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ANALYSIS OF THE INFLUENCE OF AIR VOLLEYBALL PHYSICAL EDUCATION ON NON-INTELLECTUAL FACTORS OF PRIMARY SCHOOL STUDENTS

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Analysis of the influence of air volleyball physical education on non-intellectual factors of primary school students

Abstract. Air volleyball is a sport characterized by high safety, ease of learning, and simple rules, making it highly suitable for primary school physical education. This paper conducts a teaching experiment by randomly establishing experimental and control groups. Using literature review, expert interviews, experimental comparison, and statistical methods, this paper compares and analyzes the overall levels of non-intellectual factors in the experimental and control groups before and after the experiment. The overall level of non-intellectual factors in the experimental class before and after the experiment was statistically significant ($p=0.043$, $0.01 < p < 0.05$), indicating a statistically significant difference. In the control class, the overall level of non-intellectual factors before and after the experiment was statistically significant ($t=2.346$, $p=0.389 > 0.05$), indicating no significant difference in changes in non-intellectual factors. After the experiment, the overall level of non-intellectual factors in the experimental class significantly improved, and the overall level in the control class also increased, but the impact was not statistically significant.

Key words: air volleyball, physical education teaching, teaching experiment, non-intellectual factors, comparative analysis.

Юй Лю

Анализ влияния занятий по воздушному волейболу на неинтеллектуальные факторы учащихся начальной школы

Аннотация. Воздушный волейбол – это вид спорта, характеризующийся высокой безопасностью, простотой обучения и незамысловатыми правилами, что делает его весьма подходящим для уроков физкультуры в начальной школе. В данной работе проводится учебный эксперимент путем случайного формирования экспериментальной и контрольной групп. Используя обзор литературы, интервью с экспертами, экспериментальное сравнение и статистические методы, в данной работе сравниваются и анализируются общие уровни неинтеллектуальных факторов в экспериментальной и контрольной группах до и после эксперимента. Общий уровень неинтеллектуальных факторов в экспериментальном классе до и после эксперимента статистически значимо различался ($p=0,043$, $0,01 < p < 0,05$), что указывает на статистически значимую разницу. В контрольном классе общий уровень неинтеллектуальных факторов до и после эксперимента статистически значимо различался ($t=2,346$, $p=0,389 > 0,05$), что указывает на отсутствие значимой разницы в изменениях неинтеллектуальных факторов. После эксперимента общий уровень неинтеллектуальных факторов в экспериментальном классе значительно улучшился, а общий уровень в контрольном классе также повысился, но это влияние не было статистически значимым.

Ключевые слова: воздушный волейбол, преподавание физической культуры, педагогический эксперимент, неинтеллектуальные факторы, сравнительный анализ.

Юй Лю

Бастауыш сынып оқушыларының интеллектуалды емес факторларына ауа волейболынан дене шынықтырудың әсерін талдау

Аңдатпа. Әуе волейболы - жоғары қауіпсіздікпен, үйренудің қарапайымдылығымен және қарапайым ережелермен сипатталатын спорт түрі, бұл оны бастауыш мектеп дене шынықтыруына өте қолайлы етеді. Бұл мақалада кездейсоқ түрде эксперименттік және бақылау топтарын құру арқылы оқыту эксперименті жүргізіледі. Әдебиетке шолу, сарапшылармен сұхбат, эксперименттік салыстыру және статистикалық әдістерді қолдана отырып, бұл мақалада экспериментке дейін және кейін эксперименттік және бақылау топтарындағы интеллектуалды емес факторлардың жалпы деңгейі салыстырылады және талданады. Тәжірибелік сыныптағы интеллектуалды емес факторлардың жалпы деңгейі тәжірибеге дейін және одан кейін статистикалық тұрғыдан маңызды болды ($p=0,043$, $0,01 < p < 0,05$), бұл статистикалық тұрғыдан маңызды айырмашылықты көрсетеді. Бақылау класында тәжірибеге дейін және одан кейін интеллектуалды емес факторлардың жалпы деңгейі статистикалық тұрғыдан маңызды болды ($t=2,346$, $p=0,389 > 0,05$), бұл интеллектуалды емес факторлардың өзгерістерінде айтарлықтай айырмашылық жоқ екенін көрсетеді. Тәжірибеден кейін тәжірибелік сыныптағы интеллектуалды емес факторлардың жалпы деңгейі айтарлықтай жақсарды, ал бақылау класындағы жалпы деңгей де артты, бірақ әсері статистикалық тұрғыдан маңызды болған жоқ.

Түйін сөздер: ауа волейболы, дене шынықтыруды оқыту, оқыту эксперименті, интеллектуалды емес факторлар, салыстырмалы талдау.

Introduction. The primary school stage is a critical period for children's physical and mental development. As an important part of primary school education, sports play a role in promoting children's psychological development [1]. Children in the primary school stage are in a very special period. During this period, both their physiology and psychology are in a rapid development stage. Therefore, primary school education often has a great impact on students' future learning and development [2]. As a part of school education, physical education plays an irreplaceable role in shaping and cultivating students' non-intellectual factors. During the important period of primary school students' psychological development, it is very important and necessary to cultivate non-intellectual factors in primary school students through physical education.

Air volleyball is a sport that integrates fitness, entertainment and competition. It is the inheritance and development of modern volleyball. Air volleyball is soft, lightweight, slow, and easy. It is less restricted by the venue, equipment and rules. It has high safety, fun, entertainment, diversity, wide range and economy. It is in line with the physical and psychological development characteristics of primary school students. It has been well developed in primary schools and is loved by students and schools. In some schools in Shenyang, air volleyball has been included in the physical education curriculum. However, theoretical research on air volleyball is relatively lagging behind. Therefore, it is necessary to strengthen theoretical research on air volleyball to make up for this deficiency.

It is necessary to cultivate the sports interest of primary and secondary school students. Air volleyball has strong recreational and entertainment value. It is easy to learn, fun, and the ball is brightly colored. During the exercise, it should conform to the growth and development laws and physical and mental development laws of primary and secondary school students. Moreover, the rules restrict the continuous attack characteristics, increase the number of hits and the excitement. The ball speed is slow, there are few dead balls, and there are many rallies[3]. Through experimental research on primary school air volleyball physical education teaching, this paper analyzes the differences in the impact of air volleyball physical education teaching on the non-intellectual factors of primary school students in various dimensions, and explores the value function of air volleyball in cultivating the psychological quality of primary school students in the process of physical education teaching.

Research Objective. Non-intellectual factors have a significant impact on the healthy growth of primary school students and their future development in society. Primary school is a crucial period for the development of students' psychological qualities, which are easily influenced by external factors. Therefore, it is a key period for cultivating students' non-intellectual factors. Air volleyball has significant advantages compared to other sports. Based on its unique characteristics, this study explores the role of air volleyball instruction in promoting students' psychological qualities, and also aims to explore an effective means of cultivating primary school students' non-intellectual factors.

Research Goal. Through experiments, this study aims to demonstrate that simple, easy-to-learn, and fun sports content can bring students a joyful and proactive learning experience. Innovative teaching methods make it easier for students to master sports skills, apply these skills in society, and develop a lifelong awareness of physical activity.

Materials and Methods.

Research Design. A total of 78 fifth-grade students from Zhujiang Fifth Primary School in Huanggu District, Shenyang City, Liaoning Province, were included, with 38 students in the experimental class and 40 students in the control class.

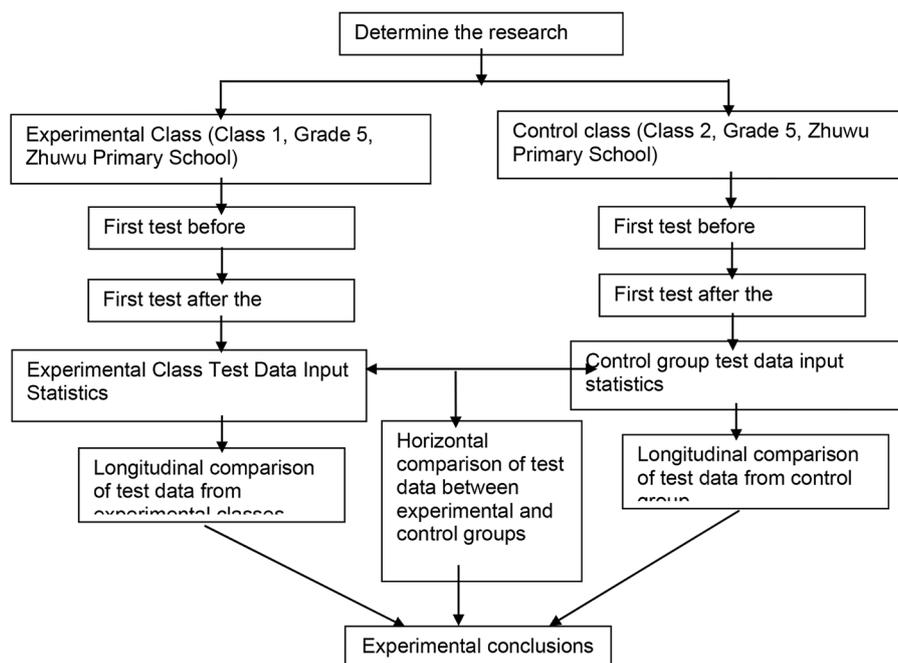
Research Methods.

1. Literature Review Method. Through journal retrieval using resources such as the China National Knowledge Infrastructure (CNKI) and the China Excellent Doctoral and Master's Thesis Database, a wide range of monographs on physical education, sports psychology, mental health measurement, and non-intellectual factor measurement, as well as relevant literature on the cultivation of non-intellectual factors and the development of sports disciplines, were extensively consulted and collected. This provided a comprehensive understanding of the current research status and methods of non-intellectual factors, offering a reliable theoretical foundation and basis for the research and design of this thesis.

2. Expert Interview Method. Consultations were conducted with experts in volleyball and sports psychology related to this research. The scientific validity and feasibility of this study were discussed, and preliminary planning and analysis were carried out on the experimental design, steps, and issues to be considered.

3. Experimental Comparison Method.

(1) Experimental steps:



(2) Experimental Process. The experimental class received 12 weeks of volleyball instruction; the control class received regular physical education instruction as before. Objective data statistics were conducted before and after the experiment, and before and after the experiment for both classes, to conduct a comparative analysis of the overall levels of non-intellectual factors in both classes.

(3) Experimental period: A 12-week teaching experiment will be conducted from September 1, 2025 to December 1, 2025. The specific class times for the two classes are as follows: Experimental class: Monday, third period (10:15-10:55), Wednesday, fourth period (11:05-11:45), Friday, sixth period (15:00-15:40); Control class: Tuesday, fourth period (11:05-11:45), Wednesday, second period (9:25-10:05), Thursday, fifth period (14:20-14:50).

4. Mathematical statistics method. According to the needs of this study, the test data before and after the experiment will be processed and analyzed using IBM SPSS Statistics data processing software.

Results.

1. Comparative Analysis of Non-Intellectual Factor Status between Experimental and Control Classes Before the Experiment

Before the experiment, a survey on the development status of students' non-intellectual factors was conducted. The experimental and control classes were tested for non-intellectual factors, and SPSS was used to detect differences in the individual and overall levels of non-intellectual factors.

1.1 Overall Level of Non-Intellectual Factors in Experimental and Control Classes Before the Experiment

Table 1 – Statistical Table of Overall Level Test Results of Non-Intellectual Factors Before the Experiment

	First T-test		T-test
	Mean	Standard Deviation	
Experimental Class	19.867	1.753	T=0.558
control group	19.865	1.553	P=0.304>0.05△
<i>Note: △ indicates no difference; ☆ indicates a significant difference; ★ indicates a highly significant difference.</i>			

Table 1 shows that the overall levels of non-intellectual factors were similar in terms of mean

and standard deviation between the two classes before the experiment, with a p-value greater than

0.05. This indicates that there were no differences between the two classes before the experiment, and they were at the same level, which meets the

experimental requirements. 1.2 Levels of Non-Intellectual Factors in Each Dimension before the Experiment

Table 2 – Statistical table of test results for each dimension of non-intellectual factors before the experiment

	Experimental Class	Control group	T-test		
	Mean ± Standard Deviation	Mean ± Standard Deviation	N	T	P
Achievement Motivation	20.346±1.874	20.971±2.193	78	0.265	0.687△
Passion for sports	21.482±1.629	20.114±1.425	78	0.466	0.213△
Sports responsibility	19.289±1.430	19.821±1.166	78	1.159	0.095△
Exercise persistence	21.585±1.908	20.371±1.518	78	0.789	0.656△
Pay attention to stability.	18.873±1.892	18.257±1.347	78	0.231	0.956△
Emotional stability	19.724±2.289	19.029±1.422	78	-1.978	0.062△
Exercise anxiety	16.278±1.238	17.257±2.079	78	0.278	0.875△
Sports confidence	19.482±2.048	21.229±1.499	78	-1.956	0.075△
athletic competitiveness	21.289±1.928	20.829±1.499	78	-0.845	0.851△
Independence of movement	20.304±1.289	20.771±1.383	78	0.654	0.576△

Note: △ indicates no difference; ☆ indicates a significant difference; ★ indicates a highly significant difference

Table 2 shows that there were no significant differences in the means and standard deviations of each dimension between the two classes. The differences in dimensions between the two classes before the experiment, as determined by the t-test, are as follows: Achievement Motivation (P=0.687), Enthusiasm for Sports (P=0.213), Responsibility for Sports (P=0.095), Persistence in Sports (P=0.656),

Attention Stability (P=0.956), Emotional Stability (P=0.062), Anxiety about Sports (P=0.875), Self-Confidence in Sports (P=0.075), Competitiveness in Sports (P=0.851), and Independence in Sports (P=0.576). All P values are greater than 0.05.

2. Post-Experiment Comparative Analysis of Non-Intellectual Factors. 2.1 Post-Experiment Comparative Analysis of Overall Levels

Table 3 – Statistical Table of Overall Level Test Data After the Experiment

	After the experiment		T-test
	average value	Standard deviation	
Experimental Class	22.967	1.842	T=2.513
control group	20.708	1.783	P=0.04<0.05☆

Note: △ indicates no difference; ☆ indicates a significant difference; ★ indicates a highly significant difference

The overall levels of the experimental and control groups measured for the first time after the experiment are shown in Table 3. As can be seen from Table 3, after the experiment, the overall level of

non-intellectual factors (X±S) of the experimental group was 22.967±1.842, and the overall level of non-intellectual factors (X±S) of the control group was 20.708±1.783. The average level of non-intel-

lectual factors in the experimental group was 2.259 higher than that in the control group. After testing, $p=0.044$, and the P value was greater than 0.01 and less than 0.05, indicating a significant difference.

2.2 Comparative Analysis of Non-Intellectual Factors in the Two Classes After the Experiment

Table 4 – Statistical Table of Non-Intellectual Factors in the Two Classes After the Experiment

	Experimental Class	Control group	T-test		
	Mean ± Standard Deviation	Mean ± Standard Deviation	N	T	P
Achievement Motivation	22.675±2.865	21.153±2.353	78	1.243	0.087△
Passion for sports	26.378±1.784	20.528±1.785	78	-5.189	0.000★
Sports responsibility	24.782±1.504	20.964±1.857	78	1.859	0.018☆
Exercise persistence	25.451±2.104	22.809±1.678	78	1.314	0.037☆
Pay attention to stability.	22.978±1.537	19.955±1.767	78	0.451	0.034☆
Emotional stability	24.029±1.422	21.234±2.354	78	-2.945	0.036☆
Exercise anxiety	10.645±1.345	16.354±1.572	78	4.535	0.000★
Sports confidence	25.596±2.196	22.524±1.546	78	2.522	0.023☆
athletic competitiveness	24.624±1.348	22.185±1.347	78	0.957	0.046☆
Independence of movement	21.526±2.312	21.376±1.571	78	-0.654	0.176△

Note: △ indicates no difference; ☆ indicates a significant difference; ★ indicates a highly significant difference

Table 4 shows that the overall levels of non-intellectual factors in both classes significantly increased after the experiment. After the experiment, the experimental and control groups showed highly significant differences in these two dimensions (sports enthusiasm and sports anxiety) using t-tests ($P = 0.000$, $P < 0.01$). However, the following showed significant differences ($P = 0.018$ for sports responsibility, $P = 0.037$ for sports persistence, $P = 0.034$ for attention stability, $P = 0.036$ for emotional stability, $P = 0.023$ for sports confidence, and $P = 0.046$ for sports competitiveness) (P values less than 0.05 and greater than 0.01).

2.3 Comparative Analysis of Non-Intellectual Factors Before and After the Experiment in the Experimental Class

The experimental class students underwent a 12-week volleyball teaching experiment to study the impact of volleyball teaching on their non-intellectual factors. This study first analyzed the changes in the overall level of non-intellectual factors due to volleyball teaching, and then analyzed the changes in each dimension of non-intellectual factors due to volleyball teaching.

2.3.1 Comparative Analysis of the Overall Level of Non-Intellectual Factors in the Experimental Class Before and After the Experiment

Table 5: Statistical Table of Overall Level Data of the Experimental Class Before and After the Experiment

	Overall level of the experimental class		T-test
	Average value	Standard deviation	
First measurement	19.865	1.753	T=2.346
Second measurement	22.968	1.842	P=0.043<

Note: △ indicates no difference; ☆ indicates a significant difference; ★ indicates a highly significant difference

After receiving instruction in air volleyball, the students in the experimental class showed a significant increase in their overall non-intellectual factors before and after the experiment, indicating that air volleyball instruction has a substantial promoting effect on the development of students' non-intellectual factors. As shown in Table 5, through an overall analysis of the data on each dimension of non-intellectual factors before and after the experiment, the overall level of non-intellectual factors in the experimental class before the experiment was ($X \pm S$) for the first time (19.865 ± 1.753) and ($X \pm S$) for the

second time (22.968 ± 1.842). A t-test was performed on the change in the overall level of non-intellectual factors, and $p=0.043$ (P values are greater than 0.01 and less than 0.05), indicating a significant difference in the changes of students' non-intellectual factors before and after the experiment. Therefore, it can be concluded that air volleyball instruction has a promoting and improving effect on the development of students' non-intellectual factors, and its effect is significant.

2.3.2 Status of Non-Intellectual Factors in the Experimental Class Before and After the Experiment

Table 6 – Non-intellectual factors of the experimental class before and after the experiment

	Before the experiment	After the experiment	T-test		
	Mean \pm Standard Deviation	Mean \pm Standard Deviation	N	T	P
Achievement Motivation	20.346 \pm 1.874	22.675 \pm 2.865	38	0.265	0.074 Δ
Passion for sports	21.482 \pm 1.629	26.378 \pm 1.784	38	5.356	0.000 \star
Sports responsibility	19.289 \pm 1.430	24.782 \pm 1.504	38	4.159	0.000 \star
Exercise persistence	21.585 \pm 1.908	25.451 \pm 2.104	38	1.789	0.042 \star
Pay attention to stability.	18.873 \pm 1.892	22.978 \pm 1.537	38	2.231	0.023 \star
Emotional stability	19.724 \pm 2.289	24.029 \pm 1.422	38	-1.978	0.037 \star
Exercise anxiety	16.278 \pm 1.238	10.645 \pm 1.345	38	6.278	0.000 \star
Sports confidence	19.482 \pm 2.048	25.596 \pm 2.196	38	-5.956	0.000 \star
athletic competitiveness	21.289 \pm 1.928	24.624 \pm 1.348	38	-2.845	0.036 \star
Independence of movement	20.304 \pm 1.289	21.526 \pm 2.312	38	1.244	0.147 Δ

Note: Δ indicates no difference; \star indicates a significant difference; \star indicates a highly significant difference

Table 6 shows the statistical data of non-intellectual factors in the experimental class before and after the experiment. The results show that, based on t-tests, the changes in students' enthusiasm for sports, sense of responsibility for sports, anxiety about sports, and self-confidence in sports were statistically significant ($t=5.356$ for enthusiasm, $t=4.159$ for sense of responsibility for sports, $t=6.278$ for anxiety about sports, and $t=-5.956$ for self-confidence in sports). All p-values were less than 0.01, indicating highly significant differences in these four non-intellectual sub-factors before and after the experiment. For the four dimensions of sports persistence, emotional stability, competitiveness in sports, and attentional stability, the t-tests showed significant differences ($p=0.042$ for sports persistence, $p=0.023$ for attentional stability, $p=0.037$ for emo-

tional stability, and $p=0.037$ for competitiveness in sports). $P=0.036$, with all P values less than 0.05 and greater than 0.01, indicating significant differences in the changes of exercise persistence, attention stability, emotional stability, and athletic competitiveness before and after the experiment among students in the experimental class. However, achievement motivation ($P=0.074$) and motor independence ($P=0.147$), with all P values greater than 0.05, indicate no significant differences in the changes of achievement motivation and motor independence before and after the experiment among students in the experimental class.

2.4 Non-intellectual factors in the control class before and after the experiment

2.4.1 Overall level of non-intellectual factors in the control class before and after the experiment

Table 7 – Overall level of the control group before and after the experiment

	Overall level of the control group		T-test
	average value	Standard deviation	
First measurement	19.865	1.553	T=2.346
Second measurement	20.208	1.783	P=0.043<
Note: Δ indicates no difference; \star indicates a significant difference; \blackstar indicates a highly significant difference			

The control group, which received regular physical education classes, showed an overall increase in non-intellectual factors before and after the experiment, indicating that regular physical education classes have a positive effect on the development of students' non-intellectual factors. An overall analysis of the non-intellectual factor data from the first and second measurements taken before the experiment in the control group revealed that the overall non-intellectual factor level in the control group was ($X \pm S$) for the first measurement

(19.865 ± 1.553) and ($X \pm S$) for the second measurement (20.208 ± 1.783). The impact of this change on the overall non-intellectual factor level was tested, with $t=2.346$ and $p=0.389 > 0.05$. Therefore, the analysis of the non-intellectual factor data from the first two measurements in the control group showed no significant difference in the changes in students' non-intellectual factors before and after the experiment.

2.4.2 Non-intellectual factors in the control group before and after the experiment

Table 8 – Non-intellectual factors in the control group before and after the experiment

	Before the experiment	After the experiment	T-test		
	Mean \pm Standard Deviation	Mean \pm Standard Deviation	N	T	P
Achievement Motivation	20.971 \pm 2.193	21.153 \pm 2.353	40	0.265	0.687 Δ
Passion for sports	20.114 \pm 1.425	20.528 \pm 1.785	40	0.466	0.213 Δ
Sports responsibility	19.821 \pm 1.166	20.964 \pm 1.857	40	1.159	0.095 Δ
Exercise persistence	20.371 \pm 1.518	22.809 \pm 1.678	40	2.789	0.046 \star
Pay attention to stability.	18.257 \pm 1.347	19.955 \pm 1.767	40	0.231	0.956 Δ
Emotional stability	19.029 \pm 1.422	21.234 \pm 2.354	40	-1.978	0.062 Δ
Exercise anxiety	15.257 \pm 2.079	16.354 \pm 1.572	40	0.278	0.875 Δ
Sports confidence	21.229 \pm 1.499	22.524 \pm 1.546	40	-1.956	0.075 Δ
Athletic competitiveness	20.829 \pm 1.499	22.185 \pm 1.347	40	-0.845	0.851 Δ
Independence of movement	20.771 \pm 1.383	21.376 \pm 1.571	40	0.654	0.576 Δ
Note: Δ indicates no difference; \star indicates a significant difference; \blackstar indicates a highly significant difference					

The statistical data of non-intellectual factors in the control group before and after the experiment are shown in Table 8. A t-test was performed on the changes in each dimension of students' non-intellectual factors. For the nine di-

mensions—achievement motivation ($P=0.687$), enthusiasm for sports ($P=0.213$), responsibility for sports ($P=0.095$), attention stability ($P=0.956$), emotional stability ($P=0.062$), sports anxiety ($P=0.875$), self-confidence in sports

($P=0.075$), competitiveness in sports ($P=0.851$), and independence in sports ($P=0.576$)—the p-values were all greater than 0.05, indicating no significant difference. For sports persistence ($P=0.046$), the p-value was greater than 0.01 but less than 0.05, indicating a significant difference in sports persistence.

2.5 The impact of air volleyball physical education on the physical fitness of primary school students

According to the 2014 National Student Physical Fitness and Health Standards [4], the test items for fifth grade primary school students are: height, weight (BMI index is calculated from both), vital capacity, 50m run, 1min sit-up, 1min rope skipping, and sit-and-reach [5]. The results of the physical fitness and health test were statistically analyzed.

2.5.1 Comparative analysis of the physical fitness indicators of the experimental subjects before the experiment

Table 9 – Statistical Table of Physical Fitness Data of Experimental Subjects Before the Experiment (N1=38, N2=40)

	Experimental Class (X±S)	Control group (X±S)	T	P	Significance
(BMI) index	16.45±6.35	15.84±5.46	0.681	0.102	△
vital capacity	1794±226.56	1718±235.82	1.324	0.072	△
Seated forward bend	8.34±3.24	8.84±4.28	0.345	0.204	△
50m run	9.56±1.54	9.84±1.68	-0.642	0.315	△
50×8 shuttle run	119.45±16.34	117.36±20.12	0.534	0.094	△
1-minute jump rope	82.35±12.24	84±13.46	0.834	0.215	△
1-minute sit-ups	25.61±5.64	28.84±5.42	0.482	0.322	△
Note: △ indicates no difference; ☆ indicates a significant difference; ★ indicates a highly significant difference					

Table 9 shows that there were no statistically significant differences between the two classes in BMI, vital capacity, 50-meter sprint, sit-and-reach test, one-minute sit-ups, and one-minute rope skipping, as indicated by p-values greater than 0.05. This suggests that there were no differences in the physical fitness indicators of the experimental subjects before the experiment.

Analysis of Test Results: Before the experiment, both the experimental and control classes followed

the school’s teaching syllabus for physical education classes. The schools’ arrangements of physical education content and format were essentially the same, ensuring that the physical fitness indicators of the experimental subjects were at the same level before the experiment, which met the requirements of the experiment.

2.5.2 Comparative Analysis of Physical Fitness Indicators of Experimental Subjects After the Experiment

Table 10 – Statistical Table of Physical Fitness Data of Experimental Subjects After the Experiment (N1=38, N2=40)

	Experimental Class (X±S)	Control group (X±S)	T	P	Significance
(BMI) index	15.84±5.21	15.95±6.82	0.358	0.282	△
vital capacity	1981±298.35	1878±312.28	1.324	0.084	△
Seated forward bend	9.82±3.65	9.58±3.56	0.634	0.372	△
50m run	7.54±1.45	9.32±1.84	-2.622	0.005	★
1-minute jump rope	118.65±15.24	96±14.51	1.974	0.043	☆
1-minute sit-ups	38.24±6.43	30.85±7.65	2.682	0.035	☆
Note: △ indicates no difference; ☆ indicates a significant difference; ★ indicates a highly significant difference					

As shown in Table 10, the experimental group and the control group had highly significant differences in the 50-meter sprint, significant differences in the 1-minute rope skipping and 1-minute sit-ups, but no significant differences in BMI, vital capacity, and sit-and-reach.

Discussion. Before the experiment, there were no differences between the control group and the experimental group in ten dimensions of non-intellectual factors: achievement motivation, enthusiasm for sports, sense of responsibility for sports, persistence in sports, attentional stability, emotional stability, sports anxiety, self-confidence in sports, competitiveness in sports, and sports independence [6-8]. Therefore, it can be concluded that: the subjects in this experiment did not differ in any of the dimensions of non-intellectual factors, and the levels of each dimension were at the same level, meeting the experimental requirements; the experimental group, after being taught volleyball, had a greater positive effect on the overall level of students' non-intellectual factors than conventional physical education, with a statistically significant difference in the impact; the changes in sense of responsibility for sports, persistence in sports, attentional stability, emotional stability, self-confidence in sports, and competitiveness in sports were all significantly different between the experimental and control groups. Therefore, it can be concluded that: volleyball teaching has a greater positive effect on improving students' enthusiasm for sports and reducing sports anxiety than previous physical education classes; it has a positive effect on cultivating students' sense of responsibility for sports, persistence in sports, attentional stability, emotional stability, self-confidence in sports, and competitiveness in sports; its effect on students' achievement motivation and sports independence is small and has no statistical significance.

Through comprehensive analysis of the data of various dimensions of non-intellectual factors before and after the experiment, the overall levels of non-intellectual factors in the experimental class before the experiment were ($X \pm S$) 19.865 ± 1.753 and ($X \pm S$) 22.968 ± 1.842 , respectively. A t-test was conducted on the impact of the overall level of non-intellectual factors, and the result was $p=0.043$. The p-value was greater than 0.01 and less than 0.05, indicating a significant difference in the changes of students' non-intellectual factors before and after the experiment. Therefore, we can conclude that: air volleyball training has a significant promoting and enhancing effect on the development of students' non-intellectual factors; air volleyball teaching promotes the development of students' non-intellectual

factors; air volleyball teaching has a highly significant effect on students' enthusiasm for sports, sense of responsibility for sports, sports anxiety, and self-confidence in sports; air volleyball teaching has a significant difference in its effect on students' perseverance in sports, attention stability, emotional stability, and competitiveness in sports; however, air volleyball teaching has no significant difference in its effect on students' achievement motivation and sports independence; conventional physical education teaching has an improving effect on the cultivation of students' non-intellectual factors, but its promoting effect is not significant.

Observations also revealed that students participating in the air volleyball physical education teaching experiment had a significantly shorter reaction time at the start of the 50-meter run than students in conventional physical education, and their running frequency was also faster during the run. Therefore, air volleyball physical education teaching has a good promoting effect on improving students' 50-meter run performance. The 1-minute jump rope index ($t=1.974$, $p=0.043$, $p<0.05$) showed a significant difference between the two classes. The reason for this is that participating in volleyball training requires students to have good arm awareness, flexible angle adjustment, and coordinated arm strength to complete passing and setting techniques; it also requires agile footwork and good lower limb jumping ability to complete spiking and blocking techniques. Therefore, volleyball training not only improves students' quick reaction and agile movement, but also effectively trains their lower limb muscle strength, upper limb dexterity, and coordinated movements, thus significantly improving their 1-minute jump rope index.

The 1-minute sit-up index ($t=2.682$, $p=0.035$, $p<0.05$) also showed a significant difference between the two classes. The reason for this is that in the process of teaching volleyball, students need good core strength to support their movements when practicing overhead serves, spikes, and blocks. In volleyball, students' core strength is well-developed, thus significantly improving their 1-minute sit-up performance.

The p-values for physical fitness indicators, vital capacity, and sit-and-reach tests were all greater than 0.05, and there were no differences between the experimental and control groups in these indicators. The reasons for this are as follows: Physical fitness indicators are affected by many factors, such as genetics and economic conditions, and require long-term influence to cause significant changes. This experiment had a short experimental period and could

not change the students' objective conditions, therefore the impact on physical fitness indicators was small and not statistically significant. Lung capacity indicators require a certain amount of time and exercise intensity to gradually improve, and are significantly affected by endurance sports dominated by physical fitness. This experiment had a short period and used volleyball as a teaching method, a skill-dominated net-based competitive sport, therefore the impact on lung capacity indicators was small and not statistically significant [9-10]. Sit-and-reach indicators relate to flexibility; good flexibility helps improve the quality of technical movements, thus improving athletic performance. This experiment did not show significant differences in sit-and-reach indicators, possibly because the training of students' flexibility was neglected or not emphasized during volleyball teaching, therefore the impact on sit-and-reach indicators was small and not statistically significant.

Limitations and Future Research Directions. 1. By comparing the experimental results of two classes, air volleyball teaching has a greater impact on the non-intellectual factors of primary school students than conventional physical education teaching. This indicates that air volleyball can be applied to primary school physical education and health courses, which is not only feasible but also has a good effect on cultivating students' non-intellectual factors. It is recommended to carry out air volleyball in primary school physical education courses [11-13].

2. My country has been promoting quality education for many years, and emphasizing the cultivation of students' non-intellectual factors is an important feature of quality education [14]. Physical education is a part of quality education, and teachers should give full attention to and cultivate students' non-intellectual factors, which is the trend of educational development. While improving non-intellectual factors, students' personalities are also fully cultivated, and finally, students' comprehensive qualities can be comprehensively improved.

3. This paper uses air volleyball teaching as a means and primary school (fifth grade) students as the research subjects to conduct experimental re-

search. Whether the experimental conclusions can be applied to other projects and populations still needs to be proven by future research. 4. In this paper, the study on the influence of students' non-intellectual factors uses the ten dimensions selected by Professors Rong Danguo and Liu Yimin, which are widely used. The influence of other dimensions needs to be studied in the future [15-17].

Conclusions.

1. In the experimental class, through volleyball instruction, there were significant differences in the overall levels of non-intellectual factors between the students before and after the experiment. Highly significant differences were found in four dimensions: enthusiasm for sports, sense of responsibility for sports, anxiety about sports, and self-confidence in sports; significant differences were also found in four dimensions: persistence in sports, attentional stability, emotional stability, and competitiveness in sports; no differences were found in the dimensions of achievement motivation and sports independence.

2. In the control class, through regular instruction, while the overall levels of non-intellectual factors increased after the experiment compared to before, the overall impact on students' non-intellectual factors was not significantly different. However, there was a significant difference in persistence in sports, indicating that the students in the control class had enhanced perseverance in sports.

3. The experiment revealed significant differences between the experimental and control groups in overall non-intellectual factors. Highly significant differences were also found in the dimensions of enthusiasm for sports and sports anxiety. Significant differences were also observed in six dimensions: sports responsibility, sports persistence, attention stability, emotional stability, sports confidence, and sports competitiveness. No differences were found in achievement motivation and sports independence.

4. Regarding physical fitness, the experiment showed highly significant differences between the two classes in the 50-meter sprint; significant differences in one-minute rope skipping and one-minute sit-ups; and no differences in BMI, vital capacity, and sit-and-reach.

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