Methodology for developing the technical skills of students with disabilities through wheelchair basketball

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Abstract

This article explores the development of technical skills in students with disabilities through wheelchair basketball training sessions. It also examines exercise benchmarks, total workload volume, and other methodologies by implementing a model weekly training plan. The participants' technical proficiency was assessed using selected tests at the beginning and end of the study, revealing significant improvements in the athletes' technical readiness. The findings confirm that wheelchair basketball is an effective means of enhancing the physical activity and athletic fitness of individuals with disabilities.

Keywords: wheelchair basketball, people with disabilities, technical training, tactical training, adaptive sports, model plan, physical activity, inclusive education, dribbling, sports pedagogy.

Introduction

Today, broadly engaging people with disabilities in sports, increasing their physical activity, and ensuring their social integration are key priorities of state policy. Wheelchair basketball serves as an effective tool for developing the physical fitness and technical skills of female athletes with disabilities. During the game, maneuvering the wheelchair, moving quickly, changing direction, and executing technical skills accurately require a high degree of dynamic balance. However, there is a lack of scientific research specifically focused on developing technical skills among the various aspects of training for students with disabilities and studying its impact. Therefore, developing and implementing effective methods for building the general, special, technical, tactical, integral, and theoretical preparedness of students with disabilities remains one of the pressing issues in this field.

Methods

The study utilized an analysis of scientific and methodological literature, pedagogical observation, pedagogical tests designed to assess technical readiness indicators, a pedagogical experiment, and mathematical-statistical analysis to process the obtained results.

Results and discussion

The study was conducted with the participation of wheelchair-using students with disabilities. During the research, a pedagogical experiment was carried out to assess and improve the participants' technical readiness indicators. In organizing the study, relevant domestic and foreign scientific and methodological literature, research articles, dissertations, and methodological guides were reviewed and analyzed. This made it possible to establish the theoretical framework of the study and examine existing scientific perspectives.

Throughout the study, pedagogical observation was used to monitor the participants' motor activity, the execution quality of technical skills, and their balance during training sessions. Additionally, the participants' baseline and final indicators were determined through pedagogical testing (Table 1).

The main part of the study is conducted using the pedagogical experiment method. In this process, participants are divided into an experimental group (EG) and a control group (CG). The experimental group follows a specialized wheelchair basketball training program aimed at developing dynamic balance, while the control group undergoes training based on a traditional program. The data obtained during the study are processed using mathematical and statistical methods to determine mean values, percentages, and statistical significance, followed by a comparative analysis between the groups.

According to the data in Table 1, a comparison of the technical readiness indicators of students with disabilities in the control and experimental groups at the beginning of the peda-

Table 1. .Baseline results of the pedagogical experiment for tests assessing the technical preparedness of students with disabilities in the experimental group (n=12)

No.	Test	Control group			Experimental group		
		$\bar{X}$	σ	V, %	$\bar{X}$	σ	V, %
1	Speed of moving in a sports wheelchair over an 11-meter short distance (seconds)	10,57	1,90	17,97	10,28	1,81	17,60
2	Number of mid-range shots made into the basket (out of 10 attempts)	5,58	0,95	16,98	5,67	0,94	16,59
3	Throwing the ball at the backboard for 15 seconds (number of times)	10,83	2,06	18,97	11,18	2,08	18,61
4	Number of two-handed chest passes to a partner at a distance of 3 meters in 30 seconds	20,93	3,76	17,95	21,33	3,76	17,62
5	Free-throw shooting accuracy (out of 10 attempts)	3,08	0,49	15,96	3,00	0,47	15,60
6	15×2 meter wheelchair dribbling shuttle time (seconds)	31,18	5,29	16,97	30,73	5,10	16,59

Note: *$\bar{X}$ – arithmetic mean; σ – standard deviation; V – coefficient of variation (%).*

gogical experiment revealed that their initial results were closely aligned across most tests. This indicates that at the outset of the study, there were no significant differences in the groups' technical readiness levels, confirming that the baseline conditions for conducting a comparative pedagogical experiment were sufficiently uniform.

In the 11-meter short-distance sports wheelchair speed test, the average time was 10.57±1.90 seconds for the control group and 10.28±1.81 seconds for the experimental group. Since a lower time in this test reflects a higher speed, the experimental group's performance was slightly superior to that of the control group. The difference between the groups was **0.29 seconds (2.74%) **, demonstrating the close proximity of their indicators at the initial stage.

In the test assessing the number of mid-range shots made into the basket, the control group averaged 5.58±0.95 shots, while the experimental group averaged 5.67±0.94. The experimental group's result exceeded that of the control group by 0.09 shots, representing a relative difference of **1.61%**. These figures demonstrate that the shooting accuracy and technical skills of both groups were developed to nearly the same level at the initial stage.

In the 15-second backboard rebound test, the control group recorded a result of 10.83±2.06 throws, compared to 11.18±2.08 throws in the experimental group. The experimental group's score was higher by 0.35 throws (3.23%). This minor difference indicates a similar level of initial technical preparedness between the groups.

In the test involving a two-handed chest pass to a partner 3 meters away for 30 seconds, the average result was 20.93±3.76 passes in the control group and 21.33±3.76 passes in the experimental group. The experimental group showed a higher performance by 0.40 passes (1.91%). Furthermore, the identical standard deviation of 3.76 in both groups indicates that the dispersion of individual results is also close-

Table 2. Sample weekly training plan for student wheelchair basketball players with disabilities

Day of the week	Type of training	Training content	Duration
Monday	**GPT, SPT, TT, ThT**	1. Fast wheelchair movement at standard maximum speed (15, 20, 25 meters). 2. Forward-backward and lateral movement across the 3, 6, and 9 m marks. 3. Throwing the ball at the backboard while quickly changing direction (rapidly with one and two hands). 4. Understanding safety rules and technical movements.	25 minutes 30 minutes 35 minutes 15 minutes **15 minutes of general rest**
Tuesday	**SPT, TacT, IT, ThT**	1. Maneuvering the wheelchair and dribbling the ball through 6–8 cones. 2. Defensive positioning (2–3 defenders positioning their wheelchairs according to the attackers' locations). 3. Using a resistance band to guide the arm motion when shooting the ball into the basket. 4. Theoretical review of the type of tactical training.	20 minutes 35 minutes 35 minutes 15 minutes **10 minutes of general rest**
Wednesday	**GPT, TT, TacT, ThT**	1. Slalom movement between 8–10 cones (focusing on turns, repeating the same movement backward). 2. Dribbling the ball with one hand while moving (maintaining a consistent pace). 3. "Attacker–Defender" 1v1 (the attacker tries to enter the designated zone while the defender blocks their path). 4. Post-session analysis after each drill.	25 minutes 30 minutes 30 minutes 20 minutes **15 minutes of general rest**
Thursday	**Recovery methods**	1. Light mobility exercises and stretching. 2. Breathing and relaxation techniques. 3. Massage and physiotherapy procedures. 4. Analysis of the week's training and individual consultations.	30 minutes 30 minutes 20 minutes 20 minutes **10 minutes of general rest**
Friday	**GPT, SPT, TT, TP**	1. Wheelchair acceleration and braking (5-meter acceleration followed by a sudden stop). 2. 20 m dribbling sprint (covering the distance at speed while controlling the ball). 3. Two-handed chest pass to a moving teammate (right-left). 4. Identifying and analyzing mistakes, and working on new tactics.	20 minutes 35 minutes 40 minutes 20 minutes **10 minutes of total rest**
Saturday	**SPT, Tac, IP, TP**	1. 30-second repeated sprints (repeating acceleration, turning, and braking). 2. 1v1 change of direction, defender blocking the attacker. 3. Technical drills with and without the ball tailored to the athlete's physical capabilities. 4. Gym equipment exercises to increase arm and leg strength. 5. Automating psychological and technical-tactical skills.	15 minutes 35 minutes 30 minutes 30 minutes **10 minutes of total rest**
Sunday	**Rest**	Full rest, recovery, and individual rehabilitation activities (if necessary).	–

Note: *When allocating hours from the model annual training plan, the model plan developed for organizing two-week training sessions clearly defines the timing and types of exercises to enhance the comprehensive preparation of athletes. SPT - special physical training, GPT - general physical training, TT - technical training, TacT - tactical training, IT - integral training, ThT - theoretical training.*

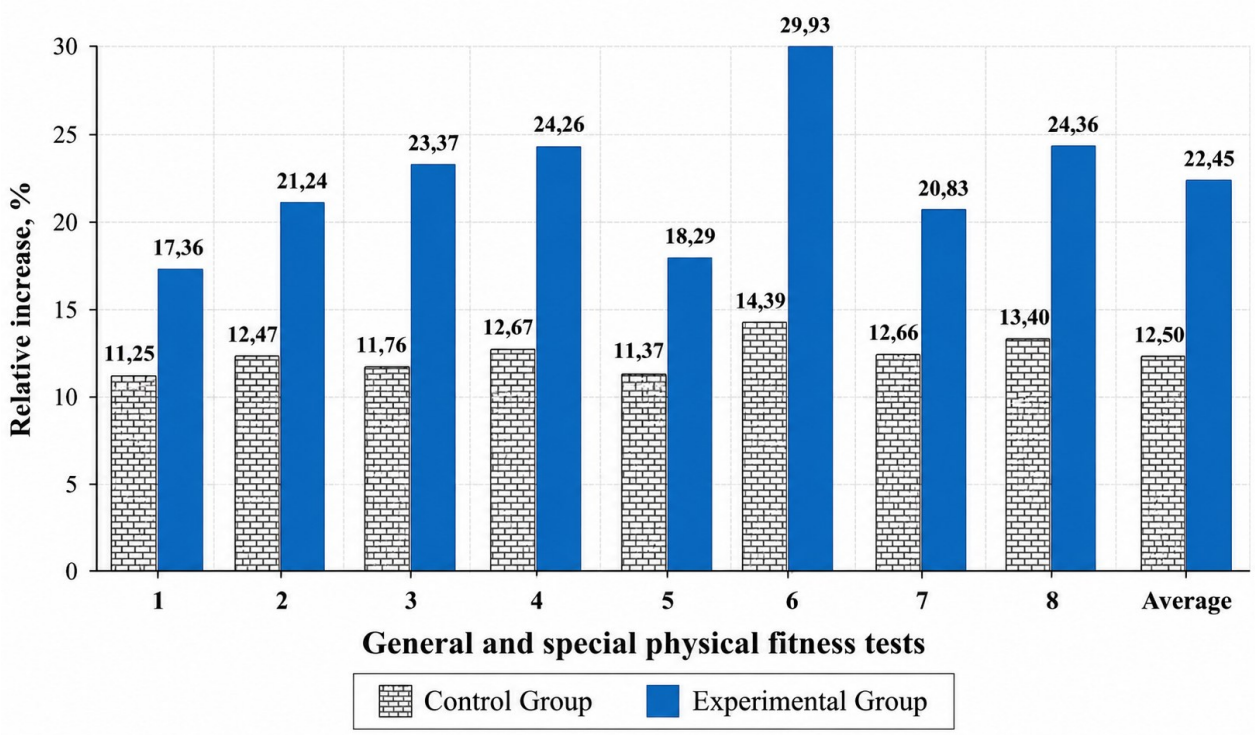
ly aligned.

In the half-court shooting accuracy test, the average result was 3.08±0.49 successful shots in the control group and 3.00±0.47 in the experimental group. Although the control group's result was 0.08 shots (2.60%) higher in this metric, the difference between the groups was minimal, confirming the similarity of their baseline fitness levels.

In the timed 15×2-meter wheelchair shuttle dribbling test, times of 31.18±5.29 seconds and 30.73±5.10 seconds were recorded for the control and experimental groups, respectively. A lower time indicates higher movement speed and more efficient execution of the dribbling technique. In this respect, the experimental group's result was 0.45 seconds (1.44%) better than that of the control group.

Furthermore, the coefficient of variation (V) values across all tests ranged from 15.60% to 18.97%. These results show that while there are certain differences among the participants' individual scores, the dispersion of results within the groups is moderate. The highest variability was observed in the control group (V=18.97%) during the 15-second backboard pass test, while the lowest variability was rec-

Fig 1. Relative growth rates in the results of general and special physical fitness tests for the experimental and control groups



orded in the experimental group (V=15.60%) in the half-court shooting test.

To effectively organize the training process for student wheelchair basketball players with disabilities, a model one-week training plan was developed (Table 2). This plan is aimed at progressively distributing training loads across various areas of preparation, improving special physical and technical skills, and developing wheelchair handling skills.

The training content covered the areas of general physical training (GPT), special physical training (SPT), technical and tactical training (TT, TacT), and theoretical training (ThT). In doing so, the individual functional capabilities of the students with disabilities, the specifics of their motor activity, and the characteristics of wheelchair mobility were taken into account.

Monday's training session began with exercises focused on rapid wheelchair movement and directional control. Specifically, these included sprints at standard maximum speeds over distances of 15, 20, and 25 meters. Additionally, forward-backward and lateral movement drills were conducted over distances of 2, 3, 6, and 9 meters. These exercises helped develop wheelchair handling speed, movement coordination, and the ability to change direction quickly.

The next part of the session involved an exercise of rapidly changing direction and throwing the ball at the backboard. This drill focused on building the skill to execute technical movements while simultaneously controlling the wheelchair—that is, coordinating wheelchair movement with ball-handling techniques. The session concluded with activities aimed at internalizing safety rules and technical movements, thereby reinforcing the correct and safe execution of the actions. Designated rest intervals were observed between exercises to ensure the physical load remained at an optimal level.

Tuesday's training session focused primarily on developing specialized physical conditioning alongside technical and tactical skills. The opening segment featured a drill in which players maneuvered their wheelchairs while dribbling the ball through 6–8 cones. This exercise was designed to refine precise wheelchair handling, maintain a set trajectory, control speed, and improve ball-handling skills while on the move.

In the following drill, 2–3 defenders practiced positioning their wheelchairs appropriately in response to the placement of the attacking players. This exercise helped develop the players' ability to adapt their defense to the situation, select the right court positions, and coordinate teamwork. Additionally, an exercise using resistance bands while shooting at the basket

worked to engage the upper arm muscles, enhance ball control, and build a more consistent shooting technique.

The final part of the session was dedicated to a theoretical review of various tactical approaches. The focus here was on analyzing game situations, player positioning relative to one another during offense and defense, the sequence of plays, and rapid tactical decision-making.

Overall, this two-week sample plan was developed on the principle of integrating physical, technical, tactical, and theoretical training methods. By progressively distributing the content and volume of the training loads, the necessary pedagogical conditions were established to enhance the specific motor skills, wheelchair handling, technical and tactical preparedness, and overall game performance of student wheelchair basketball players with disabilities. Within a 120-minute training session, rest intervals of 2 to 3 minutes are allocated between exercises, depending on the athlete's level of fatigue.

As shown by the data in the chart, a significant difference was observed between the results of the control and experimental groups in both general and special physical fitness tests at the conclusion of the pedagogical experiment (Figure 1).

Specifically, in the control group, the arithmetic mean of the relative growth rates recorded across the eight tests was 12.50%. In the experimental group, however, this figure reached 22.45%, outperforming the control group by 9.95 percentage points. Furthermore, the average result of the experimental group was found to be 79.68% higher than that of the control group. This demonstrates that the specially designed training system applied in the experimental group was highly effective in improving both general and specific physical fitness indicators.

Positive trends were also observed in the experimental group across individual tests. In the experimental group, the highest growth rates were recorded in Test 6 at 29.93%, Test 8 at 24.36%, Test 4 at 24.26%, and Test 3 at 23.37%. In the control group, by contrast, the highest figures were recorded in Test 6 at 14.39%, Test 8 at 13.40%, and Test 4 at 12.67%. These results confirm that the training tools and methods utilized in the experimental group effectively enhanced the level of general and specific physical fitness, improved motor performance, and developed the physical attributes of student wheelchair basketball players with disabilities.

Conclusion

Overall, the weekly model training plan integrates general and specialized physical conditioning, technical-tactical training, and theoretical preparation, establishing the content and standards of training loads for student wheelchair basketball players with disabilities. During the training sessions, particular emphasis was placed on wheelchair handling speed, changing direction, ball movement, executing defensive and offensive maneuvers, and refining technical and tactical skills.

As a result of implementing this training system during the pedagogical experiment, the **average** relative improvement in general and specialized physical fitness tests in the experimental group reached 22.45%, compared to 12.50% in the control group. The average improvement in the experimental group was 9.95% higher than that of the control group.

Thus, putting the exercise content and load standards specified in the weekly model training plan into practice demonstrated a positive impact on the development of general and specialized physical fitness indicators in student wheelchair basketball players with disabilities. This plan can serve as a practical and methodological foundation for the training methodology developed within the scope of this study.

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