 ± 1.492
After the experiment	18.19±1.354	21.57±1.221	19.19 ± 1.479	22.18 ± 1.398
Difference	0.40	0.68	0.13	0.16
T	2.446	3.656	1.565	0.981
P	0.003	0.001	0.081	0.349

3.1.2 Comparison results and analysis between experimental group and control group

After the experiment, the test results of the two groups of students were compared and analyzed again. According to Table 4, the scores of both male and female groups after the experiment were $P < 0.05$, and the difference was significant. This indicates that the multi ball training method is better than traditional training methods in improving the Illinois running performance of students.

Table 4: Results of Illinois Run Test for Two Groups of Students after the Experiment ($n=30$)

Gender	experimental group (s)	control group (s)	T	P
Male	18.19 ± 1.354	19.19 ± 1.479	-3.654	0.038
Female	21.57 ± 1.221	22.18 ± 1.398	-4.565	0.047

3.2 Comparison of the results of 8 low center of gravity corner runs between two groups of students

3.2.1 Comparison of Scores of Male and Female Students before the Experiment

Comparison of test results between two groups of students before the experiment. Before the experiment, the two groups of students were tested for this indicator. According to Table 5, the scores of male students in the two groups before the experiment were 19.57s and 19.33s, respectively, with standard deviations of 1.549 and 1.746, and $P > 0.05$, indicating that there was no significant difference between the two groups of male students on this indicator before the experiment; The scores of female students were 20.69s and 20.79s respectively, with $P > 0.05$, indicating that there was no significant

difference in this indicator between the two groups of female students before the experiment, which meets the requirements of the experiment.

Table 5: Test results of low center of gravity four corner running for two groups of students before the experiment (n=30)

Gender	experimental group (s)	control group (s)	T	P
Male	19.57 ± 1.549	19.33 ± 1.746	1.475	0.314
Female	20.69 ± 1.667	20.79 ± 1.304	-1.495	0.681

3.2.2 Comparison of test results between two groups of students before and after the experiment.

After the experiment, the two groups of students were tested again, and the results of the two tests were compared. According to Table 6, the male student's score in the experimental group after the experiment was 18.39 seconds, an improvement of 1.18 seconds, $P < 0.01$; the female student's score in the experimental group after the experiment was 19.24 seconds, an improvement of 1.45 seconds, $P < 0.01$, indicating that the multi ball training method was used to improve the performance

The experimental group students showed significant differences in this indicator. Control group male. The scores of students and girls after the experiment were 18.94s and 20.36s, respectively, with an increase of 0.39s and 0.33s, both $P > 0.05$, indicating that there was no significant difference in this indicator among the control group students.

Table 6: Test results of low center of gravity corner running for two groups of students before and after the experiment (n=30)

Gender	Experimental group		control group	
	male	female	male	female
Before the experiment	19.57 ± 1.549	20.69 ± 1.667	19.33 ± 1.746	20.79 ± 1.304
After the experiment	18.39 ± 1.795	19.24 ± 0.952	18.94 ± 1.953	20.36 ± 1.446
Difference	1.18	1.45	0.39	0.33
T	4.922	3.649	3.641	1.656
P	0.000	0.000	0.326	0.082

3.3 Comparison of test results between two groups of students after the experiment

After the experiment, the test results of the two groups of students were compared and analyzed again. According to Table 7, the scores of both male and female groups after the experiment were $P < 0.05$, with significant differences, and the difference between female and male groups was very significant. This indicates that the multi ball training method is better than traditional training methods in improving the performance of students in eight low center of gravity corner runs.

Table 7: Test results of low center of gravity corner running for two groups of students after the experiment (n=30)

Gender	experimental group (s)	control group (s)	T	P
Male	18.39 ± 1.795	18.94 ± 1.953	-2.685	0.044
Female	19.24 ± 0.952	20.36 ± 1.446	-2.084	0.005

3.3.1 Comparison of Nebraska sensitivity test results between two groups of students

Comparison of test results between two groups of students of different genders before the experiment. Before the experiment, two groups of students were tested for this indicator. According to Table 8, the scores of male students in the two groups were 15.91s and 16.03s respectively, with standard deviations of 1.826 and 1.386, and $P > 0.05$, indicating that there was no difference in this indicator between the two groups of male students before the experiment; The scores of female students were 18.52s and 18.48s respectively, with $P > 0.05$, indicating that there was no difference in this indicator between the two groups of female students before the experiment, which meets the requirements of the experiment.

Table 8: Sensitivity test results of two groups of students before the experiment (n=30)

Gender	experimental group (s)	control group (s)	T	P
Male	15.91 ± 1.826	16.03 ± 1.386	-1.043	0.843
Female	18.52 ± 1.722	18.48 ± 1.371	-0.914	0.506

3.3.2 Comparison of test results between two groups of students before and after the experiment

After the experiment, two groups of students were tested again, and the results of the two tests were compared. According to Table 9, the male students in the experimental group had a score of 14.48 seconds, an increase of 1.43 seconds, $P < 0.01$; the female students in the experimental group had a score of 17.25 seconds, an increase of 1.27 seconds, $P < 0.01$, indicating a significant difference in this indicator among the experimental group students through multi ball training. After the experiment, the scores of male and female students in the control group were 15.89s and 18.23s, respectively, with an increase of 0.14s and 0.25s, both $P > 0.05$, indicating that there was no significant difference in this indicator among the control group students.

Table 9: Sensitivity test results of two groups of students before and after the experiment ($n=30$)

Gender	Experimental group		control group	
	male	female	male	female
Before the experiment	15.91 ± 1.826	18.52 ± 1.722	16.03 ± 1.386	18.48 ± 1.371
After the experiment	14.48 ± 1.351	17.25 ± 1.953	15.89 ± 2.694	18.23 ± 1.762
Difference	1.43	1.27	0.14	0.25
T	3.516	6.198	2.863	3.912
P	0.000	0.000	0.088	0.079

3.3.3 Comparison of Sensitivity test results between two groups of students after the experiment

Table 10: Sensitivity test results of two groups of students after the experiment ($n=30$)

Gender	experimental group (s)	control group (s)	T	P
Male	14.48 ± 1.351	15.89 ± 2.694	-3.959	0.043
Female	17.25 ± 1.953	18.23 ± 1.762	-2.733	0.032

After the experiment, the test results of the two groups of students were compared and analyzed again. According to Table 10, the scores of both male and female groups after the experiment were $P < 0.05$, indicating a significant difference after the experiment. This indicates that the multi ball training method is better than traditional training methods in improving the Nebraska sensitivity scores of students.

4. Results and Analysis

4.1 Analysis of the impact of multi ball training on students' Illinois grades

Through in-depth research, it is known that there was no difference in this indicator between the two groups of students before the experiment was conducted. However, after the experiment, there were significant differences between the two groups of students, with the experimental group using significantly better teaching methods than the control group. The main reason for this phenomenon is that during the Illinois running test, students are required to quickly transition between different routes, directions, and distances, which places high demands on their ability to quickly transition actions and directions. The experimental group introduced software exercises in the teaching process. During this exercise, movements such as square jumping and lateral forward and backward steps will cause students' muscles to go through three stages: centrifugal, centrifugal contraction, and centripetal contraction. This not only effectively enhances students' ability to quickly complete movements, but also enhances their ability to control movements in situations where their center of gravity changes rapidly. In addition, this training also strengthens the stimulation of the student's nervous system on their own muscles, which has an ideal effect on improving their sensitivity and quality.

4.2 Analysis of the Impact of Multi ball Training Method on Students' Results in 8 Low Center Quadrangle Runs

From Tables 4 to 6, it can be clearly understood that there was no difference in this indicator between the two groups of students before the experiment, but there was a significant difference after the experiment. The teaching method of the experimental group was significantly better than that of the control group. The main reason for this phenomenon is that students' lower limb strength, ability to quickly change direction, and physical flexibility are key factors affecting the test results of this indicator. After undergoing multi ball training, the skeletal muscle structure of the experimental group students was optimized, and the elasticity and contraction of the muscles were significantly enhanced. The explosive power of the students' muscles was also stronger, resulting in a significant increase in their own

movement speed. In addition, students need to use badminton footwork when testing this project. The last step of the footwork needs to be stepped out, and the distance of the last step will directly affect the testing time. The experimental group of students underwent multi ball training, which effectively improved the flexibility and flexibility of their lower limb joints, and significantly shortened the testing time. At the same time, the multi ball training method significantly improved the directional ability of the experimental group students, making the time spent on changing directions at various points shorter. As a result, the experimental group students showed a significant improvement in their test scores for this indicator.

4.3 Analysis of the impact of multi ball training method on Nebraska sensitivity scores of students

After the experiment, the scores of male and female students in the experimental group improved by 1.43 seconds and 1.27 seconds respectively. The multi ball training method had a significant effect on improving the Nebraska sensitivity scores of students. In this test, students first need to perform forward acceleration, then change direction for lateral movement, and finally need to perform back movement. This test places higher requirements on the students' physical agility. In the process of multi ball training, teachers carry out targeted exercises on the front, side, and back to gradually enhance students' mobility in various directions, improve their lower limb flexibility and movement speed^[5]. Secondly, during auxiliary exercises such as hip hop, students' ability to change direction was effectively developed, resulting in a significant improvement in the test scores of the experimental group in this indicator.

5. Conclusion and Suggestions

5.1 Conclusion

5.1.1 Significant Improvement of Experimental Group Students

After the experiment, the experimental group students showed significant improvement in their performance in Illinois runs, 8 low center of gravity corner runs, and Nebraska agility, and showed significant differences compared to the control group students. This fully indicates that the multi ball training method plays a positive promoting role in improving students' agility quality.

5.1.2 Certain Improvement of Control Group Students

After the experiment, the control group students also showed a certain degree of improvement in their performance in Illinois runs, 8 low center of gravity corner runs, and Nebraska sensitivity, but there was no significant difference compared to before the experiment. In terms of improving students' sensitivity and quality, the teaching effect of multi ball training method is significantly better than traditional teaching methods.

5.2 Suggestions

5.2.1 Application of Multi-Ball Training Method in University Badminton Courses

The multi ball training method has certain advantages in improving students' sensitivity and quality. Targeted introduction of multi ball training method can be carried out in elective badminton courses in universities, and it should be combined with traditional sensitivity and quality training methods.

During the teaching process, teachers should fully utilize their creativity, actively explore more innovative multi ball training methods, and accurately control the intensity of multi ball training methods to achieve more ideal training results.

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