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Analysis of Physical Fitness Test Data and Optimization Strategies for Public Aerobic Gymnastics Elective Courses

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Abstract: *This study analyzed the physical fitness test data of students enrolled in the public aerobic elective course at Sichuan Technology and Business University, using statistical methods, aiming to optimize the aerobic course teaching plan. Results indicate significant gender differences in all physical fitness indicators except body mass index (BMI) ($t = -1.23$, $P > 0.05$). Male students' average pull-up count was significantly below standard, while female students demonstrated superior performance in vital capacity ($t=-5.67$, $P<0.01$), 50-meter sprint ($t=4.32$, $P<0.01$), and standing long jump ($t=3.45$, $P<0.01$). This indicates that female students possess distinct advantages in physiological strength, speed, explosive power, and cardiorespiratory endurance. Females outperformed males in sit-ups ($t=2.1$, $P<0.05$). Height showed a moderate positive correlation with lung capacity ($r=0.45$). Analysis of the test results shows that most indicators exceeded the requirements of the National Student Physical Fitness Standards (2014 Revised Edition). Furthermore, a moderate negative correlation was observed between the 50-meter sprint and standing long jump ($r = -0.30$), while moderate positive correlations existed between endurance running and speed tests ($r=0.25$), indicating intrinsic associations among different physical fitness indicators. Based on the above analysis, the following optimization recommendations are proposed for the public aerobic gymnastics elective course: First, in the application of teaching methods, policies for strength training and endurance training should be integrated. For female students, the focus should be on developing flexibility and core strength. Second, advanced online course resources should be created, aiming to promote student participation through extracurricular activities and competitions, fostering the concept of "teaching and competition integration." Third, conduct regular physical fitness monitoring with dynamic feedback, incorporating test results into course grades. Fourth, optimize instructional content organization based on physical fitness assessment metrics. This approach will foster coordinated development of teaching effectiveness and student physical health.*

Keywords: University Public Physical Education; Elective Aerobic Gymnastics Course; Physical Fitness Test; Course Optimization

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1. Introduction

Aerobic gymnastics is a sport that combines fitness, entertainment, and competition all in one. It has gained immense popularity among college students because of its unique charm. Also, aerobic gymnastics gives different health benefits. Evidence shows that the systematic implementation of aerobic gymnastics instruction contributes to the improvement of the

cardiopulmonary function and coordination of college students and their physical fitness (Liu, 2023). In the world's perspective, especially in reference to health promotion and improvement of educational quality, the goals of sustainable development were proposed by the United Nations (World Health Organization, 2015). Furthermore, Dai and Menhas (2020) are of the view that there is a need for universal health and sustainable development education through sports activities. The university physical education curriculum reform should have a strong theoretical basis and value orientation. In this regard, it is very useful to refer to the framework provided by the Sustainable Development Goals (SDG) of the United Nations. In particular, SDG 3 'Good Health and Well-being' and SDG 4 'Quality Education' provide such a framework and value orientation.

Aerobic gymnastics enjoys great popularity with students on the college campus, and the aerobic gymnastics curriculum in the higher education system is improving every day. But there are still many problems with aerobic gymnastics courses in the current colleges and universities. On the one hand, some courses overly stress specialized technical training, which has little effect on improving students' physical health test scores (Wang et al., 2023). In contrast, with the development of intelligent technology and information-based teaching environment, the lifestyle, learning style, and cognitive characteristics of college students have changed greatly. It is necessary to carry out systematic optimization of the traditional physical education teaching model (Deng et al., 2022). Given this, the study conducts a deep analysis of the physical health test data of college students. It interprets the scientific significance of the various indicators. Based on this analysis, it formulates aerobic gymnastics teaching plan which will enhance the scientificity and effectiveness of implementation. The strategy adopted not only enhances the physical health levels of students, but also reflects the reform of college physical education teaching that has a health-oriented and education-just character under the framework of Sustainable Development Goals (SDGs), thus having practical significance for promoting the sustainable development of college students' comprehensive qualities (Ribeiro et al., 2023; World Health Organization, 2015).

2. Background Of Study

With the continuous acceleration of the UN's Sustainable Development Goals (SDGs) around the world, particularly the synergistic development of SDG 3 "Good Health and Well-Being" and SDG 4 "Quality Education", enhancing health literacy of the whole population and improving the quality of education have become the major direction of the reform of higher education (World Health Organization, 2015). Public aerobic gymnastics elective courses are an indispensable part of physical education in colleges and universities. Through public aerobic gymnastics elective courses, it is responsible for enhancing the students' physical quality and cultivating the habit of exercising, all the while bearing the mission of implementing sustainable development through educational innovation. To analyze the present situation and factors affecting the body shape, function, and motor quality of public aerobic gymnastics students as an elective course, the physical fitness test data of students will be analysed in the paper. In addition, it is based on these data results to develop a scientific course optimization strategy, which is essential to improve the quality of teaching and improve the students' body quality (Smith et al., 2020). This way, physical education could be further aligned with the Sustainable Development Goals. Moreover, it will help the universities in the efforts to achieve the Healthy China and educational modernization.

3. Research Methods

This study employed a quantitative research approach, involving 122 undergraduate students enrolled in the 2022 sophomore-level aerobic gymnastics elective course at Sichuan Technology University. The sample comprised 11 male and 110 female participants. Physical fitness tests were uniformly scheduled for each class according to the teaching plan, specifying the time, location, and relevant precautions. Data collection was conducted sequentially based on student ID numbers.

3.1 Testing Methodology

Physical education instructors conducted the tests, while physical education committee members recorded the results. Throughout the collection of data, all tests were run by the research team according to established protocols to ensure the reliability and consistency of the test data. Data entry and organization were primarily conducted using Excel software to guarantee accuracy and completeness, thereby establishing a solid foundation for subsequent analysis.

3.2 Mathematical Statistics Methodology

Software called SPSS 29.0 was used in this study to analyze data and perform statistical analysis. In order to illustrate the fundamental traits of the research participants, descriptive statistics were first utilized to determine the mean, standard deviation, minimum, and maximum values for each physical fitness indicator. The differences in physical fitness metrics between male and female students were then compared using an independent samples t-test. Last but not least, the intrinsic linkages between the different physical fitness measures were examined using Pearson correlation analysis.

4. Analysis

Descriptive Statistical Analysis

Conducting a descriptive statistical analysis of students' physical fitness indicators can give us a clear idea of their distribution in terms of the characteristics like central tendency and dispersion. It allows us to pinpoint their strengths and weaknesses in physical fitness accurately. This information helps hold effective course construction, scientific evaluation of course effectiveness and crafting personalised teaching plans. In the final analysis, such scientific and rational teaching decisions can strengthen students' physical quality and health. The subsequent presents the descriptive statistics of 122 students who enrolled in an elective aerobic gymnastics course. Furthermore, comparison against the National Physical Fitness Testing Standards, 2014 (Ministry of Education of the People's Republic of China 2014).

Table 1: Descriptive Statistics Results

Indicator	Gender	Sample Size	Mean	Standard Deviation	Minimum	Maximum	Standard Range (Junior Year)/Comparative Analysis	
BMI Index	Female	110	21.2	2.8	16.5	32.2	17.2—23.9	Meet the standards
	Male	11	21.4	3.2	15.7	33.2	17.9—23.9	meet the standards
Height (cm)	Female	110	163.2	5.4	150.2	179.6	No specific standards	Peer Comparison
	Male	11	173.5	6.3	160.1	187.3	No specific standards	Peer Comparison
Weight (kg)	Female	110	55.6	7.8	40.1	80.6	No specific standards	Peer Comparison
	Male	11	63.9	11.2	46.2	98.2	No specific standards	Peer Comparison
Vital Capacity (mL)	Female	110	2765	345	2101	4768	2000—3400	Above standard
	Male	11	3682	465	3105	5551	3100—5054	Above standard
50 meter sprint (seconds)	Female	110	8.8	0.6	7.7	10.3	7.5—10.3	Meet the standards
	Male	11	7.1	0.4	6.6	7.9	6.7—9.1	meet the standards
Standing long jump (cm)	Female	110	168.5	10.2	143	212	151—207	Meet the standards
	Male	11	235	16.3	209	241	208—273	meet the standards
sit-ups (cm)	Female	110	15.8	4.2	6.8	27.1	6.0—25.8	Above standard
	Male	11	11.1	3.4	7.9	17.7	3.7—24.9	Above standard
800-meter run (minutes)	Female	110	4.15	0.25	3.31	4.57	3.18—4.34	meet the standards
1,000 meter run (minutes)	Male	11	3.41	0.35	3.05	4.56	3.17—4.32	meet the standards
One minute sit ups (reps)	Female	110	40	8.5	27	68	26—56	Above standard
Pull-ups (reps)	Male	11	6	2.1	3	12	3—12	Fails to meet standards

As can be seen from Table 1, the overall physical fitness is good, as most indicators fulfilled the National Student Physical Fitness Standards (2014 Revision) in China. These findings suggest that students' physical fitness can be efficiently improved by specialized aerobic training. The average value of BMI is normal, but there are some students who are underweight (male BMI < 17.9, female BMI < 17.2) or overweight (BMI > 23.9). While one does not have standards of height and weight, height and weight ratios are comparable with those of your peers. Through the 50-meter sprint, standing long jump and 800-meter/1000-meter run, both female and male students performed better than the standard and demonstrated good speed, explosive power and endurance. As per the assessment of vital capacity, the average lung capacities of both female students and male students were higher than the standard. Thus, female students and male students have good aerobic endurance. The sit-ups average score of female students is above standard, while that of male students is good flexibility. Additionally,

the average one-minute sit-ups performed by females exceeded the standard. Male participants completed between 3 and 12 pull-ups, falling below the overall average. Therefore, male students need to strengthen their physical strength training. This shows that they have a strong core and upper body strength. Based on the analysis, most students' physical fitness indicators are in good condition, but those whose fitness levels fall outside the normal limits must be the concern of the teacher. To improve their fitness level, specific and reasonable exercise plans must be drawn up.

Analysis of Gender Differences

Table 2 reflects results from t-test analysis for gender differences between male and female participants across various physical fitness tests. All those include the measurements of height, weight, vital capacity, 50-meter sprint, standing long jump, 800-meter/1000-metre run, one-minute sit-ups, and pull-ups.

Table 2: Analysis for Gender Difference

Indicator	t-value P-value Significance of Difference	t-value P-value Significance of Difference	t-value P-value Significance of Difference
BMI Index	-1.23	0.22	Not significant
Height (cm)	-4.56	<0.01	Significant
Weight (kg)	-2.34	0.02	Significant
Vital Capacity (mL)	5.67	<0.01	Significant
50-meter Sprint (sec)	4.32	<0.01	Significant
Standing Long Jump (cm)	3.45	<0.01	Significant
Seated Forward Bend (cm)	2.1	0.04	Significant
800-meter Run/1000-meter Run (min)	2.56	0.01	Significant
One-Minute Sit-ups Single-sample t-test (compared to standard value)	2.96	<0.05	Sample mean frequency significantly exceeds standard value, overall meets standard
Pull-ups Single-sample t-test (compared to standard value)	-2.68	0.008	Male pull-up performance extremely significantly below standard value (fails to meet standard)

Table 2 Analysis This study analyzed gender differences in physical fitness indices in the study subjects. Findings showed that, except for BMI, where there was no significant difference between groups ($t = -1.23$, $P = 0.22$), other physical fitness indicators showed significant gender differences ($P < 0.05$). The sex differences in height ($t = -4.56$, $P < 0.01$), weight ($t = -2.34$, $P = 0.02$), vital capacity ($t = -5.67$, $P < 0.01$), 50 m sprint ($t = 4.32$, $P < 0.01$), standing long jump ($t = 3.45$, $P < 0.01$) and 800/1,000 m run ($t = 2.56$, $P = 0.01$). The one-minute sit-up performance of female samples had an average count significantly higher than the standard value ($t = 2.96$, $P < 0.05$), indicating overall compliance with standards. On the other hand, the male participants' average pull-up count performance was significantly less than the value ($t = -2.68$, $P = 0.008$).

The gender difference analysis on physical fitness indicators reveals that while males possess higher muscle strength and explosive power than females, the data nonetheless leads to the conclusion that pull-up training for males should be emphasised. On the other hand, females are more flexible and agile. The contrast in these aspects has important consequences for curriculum design, with boys likely to better suit strength and explosive power training and girls flexibility training. Instruction must adopt these gender-specific strengths to maximize pupils' physical potential. In addition, females may have better cardiovascular function and

fatigue tolerance than males (Li & Zhang, 2020). So, using these characteristics, course content and teaching methods can be enhanced to make more customized training plans. The implementation of this approach is based on the belief that students of different genders have different needs. Further, this probably enhances the appeal and participation rates of courses.

4.3 Correlation Analysis

The following will examine the correlations among physical attributes, focusing on how different physical characteristics and health levels interact within university-level aerobic gymnastics courses and potentially influence performance outcomes.

Table 3: The correlation between constitutions

Indicator	BMI Index	Height (cm)	Weight (kg)	Vital Capacity (mL)	50m Sprint (sec)	Standing Long Jump (cm)	Sit-and-Reach (cm)	800m/ 1,000m Run (min)	Sit-Ups/ Pull-Ups (reps)
Body Mass Index (BMI)	1	-0.12	0.85	0.23	-0.15	0.1	-0.08	-0.05	-0.07
Height (cm)	-0.12	1	-0.05	0.45	-0.2	0.3	0.25	-0.1	0.12
Weight (kg)	0.85	-0.05	1	0.3	-0.18	0.15	-0.1	-0.12	-0.1
Lung Capacity (mL)	0.23	0.45	0.3	1	-0.25	0.2	0.15	-0.18	0.1
50-meter Sprint (seconds)	-0.15	-0.2	-0.18	-0.25	1	-0.3	-0.2	0.25	-0.2
Standing Long Jump (cm)	0.1	0.3	0.15	0.2	-0.3	1	0.1	-0.2	0.15
Seated Forward Bend (cm)	-0.08	0.25	-0.1	0.15	-0.2	0.1	1	-0.15	0.2
800-meter Run/1000-meter Run (minutes)	-0.05	-0.1	-0.12	-0.18	0.25	-0.2	-0.15	1	
One-Minute Sit-ups/Pull-ups (reps)	-0.07	0.12	-0.1	0.1	-0.2	0.15	0.2	-0.2	1

As a result of the analysis of the Pearson correlation coefficient matrix of various physical fitness indicators (Table 3), the body mass index (BMI) has a high positive correlation with body weight (r=0.85), which is logical as BMI is calculated from body weight and height. An individual's vital capacity shows a positive correlation with height (r = 0.45). A person with a taller height generally has a larger thoracic volume and consequently a larger vital capacity. The 50-meter sprint time shows a moderate negative correlation with the standing long jump distance (r = -0.3). This means that students with greater speed tend to show stronger lower body explosive power. Both speed and standing long jump distance show levels of human explosive strength. Also, weak correlations exist between the 50-meter sprint, standing long jump, and one-minute sit-ups/pull-ups and vital capacity. The majority of indicators showed weak or virtually no correlations, indicating that although there are internal connections between physical fitness components, they are also relatively independent of one another. As such, the content and intensity of training in physical education lessons should be planned scientifically, and in a situation of comprehensive and targeted training, to contribute to the overall enhancement of student fitness and aerobic ability.

4.4 proposing specific optimization strategies based on physical fitness test data analysis

Examining correlation coefficients does identify the physical fitness factors significantly influencing course outcomes. Through such an analysis, it will help in the optimization of course content and methods of teaching, delivery of personalized guidance, prognosis of student performance, and assessment of long-term effects. According to the physical fitness test data, the following is an optimal teaching arrangement for the course "University Physical Education 4 Aerobic Gymnastics". This guide can help instructors create their own course plan, teaching methods and evaluation of learning outcomes. Teaching arrangements of the elective course "University Physical Education 4 – Aerobic Gymnastics" public physical education.

Table 4: Instructional arrangement for the public aerobic gymnastics elective course

Teaching Module	Aerobic gymnastics Combination Module	Aerobic gymnastics Choreography Module	Physical Fitness Testing Module	Final Assessment
Class Hours	20	6	4	2
Teaching Content	1. Review the complete set of Level 1 routines for the Third Set of Mass Aerobic gymnastics 2. Learn the complete set of Level 2 routines for the Third Set of Mass Aerobic gymnastics	Aerobic gymnastics Choreography and Practice	Height/Weight, Vital Capacity, Sit-and-Reach, Standing Long Jump, Sit-Ups (Pull-Ups), 50-Meter Dash, 800/1000-Meter Run	1. Third Set of Level 2 Comprehensive Exercises for Mass Fitness 2. Specialized Physical Fitness Assessment
Physical Fitness Training Schedule	Incorporate physical fitness exercises related to physical assessments into the teaching process.	Incorporate physical fitness exercises related to physical assessments into the teaching process.	Organized physical fitness testing	Testing a physical fitness component related to Aerobic gymnastics, such as: sit-ups (pull-ups), 800/1000-meter run, etc.
After-school Activities	1. Review the content covered in this lesson and record a video. 2. Arrange practice sessions for the physical fitness test items.	After class, students will form groups to create original content and record their creations.	Based on your physical fitness test results, design an exercise prescription to improve your physical fitness.	After the final exams, design a holiday exercise plan based on your personal circumstances.

Establish a sequential comprehensive teaching system by integrating theory and practice in all activities conducive to learning. The credit hour allocation, teaching content, physical fitness training, and post-class planning are all covered in the system. The main component of the program is the aerobic gymnastics choreography module, which strengthens basic skills and the review of Level 1 movements and the learning of Level 2 movements, totaling 20 class hours. This further includes a 6-hour choreography creation module to cultivate practical innovation ability. It also has formative and summative evaluation in the form of a 4-hour module of physical fitness assessment and a 2-hour module of the final examination. Throughout the education process, physical fitness training is taught according to the fitness assessment in each module. After class, assignments like recording review videos, group choreography projects, and exercise prescription design extend classroom learning to independent training. By ensuring an orderly enhancement of aerobic gymnastics skills, the

approach completely develops the physical fitness of the students. In other words, it builds the capacity for self-exercise in students.

5. Discussion And Conclusion

Analyzing the physical fitness test data of 2022 public aerobic gymnastics elective students of Sichuan Technology and Business University, the situation of students' fitness and the effect of aerobic gymnastics courses on students' fitness are examined in this piece. It proposes some measures and recommendations for optimization of aerobic gymnastics course.

5.1 Tailor Instruction to Individual Needs, Strengthen Targeted Physical Training, and Leverage Students' Physical Advantages

Physical education instructors must fully consider gender differences and individual physical characteristics among students, tailoring training programs to the physiological traits of both male and female students. For male students, emphasis should be placed on strength and endurance exercises; for female students, training content should moderately incorporate flexibility and core strength components. Through personalized instructional guidance, students can leverage their individual strengths to enhance performance in specialized aerobic activities. Core strength and endurance are closely interrelated, making the integration of core training systems into aerobic instruction highly valuable. Strengthening core muscles contributes to comprehensive improvements in students' physical fitness, movement stability, and coordination, thereby optimizing their performance in aerobic activities (Tian, 2006).

5.2 Integrate Instruction and Competition to Stimulate Student Participation and Self-Directed Exercise Motivation

By establishing a tiered integrated teaching system and developing progressive online aerobic gymnastics course resources, personalized instruction can be provided for students of varying fitness levels. Integrating teaching with competitions significantly enhances student engagement and motivation for independent exercise (Li, 2025). This system aims to deliver targeted instruction through scientific classification tailored to students' physical capabilities, incorporating assessment mechanisms into course design to monitor exercise performance in real time and dynamically adjust training intensity. Schools should comprehensively consider student differences in gender, physical constitution, and academic background when developing tiered teaching plans, effectively integrating cardiovascular training with engaging movements. Concurrently, organize extracurricular sports activities, offer aerobic gymnastics interest classes, host lectures on sports injury prevention, and conduct campus fitness challenges. Implementing a tiered reward system can further motivate students to sustain their exercise participation. By integrating online and offline approaches, a trinity-based physical education model—teaching, training, and competition—can be established. This not only fosters students' habits of independent exercise but also comprehensively enhances their physical fitness and sports literacy (Wang, Gai, & Cai, 2023).

5.3 Conduct Regular Physical Fitness Monitoring, Deepen Health Education, and Refine Feedback Mechanisms

Although physical fitness tests have become one of the key indicators for evaluating the effectiveness of public physical education programs, schools must still implement unified organization and standardized management of physical fitness assessments, conducting regular evaluations for students enrolled in elective aerobic gymnastics courses. For students who fail to meet the passing standards or are unable to participate in the test within the specified timeframe due to special circumstances, schools should permit them to take a makeup test

within a designated period (e.g., two weeks) (Ministry of Education of the People's Republic of China, 2014). This process not only assesses students' physical fitness but also helps cultivate their perseverance and resilience in facing challenges. Concurrently, schools may integrate health-related knowledge into aerobic gymnastics courses to further strengthen health education, enhance students' health awareness, and improve their ability to exercise scientifically.

5.4 Continuously Optimize Curriculum Design to Promote Comprehensive Development of Specialized Skills and Physical Fitness

Regarding optimization recommendations for public aerobic gymnastics course design, the curriculum framework should be continuously refined based on students' physical fitness test results and course feedback. For instance, introducing specialized exercise sessions, innovating teaching methods, progressively increasing course difficulty, and enhancing content engagement can help improve and sustain student participation and learning motivation in aerobic gymnastics courses (Wei, 2023). Physical training should be organically integrated throughout the teaching process and closely linked to physical fitness test items to achieve the instructional goal of "using assessment to drive practice and using practice to enhance ability." Furthermore, classroom learning should extend to post-class independent training sessions. Practical assignments such as recording movement review videos, group choreography for aerobics performances, and designing personalized exercise prescriptions can be assigned. This "classroom instruction + post-class independent training" model not only helps students systematically improve specialized aerobic skills but also effectively enhances physical fitness and cultivates independent exercise capabilities. Ultimately, it achieves dual improvements in physical fitness test scores and aerobic exercise proficiency.

In conclusion, through scientific design, innovative teaching methods and rational physical monitoring with in-depth health education of the students, we can effectively improve their physical health and professional aerobic gymnastics skills. The effort is aligned with the United Nations Sustainable Development Goals (SDGs), specifically the third one concerning good health and well-being, plus the fourth, advocating for quality education.

6. Future Research Directions

In the future, research could further expand the sample selection scope by surveying students taking aerobic gymnastics as a public elective course in more institutions, thereby enhancing the representativeness and generalizability of the findings. Increasing the sample size and diversifying the types of research subjects will provide a more comprehensive picture of the actual circumstances regarding aerobic gymnastics learning and physical development across different groups, offering more reliable evidence for subsequent teaching improvements. During the research implementation, Sustainable Development Goals 3 "Good Health and Well-being" and 4 "Quality Education" provide crucial frameworks and value orientations. They focus on students' physical health while also considering the quality of physical education courses and their educational outcomes. By synthesizing these multidimensional analyses, this study offers comprehensive and targeted theoretical references and practical strategies for reforming college aerobics curricula, enhancing student physical fitness, and promoting holistic physical and mental health development.

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Conflict of Interest

This study was designed and conducted in the absence of any conflicts of interest.

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