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Analysis of the Impact of Chinese Classical Dance "Shenyun" Training on the Improvement of Dancers' Physical Coordination

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SUMMARY: *Classical Chinese dance body rhyme training is integrated into dance teaching, which can make the dance have both god and form, and plays an important role in the improvement of dancers' body coordination. In this study, the effect of classical Chinese dance body rhythm training on dancers' body coordination ability was the purpose of the study. 30 students from the class of 2020, majoring in dance performance in a college in province A, were selected as the experimental subjects, and were randomly grouped in a reported way, and the experimental group and the control group underwent a 13-week training using the classical Chinese dance body rhythm training method and the traditional body coordination training method, respectively. The experimental data were statistically analyzed using hypothesis testing and paired-sample t-test to analyze the gap between the effects of different training styles on dancers' body coordination ability. The experimental results showed that dancer A1 in the experimental group had smaller fluctuations in the center of gravity, smooth technical movement status, and stable changes in the center of gravity speed in the range of 190-320 mm/s during the first 60% phase of the movement cycle after systematic training in classical Chinese dance body coordination. There was a significant improvement in all indicators of body stability and all dimensions of body coordination in the experimental group of students compared to the control group of students. The results of the study provide data support and guidance for dance teaching and training time of classical Chinese dance body rhythm, which can help dancers improve their body coordination and dance performance.*

KEYWORDS: *Classical Chinese dance; physical coordination improvement; body rhythm training; paired-samples t test*

1 Introduction

Body coordination is one of the core elements of dancers' physical quality, which helps dancers to make the body organ systems coordinate and cooperate efficiently with each other when accomplishing complex multi-joint movements, thus ensuring the accuracy of movements and preventing sports injuries [1-3]. For the study of dancers' body coordination, literature [4] believes that body coordination training is necessary for dancers because traditional technical training courses are not enough to compensate for the dancers' need for perfect coordination between muscle strength and movements. Literature [5] believes that the physical quality of dancers contains strength, flexibility, coordination and balance, through systematic training, can make the dancer's dynamic balance, rhythm control can be effectively improved, and then improve the dancer's physical coordination. For the study of body coordination training, literature [6] explored the impact of core stability training (CST) program on dancers' body

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coordination, and found that through CST training, dancers' jumping ability, proprioception, coordination, and dynamic balance and other bodily function indexes can be simultaneously, which can help dancers to improve their artistic skills. Literature [7] explored the effect of lower limb strength training on dancers' physical coordination through a controlled experiment, and found that compared with the control group, there was a significant difference in coordination between dancers in the experimental group ($P<0.05$), and that the lower limb strength training program significantly improved the dancers' muscular strength, which correspondingly improved the coordination of skills. Literature [8] revealed specific mechanisms of dancers' body coordination, i.e., neuromuscular control and perceptual sensitivity, as evidenced by less variability in dancers' ankle-hip coordination and less deterministic coupling relationships, characteristics that were not evident in non-dancers. Literature [9] explored the specific mechanisms of dancer body coordination from a brain neuroscience perspective and found that it is related to adaptive changes in the brain in terms of sensorimotor integration involving tertiary brain regions such as the anterior cingulate cortex (IPFC) and the anterior parietal cortex (IPS). Therefore, body coordination is a complex system consisting of a combination of multiple abilities, the operation of which is mainly dependent on the central nervous system, which, through effective integration, outputs precise movement commands in order to achieve coordinated movement of all body parts [10].

Classical Chinese dance, as an important part of Chinese traditional culture, is loved by people for its unique dance posture, rhythm and connotation, and the integration of the body rhythm of classical Chinese dance into the training of dancers' body coordination not only trains the content, but also improves the dancers' cultural literacy and dance skills [11-13]. For the study of classical Chinese dance body rhythm training, literature [14] believes that it integrates various art forms, can choose the theme according to cultural taste and sense of history, and design the dance posture and movement to convey the artistic meaning, classical Chinese dance is the perfect unity of rhythm, power, spirit and external image, which embodies the cultural connotation and meaning. Literature [15] suggests that the integration of classical Chinese dance body rhythm training into the “body art” program can enhance the dancers' ability to control the body form and express their emotions, and at the same time improve the connotation and culture of body art. Literature [16] believes that classical Chinese dance body rhythm training, emphasizing the perfect combination of clothing and body language, through the body rhythm training dancers can deeply understand the ancient literati's interest in life and aesthetic concepts, feel the charm of traditional Chinese culture. Body rhythm training focuses on the coordinated use of all parts of the body, and by practicing the movements and postures of classical dance, it can help dancers to improve the coordination and flexibility of the body, so that they can show more elegant and smooth dance posture on the stage [17, 18].

In classical Chinese dance body rhyme training dancers need to coordinate the movements of arms, head and other parts of the body to form a harmonious overall effect, and this coordinated movement not only requires high flexibility of the body, but also requires dancers to have a higher grasp of the movement and control ability [19, 20]. Literature [21] analyzed the comparison between Chinese classical dance and western dance in terms of technical skills, and found that Chinese classical dance integrates elements of traditional drama, martial arts and western ballet; compared with western dance, Chinese classical dance is more unique in terms of skill characteristics, and pays more attention to the aesthetic value and expressive power. Literature [22] believes that Chinese classical dance is influenced by Chinese culture, aesthetic value and historical development, and its essence is the combination of strength and gentleness, and influenced by Taiji cultural consciousness, which makes it pay more attention to the coordination and flexibility of the body, and the smoothness and naturalness of the dance posture. In the body rhythm training of classical dance, dancers need to perform various

flexibility training, such as jumping, stretching, twisting, and stretching. Literature [23] found that jumping training in classical Chinese dance is essential for improving the quality and technique of dance movements, which can exercise the muscles, enhance physical fitness, and is also essential for conveying emotions and shaping a perfect stage image. Therefore, classical Chinese dance body movement training can not only help dancers to accomplish various complex dance postures and movements, but also prevent dance sports injuries and improve dancers' dance skills and expressiveness.

In the current dance teaching practice, the evaluation of the effect of body rhythm training mostly relies on the subjective test of teachers, lacks objective quantitative standards, and the mechanism of its influence on the enhancement of body coordination has not been scientifically verified. In this study, we quantified the effect of body rhythm training on dancers' body coordination through mathematical and statistical methods. A controlled teaching experiment was designed, and before and after the experiment, students' body stability and coordination-related indexes such as fluctuation of the center of gravity and speed of movement were recorded by professional equipment, and the data were analyzed by using the paired-sample t-test method, in order to scientifically verify the differences in the effects of different training methods in enhancing dancers' body coordination, and to provide reference for the optimization of dance teaching and training methods.

2 Elements of Body Rhythm Training in Classical Chinese Dance

Currently in the dance teaching, many teachers try to integrate the classical Chinese dance body rhyme training, in order to continuously standardize and improve the dance teaching, enhance the teaching level, so that the dance not only has a sense of beauty, but also more form of charisma. In order to better develop the teaching of body rhythm training, we must first understand the learning elements. Only by firmly grasping the characteristics of body rhythm training can we grasp the essence and improve the learning efficiency. The most crucial point in the body rhythm training of classical Chinese dance is “form, spirit, strength and rhythm”. Classical dance is a form of art that integrates many factors, from which we can hear the beautiful music, and we can also find out one or two martial arts factors. Therefore, classical Chinese dance is not only a combination of movement and music, but also the beauty of both spirit and rhythm.

2.1 The “Shape” of Classical Chinese Dance Body Rhythm Training

The “form” of classical Chinese dance body rhyme training refers to the specific dance movements, dancers express their emotions through rhythmic, rhythmic body movements in the dance performance, and the dancer's body shape is also an important reflection. Dance works contain a certain degree of storytelling, and the dancers express the inner activities of the characters through their body movements. Classical Chinese dance can give people visual stimulation through the molding of “shape”, so that they can get the feeling of beauty and enter the space of imagination through the specific movements of the dancers. Some elements of dance can also be detected in traditional Chinese opera, and the performer's stance is also one of the key points of appreciation. Opera performers either read or sing, or do or fight, using various postures and techniques to complete the artistic expression. It can be seen that the body shape and rhythm of dance are also different due to the influence of performance forms and cultural differences.

2.2 The “God” of Classical Chinese Dance Body Rhythm Training

The “God” of classical Chinese dance body rhyme training refers to the expression of inner emotion, which is a very crucial point in dance teaching. Compared with the external “shape”, the internal “God” is often more difficult to grasp, which is one of the reasons why many dancers' performances lack vitality. A dance work often contains strong storytelling and extremely rich emotions, or relaxed and happy, or contains the feelings of longing, or has a grand family and country feelings. There are millions of emotions expressed in the work, as a dancer must convey the emotions of the work to the audience through their own dance performances, and make the dance movements more God-shaped, in order to show the vitality of the dance.

2.3 The “Power” of Classical Chinese Dance Body Rhythm Training

The “strength” of classical Chinese dance body rhyme training refers to the strength and rhythm of the dancer's body movements. Classical Chinese dance harmonizes the dancer's body movements and rhythm through music, forming a coherent sense of beauty and unity. The dancer's movements or strong or gentle and slow, which is a kind of elastic power, in the whole dance performance, from the beginning to the climax to the end, “strength” are throughout, plays an important role. If the dancers can grasp the factor of “strength”, then the rhythm of the whole dance will be better, and the dance will be more appreciated.

2.4 The “Rhythm” of Classical Chinese Dance Body Rhythm Training

The “rhythm” of classical Chinese dance body rhyme training refers to the laws that should be followed in the performance of dance works, all the movements of the dancers should be coherent, and should not be intermittent and have a sense of deviation from the music. Coherent movements can give the audience a high-quality visual experience, and then make them get the space of imagination in the complete dance performance.

3 Subject and methodology of the study

3.1 Subjects of study

In this study, the effect of body rhythm training on the improvement of dancers' physical coordination was taken as the object of research, and the students of a college in province A majoring in dance performance in grade 2020 were taken as the experimental subjects, with a total of 30 people, including 15 in the experimental group and 15 in the control group.

3.2 Research methodology

3.2.1 Literature method

In order to have a comprehensive and systematic understanding of the current research status and development trend of classical Chinese dance [24] and body coordination [25], we studied functional anatomy and athletic training to expand our knowledge system through Knowledge.com, the library of the College of Physical Education and Sport, the National Library, and sports magazines and journals, etc. At the same time, we searched for relevant journals, papers, and books about the training of body coordination, physical function, and the training of body rhythm of classical Chinese dance, and summarized them to lay a certain theoretical foundation for this study. At the same time, we searched for journals, theses and

books to learn from advanced theories and practices at home and abroad, and summarized them to lay a certain theoretical foundation for this study.

3.2.2 Interview method

We interviewed relevant experts in physical training, physical education and classical Chinese dance, front-line teachers and national-level referees to discuss issues related to the experimental study on the influence of classical Chinese dance body rhyme training on the physical coordination of students majoring in classical Chinese dance, collected their problems, recognition and suggestions on the test indexes of the present study and the content of the body rhyme training of classical Chinese dance, and collated the feedbacks we received to provide references and bases on the ideas and content of the study, as well as to ensure the significance and value of the study on the development of the physical coordination of students majoring in classical Chinese dance. The feedback received will be organized to provide reference and basis for the idea and content of the study, as well as to ensure the significance and value of the study on the development of physical coordination of students majoring in classical Chinese dance.

3.2.3 Experimental methods

This experiment is divided into four steps. Firstly, we read the relevant literature to make experimental hypotheses, and interviewed relevant experts and teachers about the test indexes and the determination of soft-body combination training movements; secondly, we chose the experimental subjects to meet the requirements, conducted pre-tests and analyzed the relevant data to ensure that the experimental groupings were reasonable and effective; then we intervened in the body coordination training for the two groups, the experimental group adopted the Chinese Classical Dance Body Rhythm training, and the control group adopted the traditional body The experimental group used Chinese classical dance body rhythm training, and the control group used traditional body coordination training; finally, a post-test was conducted at the end of the experiment to collect and analyze the experimental data of the two groups and draw conclusions.

The experimental subjects were 30 students in the class of 2020, majoring in dance performance at Anyang College, who were all studying classical Chinese dance as their main dance type, which meets the requirements of this study.

In order to ensure the control of the basic situation of the two groups of experimental subjects, let 30 students stand in two horizontal rows, two rows from right to left according to the height of the height from high to low in order, “1, 2” sequentially reported the number, the number of 1 for the experimental group, the number of 2 for the control group. In this way, the experimental subjects were divided into experimental group and control group, 15 people in each group. In order to reduce the experimental error, the basic conditions of the experimental subjects were statistically analyzed, and the basic conditions of the experimental subjects included the age, height, weight BMI, and years of learning Chinese classical dance of the experimental subjects, and statistically significant level test was carried out.

Before the experiment, T-test was conducted on the indicators of age ($p=0.461$), height ($p=0.8753$), weight ($p=0.392$), BMI ($p=0.391$), and years of dance experience ($p=1.002$) for the two groups, and there was no significant difference between the two groups of subjects.

Experimental time: the experiment was carried out from September 15 to December 28, 2020, of which one week of pre-experiment, excluding the legal holidays during the experiment, the formal experiment totaled 13 weeks, three times a week training, respectively, every Monday, Wednesday, and Friday of the Classical Dance of China in the professional class.

Place of experiment: Dance practice room of the campus.

3.3 Rationale

The data of the basic situation of the experimental subjects, the test indexes before and after the experimental training were counted by using Excel, and analyzed by using SPSS23.0, to analyze whether there is an effect of the influence of the body rhyme training of Chinese classical dance on the physical coordination of the students majoring in Chinese classical dance by comparing the changes of the data before and after the training.

3.3.1 Hypothesis testing

Hypothesis testing (also known as significance testing) [26] is an important statistical test. The method first makes some reasonable assumptions about the analyzed specimen, and then analyzes the sample to determine whether the assumption is valid. Hypothesis testing is divided into parametric and non-parametric tests according to whether the overall distribution is known or not. When the overall distribution is known (e.g., normal distribution), the parameters included in the overall situation is called parametric test; when the overall distribution is unknown, it is non-parametric test.

3.3.2 Fundamentals of paired-sample t-tests

In order to compare whether there is a significant difference between two methods (or instruments, products, etc.), it is common to do a comparison test under the same conditions to obtain two sets of paired test values, which are often correlated, and then analyze the two sets of test values to make statistical inferences. The t-statistic is utilized in hypothesis testing and is therefore called the paired samples t-test [27]. The paired samples t-test is a parametric test.

Let $x_1, x_{12}, \cdots\cdots, x_{1n}$ and x_2, $x_{22}, \cdots\cdots, x_{2n}$ be random samples from 2 independent distributions x_1, x_2 respectively. Let $d = X_1 - X_2$, the corresponding sample difference is $d_{\mathrm{i}} = X_1 - X_{2i} (i = 1, 2, \cdots, n)$, and if the difference between the x_1, x_2 samples is very small, then we can consider that the difference between $d_1, d_2, \cdots\cdots, d_n$ obeys a normal distribution with mean 0 $N\left(\mu_d, \sigma^2\right)$.

Original hypothesis: $H_0 : \mu_d = 0$ (i.e., the data between the two samples are considered not significantly different).

Alternative hypothesis: $H_0 : \mu_d \neq 0$ (i.e., the data between the two samples are considered significantly different).

The formula for the test statistic is as follows:

$$t = \frac{\bar{d}}{\frac{S_n}{\sqrt{n}}} \tag{1}$$

In Equation (1), $\bar{d}$ is the mean of $d_1, d_2, \cdots\cdots d_i$, n is the sample size, and S_n is the standard deviation of $d_1, d_2, \cdots\cdots d_i$. $\bar{d}, S_n$ is calculated according to equations (2) and (3):

$$\bar{d} = \frac{\sum_{i=1}^{n} 1^{di}}{n} \tag{2}$$

$$S_n = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(d_i - \bar{d}\right)^2} \tag{3}$$

When the hypothesis H_0 holds, the t statistic conforms to the t distribution with $(n-1)$ degrees of freedom.

For a given significance level $\alpha(0<\alpha<1)$, the test threshold $t_{\alpha/2}(n-1)$ can be obtained by checking the distribution table of t such that $P\{|t|\geqslant t_{\alpha/2}(n-1)\}=\alpha$, if $|t|\geqslant t_{\alpha/2}(n-1)$, then reject H_0 and consider there is a significant difference between the two samples. Otherwise, no significant difference between the two samples is considered.

In the statistical analysis software currently in use, the difference between the two sets of samples is usually calculated and the corresponding data are substituted into Equation (1) to calculate the test statistic and the corresponding probability P-value; if the P-value is less than a given significance level, the original hypothesis is rejected; otherwise, the original hypothesis is accepted.

4 Analysis of the results of the experiment

4.1 Characteristics of center of gravity movement in classical Chinese dance body rhythm training

One dancer from the experimental group and five students from the control group were selected to demonstrate the changes in movement characteristics, to protect the privacy of the students, the dancers in the experimental group were numbered as A1, and the students in the control group were numbered as B1~B5. The center of mass data were only taken from the middle three phases of the data to be interpolated and standardized, and the method of finding out the mean value was used to derive the data, which were used to further analyze the center of gravity of the body rhyme training of Chinese classical dance in the horizontal direction, the anterior-posterior direction and vertical direction change trend characteristics.

4.1.1 Trend of Changes in the Center of Gravity of Chinese Classical Dance Body Rhythm Training

Since the classical Chinese dance body rhyme training movement belongs to the center of gravity movement category of technology. And under normal circumstances, the dance movement is mostly in the horizontal direction to turn over and move, therefore, in the horizontal direction, the coordinates should converge to the horizontal straight line state, which indicates that the center of gravity of the movement is better controlled in the horizontal direction, and the movement is more uniform. Horizontal center of gravity coordinates change as shown in Figure 1, excellent dancer A1, student B2 two horizontal center of gravity coordinates and straight line state is closest to the center of gravity coordinates change fluctuation amplitude is relatively small, indicating that the two horizontal center of gravity control is better, the body control ability and ontological sense of the balance is stronger.

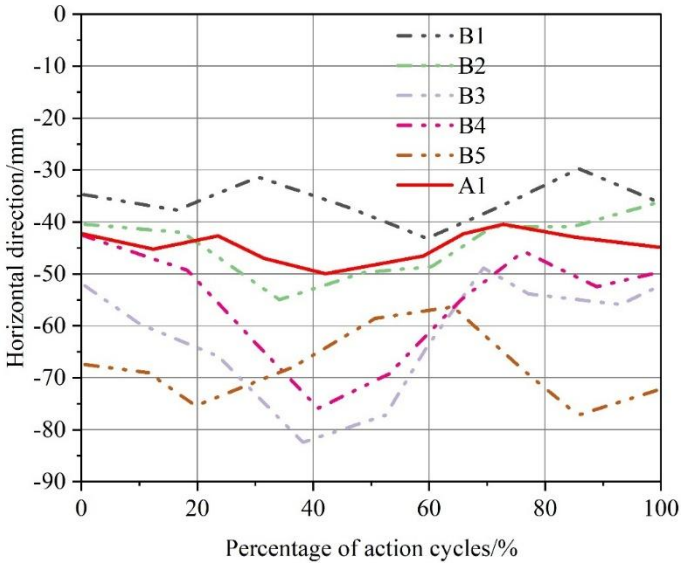

Figure 1: Horizontal direction

The coordinate changes of the center of gravity in the forward and backward directions are shown in Figure 2. Among all the subjects, except for the excellent dancer A1, the other five subjects had unstable centers of gravity in the early part of the smooth phase, and the coordinate changes in the forward and backward directions were in the trend of gradual increase. Excellent dancer A1, in the middle stage, the center of gravity in the forward and backward directions was more stable than the other subjects, although there were some fluctuations, but the fluctuation amplitude was relatively small. The center of gravity in the forward and backward directions was always at a relatively high level, with a large peak value, which also indicated that the amplitude of the movements in the left and right side lifting, stooping and chest tilting phases was relatively large, but the state of the technical movements was smooth.

Dancer A1 subjects had high values at the initial stage, indicating that the center of gravity could fall forward sufficiently on the anterior lateral support foot. Moreover, the relocated center of gravity could be adjusted back at a later stage, indicating the ability to make adjustments after realizing the problem of the forward shift of the center of gravity, which indicates proprioception as well as a good perception of one's overall positional awareness.

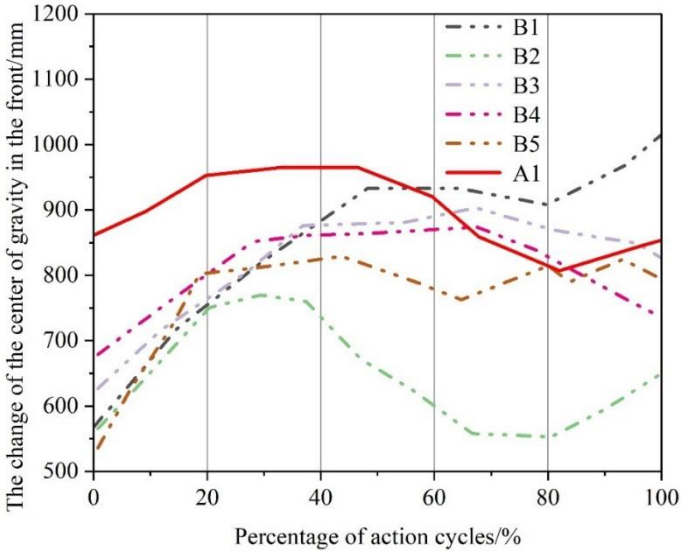

Figure 2: The change of the center of gravity in the front

The change of the coordinates of the center of gravity in the vertical direction is shown in Fig. 3. The movements of classical Chinese dance body rhythm training belong to the continuous periodic movements, so the trend curves of the change of the center of gravity of all subjects in the vertical direction are all periodic curves, and the difference of the values of the center of gravity of all subjects except the excellent dancer A1 did not change much. Except for the excellent dancer A1, the change of the center of gravity in the vertical direction was more clear and obvious compared with the other subjects, and the peak value of the change of the center of gravity curve was obviously higher, which indicated that the amplitude of her movement was the largest.

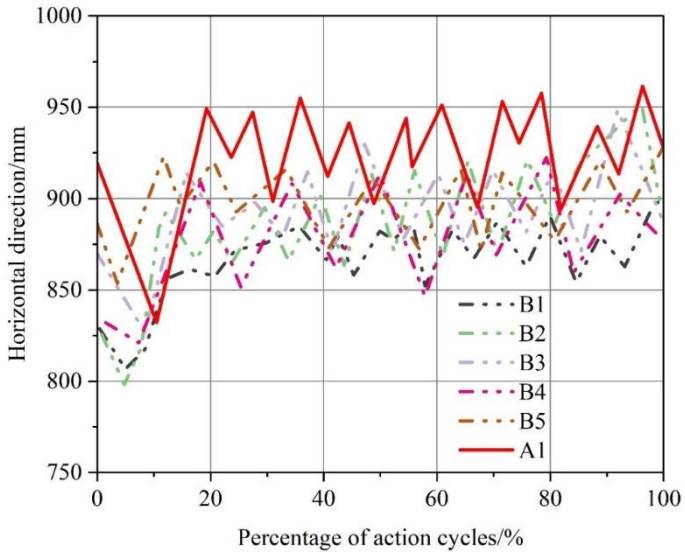

Figure 3: The vertical direction of the center of gravity

4.1.2 Trends in the Speed of Change of the Center of Gravity in Chinese Classical Dance Body Rhythm Training

Based on the five sets of raw data measured by each subject, the middle three stages were taken and interpolated and normalized to obtain the processed mean value of data for each subject. Based on the mean data of the subjects, the center of gravity velocity changes in the horizontal, anterior-posterior and vertical directions were obtained, and further the comparison plots of the center of gravity velocity changes in different directions were obtained. The maximum and minimum values and the list of standard deviations were also obtained based on the five sets of raw data measured by each subject, which were analyzed and compared.

Based on the interpolated mean data, the comparison of center of gravity velocity change in the horizontal direction was obtained as shown in Figure 4. Also according to the analysis and organization of the original data, the analysis of the center of gravity velocity in the middle horizontal direction was obtained as shown in Table 1.

Excellent dancer A1, in the horizontal direction of the movement, the center of gravity velocity curve is the most regular. In the first 60% of the action cycle, the center of gravity speed change is almost always in the 190-320mm/s range up and down, indicating that the center of gravity speed change is relatively smooth, and the speed is more average. And the center of gravity speed of excellent dancers A1 is in the form of regular waves, which can clearly see the beginning and end of the movement, indicating a better mastery of the technical rhythm of the movement.

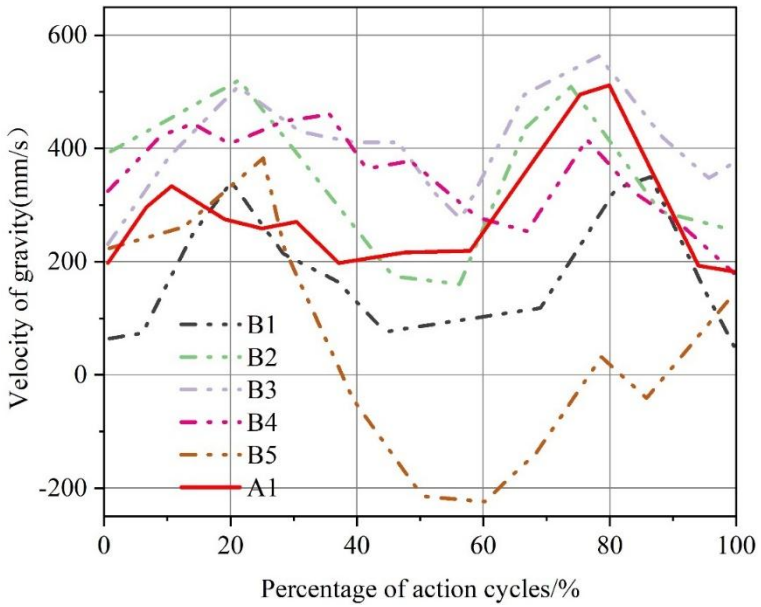

Figure 4: The comparison of the velocity of gravity in the horizontal direction

Table 1: The velocity analysis of horizontal direction

Subject number	Maximum (mm/s)	Minimum (mm/s)
A1	503.42±41.11	190.53±43.12
B1	325.63±49.40	40.35±86.23
B2	180.45±84.63	510.33±47.12
B3	220.21±45.51	580.14±56.58
B4	190.89±76.52	470.12±36.44
B5	380.56±67.78	220.44±48.51

According to the mean value data after interpolation, the comparison of the center of gravity velocity change in the front and rear directions is obtained as shown in Fig. 5. Also according to the original data analysis and collation, the analysis of the center of gravity speed in the forward and backward direction is obtained as shown in Table 2.The difference between the extreme value of the speed change of A1 and B2 is 254.55mm/s and 289.92mm/s, respectively, which indicates that the time of changing the center of gravity of the two is faster. Excellent dancer A1 in the forward and backward direction, the center of gravity speed change is the most regular, can be clearly seen in each action stage of the change cycle, in all subjects, the cycle change is the smallest, indicating that when it dances, the center of gravity change in the forward and backward direction is faster, which indicates that the time of changing the center of gravity of both feet alternately is fast.

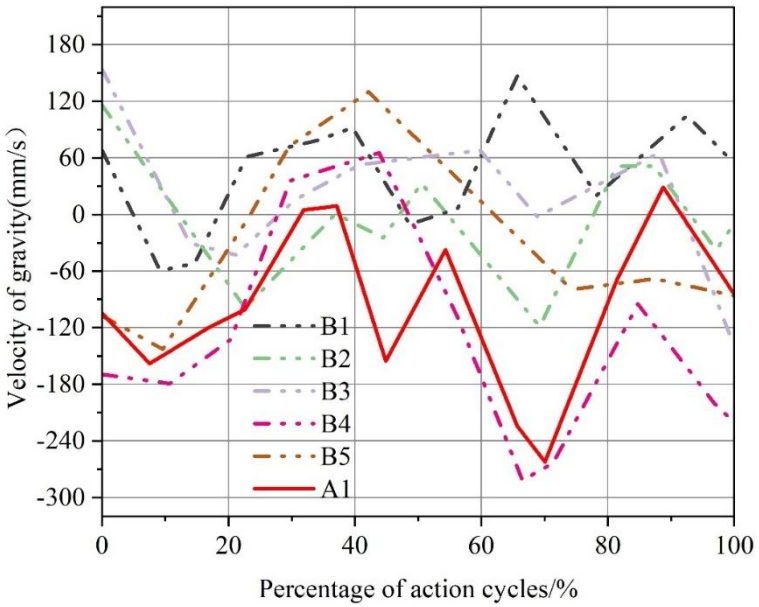

Figure 5: The velocity of the center of gravity is changing

Table 2: The velocity analysis of the front rear

Subject number	Maximum (mm/s)	Minimum (mm/s)
A1	280.31±42.12	25.76±1.56
B1	165.72±53.82	16.21±29.61
B2	293.15±74.44	3.23±2.05
B3	233.28±84.45	5.46±9.13
B4	202.93±53.45	1.27±1.82
B5	230.65±48.24	0.81±2.24

According to the mean value data after interpolation, the comparison of the change of center of gravity velocity in the vertical direction is obtained as shown in Fig. 6. Also based on the analysis and organization of the raw data, the analysis of the center of gravity velocity in the vertical direction was obtained as shown in Table 3. The trend curves of center of gravity velocity change in the vertical direction of all subjects are approximately the same. The maximum and minimum values of the excellent dancer A1 in the vertical direction are the extremes of the maximum and minimum values, and the maximum and minimum values are 711.91 mm/s and 9.63 mm/s, respectively, which indicate that their center of gravity transition speed is faster and the quality of their movements is higher.

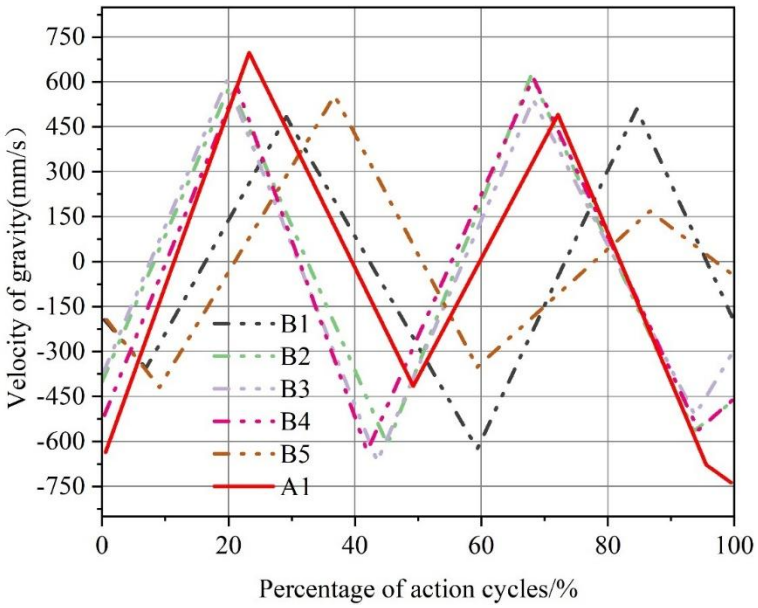

Figure 6: The vertical direction of the center of gravity is changing

Table 3: The vertical direction of the center of gravity is analyzed

Subject number	Maximum (mm/s)	Minimum (mm/s)
A1	711.91±34.55	9.63±6.71
B1	660.46±39.45	12.75±9.52
B2	726.33±61.25	10.31±12.23
B3	584.15±102.78	1.25±0.94
B4	799.03±105.26	8.63±15.14
B5	692.15±78.41	40.44±12.75

4.2 Trends of the coordinates of the head apex in Chinese classical dance body rhythm training

4.2.1 Trends in the coordinates of the vertex of the head in the forward and backward directions

Comparison of the trend of the subjects' head apex point changes in the forward and backward directions yielded a comparison of the trend of head apex point coordinate changes in the forward and backward directions as shown in Figure 7. Excellent dancer A1 has the smallest change in the head apex point coordinates in the forward and backward directions relative to all other specialization students, and has been fluctuating with a very small amplitude from about the first 80% of the cycle of the movement. This indicates that there are small fluctuations in the front and back of the head apex point, the center of gravity is relatively smooth, and there are only very small fluctuations in the head apex point from the beginning of the start-up phase to the middle smooth phase.

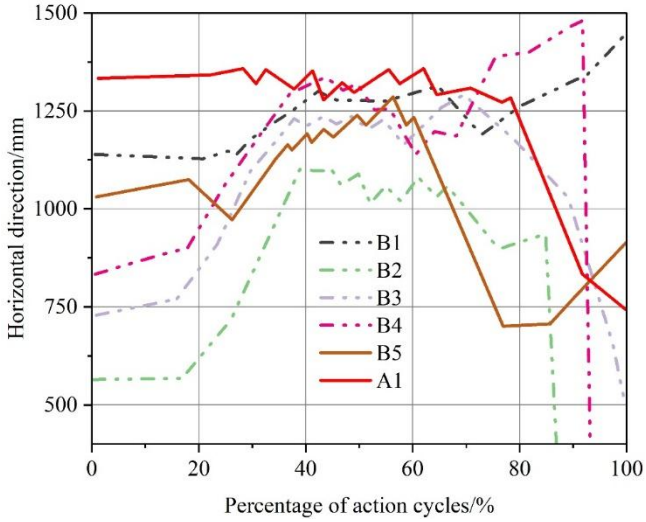

Figure 7: The direction of the position of the head

4.2.2 Trends in the coordinates of the vertex of the head in the vertical direction

Comparison of the trend of the subjects' vertex of the head in the vertical direction, we get a comparison of the trend of the change of the vertex of the head coordinates in the vertical direction as shown in Fig. 8. Excellent dancer A1, from the beginning of the start-up phase to the later smooth phase, the fluctuation of the change in the vertical direction of the top of the head fluctuates the least, and there is no large-scale change in the trend of the curve, which indicates that from the start-up phase to the later smooth phase of the movement, the top of the head fluctuates less, and the control of the center of gravity is the smoothest among all the subjects, there is no large-scale movement of the center of gravity, and the head turn is smooth and fluent. For the other subjects, there was a large difference between the vertical direction coordinates of the vertex of the head in the first 40% of the horizontal coordinate movement cycle and the vertical direction coordinates of the vertex of the head when entering the smooth dance movement phase.

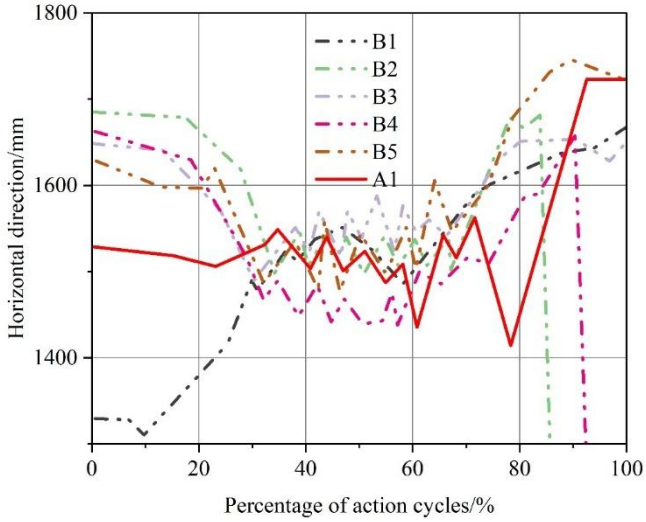

Figure 8: The vertical direction of the vertical direction

4.3 Stabilizing effects of body rhythm training in classical Chinese dance

After a 13-week training of 15 students in the experimental group in classical Chinese dance

body rhyme, as well as pre-test and post-test ability tests for the two groups of students in the experimental subjects, the tests included core stability test and balance stability test, as well as the test of specific movements of classical dance. The core stability test indexes were selected: time-limited sit-ups, plank support, and Teaser movements. For the balance stability test, static balance: one-legged stand with eyes closed, foam axis stand, and dynamic balance: Swiss ball walk and pause, turn around and walk in a straight line. The test movements for specific classical dance movements were based on the subjective evaluation of the students' performance in the classical dance basic training class and the subjective evaluation of the professional teachers, in addition to the single-leg relevepassé and the measurement of straddle opening strength. Then, statistics and comparisons were made between the pre-test and post-test body measurements of the two groups of students. (Note: the difference between post-training and pre-training is generally significant ($p \leqq 0.1$); the difference between post-training and pre-training is comparatively significant ($p \leqq 0.05$); the difference between post-training and pre-training is highly significant ($p \leqq 0.01$)).

Table 4 and 5 show the results of paired t-test for the training group and control group, respectively. The indicators of the experimental group before and after the experiment show p-value <0.01, with highly significant difference, while the indicators of the control group before and after the experiment show 5 of them have no significant difference, 3 of them have p-value ≤0.1, which is comparatively significant, and 1 of them has p-value ≤0.1 with general significance. The two tables can show that the difference of core stability and balance stability before and after the experiment of the control group is not obvious, and the individual indexes have been improved but the effect is not ideal, while the core stability and balance stability of the students in the training group have been significantly improved, so the training of the classical Chinese dance body rhyme has a certain efficacy on the core stability and balance stability of dancers, and it has a positive effect on the enhancement of the dancers' body stability. The

In the post-experimental test of the control group, part of the test indexes showed no significant difference with those tested before the experiment, while some of the test indexes showed different degrees of improvement, which is a normal phenomenon. Because the students in the control group also carried out regular body coordination training as usual during this period, and were able to improve their own abilities to a certain extent, but because the body functions of dance majors are able to adapt to this regular body coordination training faster, when the amount of training fails to reach a certain height, it is not possible to produce enough stimulation and load on the body's muscles, and then all the abilities of the organism will arrive at a “bottleneck”, stopping or hindering the development of students' abilities.

Table 4: The test index was compared before and after the experimental group

Index test (n=15)	Preexperiment	After the experiment	P value	
The tablet supports (s)	105.5±56.32	233.65±78.32	0.000	P<0.01
One minute sit-ups (s)	39.1±6.62	51.00±9.22	0.005	P<0.01
Teaser (s)	67.12±30.23	141.2±27.3	0.000	P<0.01
Swiss polo step support (s)	16.52±22.92	110.2±81.5	0.001	P<0.01
The foam shaft stands on his legs (s)	22.12±19.11	192.2±64.1	0.000	P<0.01
Stand up (s)	41.62±22.02	122.46±67.44	0.002	P<0.01
Releve single leg (s)	16.25±10.32	21.73±8.52	0.001	P<0.01
Walk 30 circles straight (cm)	-133.1±47.63	-20.95±19.42	0.000	P<0.01
Crotch (cm)	73.15±5.41	92.43±3.62	0.000	P<0.01

Table 5: The control group was trained before and after the training

Index test(n=15)	Preexperiment	After the experiment	P value	
The tablet supports (s)	130.25±39.12	170.42±97.65	0.154	No significant difference
One minute sit-ups (s)	42.26±5.92	42.81±5.71	0.875	No significant difference
Teaser (s)	82.12±29.71	96.84±27.75	0.083	p≦0.1
Swiss polo step support (s)	27.12±20.53	36.96±24.35	0.341	No significant difference
The foam shaft stands on his legs (s)	30.23±23.05	52.81±40.25	0.053	p≦0.1
Stand up (s)	49.78±16.26	55.67±30.09	0.492	No significant difference
Releve single leg (s)	8.92±6.44	12.91±5.43	0.031	p≦0.1
Walk 30 circles straight (cm)	-36.78±44.74	-47.78±70.61	0.645	No significant difference
Crotch (cm)	79.35±8.54	86.12±5.34	0.073	p≦0.1

In Table 5 the general significant difference and the comparative significant difference in the movement Teaser (s), foam axis two-legged standing (s), hip opening (cm), and single-leg releve (s), appeared due to the fact that in the traditional body coordination training, the focus is on the training of the four limbs strength, the requirement of hip rotation outward as well as the training of the half-toeing and single-legged support movement. In the training of limb strength, the core region of the body as the fulcrum of limb strength also participates in the movement, so the strength of the core region of the muscles involved in the movement Teaser is also improved. In the traditional body coordination training, the lower limb “opening” and single leg support training is reflected in each movement, which is conducive to the ability of hip rotation and the main leg half toe ability. Foam axis two-legged standing movement is mainly a test of the static stability of the experimental subjects, static stability requires dancers to have good muscle strength, control and proprioceptive coordination to maintain, the students in the traditional body coordination training to enhance the muscle strength of the limbs, thus affecting the control of their own static stability. Although these test indicators were improved, the differences in the obtained data were not significant.

Table 6 shows the comparison of the differences between the indicators of the experimental group and the control group before and after the experiment, the increase value produced before and after the experiment between the training group and the control group has a big difference, and the increase value before and after the training of the experimental group is obviously larger than that of the control group, especially the time of standing on both legs of the foam axis, the control group only increased by 22.58s, and the experimental group's increase was 170.08s, which shows that the body rhyme training of the Chinese classical dance is able to have an effect on the dancers' body stability during the traditional body coordination training can significantly improve the body stability of dancers in traditional body coordination training, which has a positive effect.

Table 6: The difference between the group and the control group

Index test (n=15)	Experimental group			Control group		
	Pre-test	Pro- test	Added value	Pre-test	Pro- test	Added value
The tablet supports (s)	105.5±56.32	233.65±78.32	128.15	130.25±39.12	170.42±97.65	40.17
One minute sit-ups (s)	39.1±6.62	51.00±9.22	11.9	42.26±5.92	42.81±5.71	0.55
Teaser (s)	67.12±30.23	141.2±27.3	74.08	82.12±29.71	96.84±27.75	14.72
Swiss polo step support (s)	16.52±22.92	110.2±81.5	93.68	27.12±20.53	36.96±24.35	9.84
The foam shaft stands on his legs (s)	22.12±19.11	192.2±64.1	170.08	30.23±23.05	52.81±40.25	22.58
Stand up (s)	41.62±22.02	122.46±67.44	80.84	49.78±16.26	55.67±30.09	5.89
Releve single leg (s)	16.25±10.32	21.73±8.52	5.48	8.92±6.44	12.91±5.43	3.99
Walk 30 circles straight (cm)	-133.1±47.63	-20.95±19.42	112.15	-36.78±44.74	-47.78±70.61	-11
Crotch (cm)	73.15±5.41	92.43±3.62	19.28	79.35±8.54	86.12±5.34	6.77

4.4 The Role of Body Coordination in Classical Chinese Dance Body Rhythm Training

The mean values of the two groups' movement coordination abilities before the experiment were 0.14 and 0.09, respectively, and the one-way ANOVA showed that the P-value = 0.935 > 0.05. It indicated that there was no significant difference in the movement coordination abilities of the 30 students who participated in the experiment before the experiment began. There was also no significant difference in the students' motor coordination ability between the groups, indicating that the group sample distribution of this group control experiment was reasonable and the results were reliable.

Analyzing the differences in motor coordination ability. This analysis can help us determine the changes in movement coordination ability before and after the experiment and assess the validity of the experiment. By comparing the results of the pre- and post-tests, we can understand whether the experiment was able to significantly improve the subjects' motor coordination ability. In conclusion, the pre and post-test paired samples t-test is an important data analysis method that can help us gain insight into the effectiveness of the experiment. The results are shown in Table 7.

In this experiment, we observed that there was an improvement in both movement coordination abilities. In addition, we performed statistical analysis and found that the magnitude of improvement was significantly different between groups. This indicates that both conventional body coordination training and classical Chinese dance body rhyme training have a positive effect on dancers' movement coordination ability. In conclusion, the results of this experiment show that both of these programs can be used as an effective method to improve dancers' movement coordination ability.

Table 7: Action coordination ability matching sample t test

Sample pairing	Group	X±S	t	df	P
Pre-Pro test	Experimental group	11.06±2.37	20.25	11	0.00
	Control group	7.94±2.74	11.98		0.00

Paired-sample t-tests were conducted before and after the experiment on the three dimensions of coordination ability in each group, and the results are shown in Table 8. The results show that before and after the experiment, the two groups of students have improved to some extent in the three dimensions of balance ability, rhythmic ability and reaction ability. The balance ability of the experimental group and the control group before and after the experiment improved by 12.9 and 10.51, respectively, and through statistical analysis, it was found that the differences between different groups were significant in these ability dimensions. This implies that these programs not only have a positive impact on the overall coordination ability of the students but also have a meaningful impact on different dimensions. Therefore, both body coordination training and Chinese classical dance body rhyme training are effective ways to improve children's movement coordination ability.

Table 8: Coordination ability 3d matching sample t test

The experimental group	Balancing ability	Rhythmic ability	Response ability
Pre-experimental experimental group	14.68±2.05	31.56±2.35	6.32±1.02
After experimental group	27.58±1.75	26.56±2.14	9.85±1.35
Difference	0.00	0.00	0.00
Pre-experimental control group	14.85±2.12	30.85±2.79	6.12±1.03
The control group was after the experiment	25.36±1.65	26.67±1.94	8.79±1.55
Difference	0.00	0.00	0.00

The two groups differed on the three dimensions of coordination ability after the experiment, and multiple comparisons were conducted to further explore the source of the differences. The comparison results are shown in Table 9. After the experiment, there was a significant difference between the experimental group and the control group ($P < 0.05$), indicating that the dancers' balance enhancement effect was more effective than the traditional body coordination training through the classical Chinese dance body rhyme training.

Table 9: Coordination capability

Coordination ability dimension	Mean difference	P
Balancing ability	3.112	0.000
Rhythmic ability	3.114	0.000
Response ability	1.623	0.003

5 Conclusion

In this study, the effect of classical Chinese dance body rhyme training on the improvement of dancers' physical coordination was taken as the research purpose, and a total of 30 students of 2020 grade of a college in province A, majoring in dance performance, were selected as the experimental subjects and equally divided into two groups. Mathematical statistics method, hypothesis testing and other methods were used to process and analyze the experimental data.

The following conclusions were drawn through the comprehensive study.

(1) Dancers who have undergone standardized classical Chinese dance body rhythm training show significant cover on multiple dimensions. Excellent dancer A1 maintains the speed of his center of gravity in the interval of 190-320mm/s in the first 60% core phase of the movement cycle, which is a regular wave-shaped change, indicating that he moves at a uniform speed, reflecting his precise grasp of the inherent rhythms of classical Chinese dance dance movements and his excellent sense of rhythmic control of the body. This reflects his precise grasp of the rhythm inherent in classical Chinese dance movements and his excellent sense of rhythmic control. By analyzing the coordinates of the center of gravity, speed changes and head stability in the three directions, dancer A1 showed comprehensive control ability, which initially confirmed the positive effect of the classical Chinese dance body rhythm training on the improvement of dancers' body coordination.

(2) The 13-week targeted classical Chinese dance body rhythm training experiment showed that, through the comprehensive training of core stability, balance and specific movements of classical dance, the experimental group students made significant progress in all the indexes of body stability, especially in the foam axis double-legged standing time, the experimental group students compared with the control group students in the foam axis double-legged standing time increased by 147.5 s. The experimental group students' body rhythm training was also shown to have a positive effect on dancer A1's body coordination. This confirms that the body rhythm training of classical Chinese dance can effectively improve the dancers' body control ability, which is an effective way to rapidly improve the technical level of student dancers.

(3) Before the experiment, there was no significant difference in the students' movement coordination ability ($p=0.935$), and after the experiment, although both groups improved, the experimental group showed a significant difference between the control group and the experimental group in their movement coordination ability, especially in their balance ability ($p=0.000$), and this result strongly confirms that the classical Chinese dance body rhythm training is more effective than the traditional physical coordination training is more effective.

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