DEVELOPMENT OF PRECISION IN PEOPLE WITH DOWN SYNDROME THROUGH THE MEANS OF BOCCE

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Abstract. *Precision is a component of the coordination ability, which is necessary as a motor task for the bocce game to be practiced. This paper aims to determine and investigate the development of precision in the bocce game for athletes with Down syndrome. The research athletes performed two tests for the assessment of precision, which were taken over from the Bocce Coaching Guide, and adapted and modified by us. The tests were applied to 19 athletes who were divided into two groups: one group was made up of 11 athletes (aged 18 or less) and the other included 8 athletes (aged 19 and above). The research methods used were: documentation, experiment, statistical and mathematical method, and graphical method. After the initial test, the athletes with Down syndrome attended the lessons of the interventional programme over a period of 8 months. The exercises used were bocce-specific means and were applied in real-game conditions. The final test has highlighted that the precision required by the bocce game can be educated and developed in people with Down syndrome. The development of this ability is based on the rigorous planning of the lesson content through the selection, design and application of the bocce-specific means. This research is part of the "Sport together, active forever" project (Erasmus+ Sport Project - 590526).*

Keywords: *bocce, young people and children with Down syndrome, training sessions, precision.*

Introduction

Bocce is a type of sport where a ball is driven to a target by throwing or rolling it (Colibaba-Evuleț & Bota, 1998, p. 13). The specific motor skills used for this are simple (Pagnoni, 2010, p. 19), which makes it easier for people with intellectual disabilities to learn the game. At the same time, Pagnoni (2010, p. 56) states that time and numerous repetitions are needed to acquire precision for these skills.

Bompa (2002, p. 413) thinks that, when an athlete starts learning the specific motor skills for a sport, they must also begin the development of general motor skills, which will allow for further development of the specific motor functions. This aspect must be considered when training athletes with Down syndrome for whom the time allotted for the development of motor skills is longer (Sacks & Buckley, 2003, p. 132; Silva et al., 2017, p. 756), because their initial level is very low (Teodorescu, Bota, & Stănescu, 2007, p. 146). They will gradually consolidate and develop their motor skills (Capio, Mak, Tse, & Masters, 2017), and the coordination specific to the sport in question will allow performing them perfectly, with ease and precision (Bompa, 2002, p. 413). Pagnoni (2010, pp. 59-60) mentions that precision is much more important than the speed of the ball as it allows the athlete to get close to the pallina and get the point. Under these conditions, the hand-eye coordination is very important as it can determine success when performing motor tasks.

Bota and Prodescu (1997) claim that the more complex a movement or series of motor actions is/are, the more the coordination ability has to be developed; it is manifested through precision, economy, enhanced strength and muscle energy expenditure, delay in the onset of fatigue, harmonious and expressive movement, release of cortical control following the formation of an automated stereotype, and accident prevention.

At the same time, throwing the ball forcefully is also important. Depending on the spot where the pallina is, the position of a player's own balls onto the court surface, but also that of their opponents, the athlete must push the ball with a certain amount of strength in order for the pallina or the ball to reach the desired position. In this case, the throwing force is positively paired with coordination and allows the athlete to perform the specific movement in a more relaxed manner and with less energy expenditure (Bompa, 2002, p. 414).

When planning the content, the specific methodology for the development of coordination skills must be observed, which requires addressing them in the first lesson, in the context of a well-rested central nervous system. The test conducted by Alderman (1965) has shown that the onset of severe fatigue during the practice period causes a decrease in movement speed and precision (movement precision is lower by 40%), but the amount of learned movements is not influenced.

Methodological aspects regarding the development of coordination skills were studied by Farvel (quoted by Marcu & Chiriac, 2009, p. 156), who divided coordination-building exercises into three groups:

- level I: exercises characterised by high-precision movements, but where speed is not relevant;

- level II: exercises that involve performing precise movements within a specified period of time;
- level III: exercises where the level of coordination requires the ability to perform high-precision movements in a short period of time and under various conditions.

Material and Methods

Subjects

The study involved 19 athletes with Down syndrome, namely 11 children and 8 adults. Of them, 9 were female and 10 were male.

The research took into consideration the provisions of the WMA Declaration of Helsinki (2013) regarding the ethical principles for the studies conducted on human subjects.

Research methods

For this study, we used:

- the documentation method – which allowed us to review issues related to learning and enhancing the bocce-specific motor skills and their adaptation to athletes with Down syndrome;
- the experiment method – which facilitated the application of the precision tests used. They were taken from the *Bocce Coaching Guide* (Special Olympics, 2006), and adapted and modified by us (2018). The athletes roll the balls down the court towards the coloured rectangle (the rectangle = 25 A4 coloured sheets of paper). The ball must cross the centre court line and stop inside the coloured rectangle. When releasing the ball, the athletes must not cross the start line. They have two attempts for every two coloured rectangles. The teacher or volunteer writes down if the ball stops inside the rectangle and awards 2 points if it stops inside the rectangle and 1 point if the ball is not inside it. The first rectangle, on the right side of the court and in the direction of the athlete's gaze, is placed 1.50 m up from the centre court line. It is 1 m away from the board up to the side board. The second rectangle is placed before the opposite start line, on the left side of the court and in the direction of the athlete's gaze. It is 1.50 m away from the left side board and 1 m down from the opposite start line. The tests described were performed in March 2018 (initial testing) and in December 2018 - January 2019 (final testing);
- the statistical method – which allowed us to interpret the available data using significant indicators;
- the graphical method – which allowed us to graphically express the results obtained by the tested athletes.

Intervention programme

The intervention programme consisted of training classes focused on the learning and consolidation of the bocce-specific skills.

The lessons took place once per week over 8 months (March-June and September-December 2018). During this period, multiple variables influenced the course of the classes: legal holidays, school schedule for certain athletes (those under 18 were included in special-school classrooms for mentally disabled children), other activities of the association whose members they were, availability of parents or other family members to bring them to the training classes, etc.).

The classes followed the sequences of sports training and used various means that increased the interest of the athletes (Table 1). We should mention that some means used during the classes cannot be classified within the aspects taken into consideration for assessing precision: familiarisation with the ball, ball release, movement direction of the ball, and precision of throwing.

Table 1. *Bocce-specific means used during the 21 classes of the intervention programme*

Familiarisation with the ball* (F)	Throwing (T)	Direction (D)	Precision (P)
F1 – passing the ball from one hand to the other from standing with arms bent and hands at chest level F2 – rotating the ball around different body parts from standing F3 – carrying the ball in the palm F4 – rotating the ball around different body parts while moving F5 – who can stand longer while holding the ball in their hand F6 – who can stand longer on one foot while rotating the ball around the waist F7 – passing the ball from one person to the next, from hand to hand F8 – rolling the ball on the ground	T1 – learning the throw position T2 – imitating the throw position T3 – throwing the ball towards a pole placed 3 m away T4 – who gets 10 points first (each athlete throws 2 times, then moves to the rear of the end line) T5 – distance throw T6 – throwing the ball from one person to the next, the distance between partners being different, as well as the formation in which they practice T7 – throwing the ball followed by movement T8 – rolling the ball on the ground, rounding a pole, throwing the ball towards a partner	D1 – throwing the ball towards a fixed target D2 – throwing the pallina D3 – throwing the ball towards the pallina placed 3 m away from the start line D4 – throwing the ball towards the pallina placed in the centre court D5 – throwing the ball towards the pallina placed between the centre court line and the opposite start line D6 – throwing the ball from one person to the next, the athletes standing in a circle; the direction in which the ball is thrown is switched at an order; the number of direction switches is counted	P1 – throwing the ball through a hurdle placed at a given distance (2 m, 5 m, 7 m) P2 – throwing the ball through a series of hurdles placed at a given distance P3 – throwing the ball towards a fixed point placed at a given distance (different distances) P4 – throwing the ball by a team towards a fixed point placed at a given distance P5 – throwing the ball to the team captain P6 – throwing the ball in a shuttle run

The content of each training class is presented in Tables 2, 3 and 4. We should mention that classes 1-12 took place in March-June 2018, and classes 13-21, in September-December 2018.

Table 2. *Allotment of exercises for classes 1-7*

Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
P1 x 4	O1 x 8	O1 x 5	O1 x 10	D2 x 4	L5 x 12	D5 x 10
P2 x 2	D1 x 8	L4 x 8	O2 x 26	D5 x 4		
O1 x 8	L1 x 5		O4 x 6			
O3 x 8	L3 x 10		O5 x 2			
D1 x 5			O6 x 2			
			D2 x 6			
			D3 x 3			
			D4 x 4			
			D5 x 3			

Table 3. *Allotment of exercises for classes 8-14*

Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Class 14
P3 x 3	P3 x 10	L6 x 12	P3 x 5	P3 x 18	O2 x 8	O2 x 12
P1 x 10	D6 x 4	P3 x 12	L6 x 26		P5 x 14	O7 x 4
P4 x 5					L6 x 20	L6 x 16
					L7 x 24	P5 x 6
						L7 x 10
						P6 x 10

Table 4. *Allotment of exercises for classes 15-21*

Class 15	Class 16	Class 17	Class 18	Class 19	Class 20	Class 21
O2 x 4	O1 x 6	O7 x 4	P5 x 2	P5 x 10	L6 x 14	L6 x 6
O4 x 5	O2 x 4	O2 x 4	L8 x 15	P6 x 10	L9 x 2	P7 x 4
L6 x 12	O8 x 2	O8 x 4	P4 x 10	P4 x 8	P6 x 15	P6 x 8
L7 x 2	L6 x 12	L6 x 4		L6 x 12		P8 x 8
	P5 x 30	L8 x 8				P5 x 2
	P6 x 8	P6 x 4				

The number of repetitions performed by each athlete for each aspect of interest is shown in Figure 1.

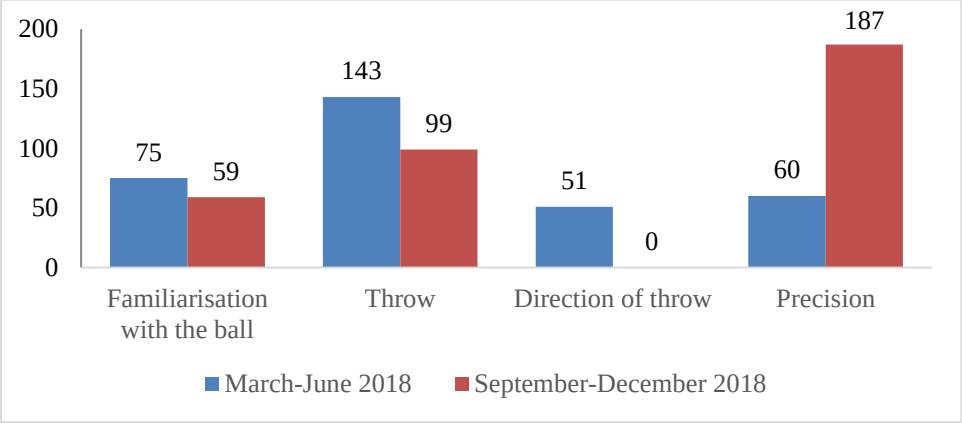

Figure 1. Number of repetitions for specific means

Results

The results obtained by the 19 athletes included in the research are presented in Figures 2 to 5. We mention that Figure 2 and Figure 3 show the results obtained in the two tests by the athletes aged 18 years or under. Each test presents the best attempt in the initial test (IT) and the best attempt in the final test (FT).

Figure 4 and Figure 5 present the results obtained in the two tests by the athletes aged 18 years and over. We show the best results for both the initial and final tests.

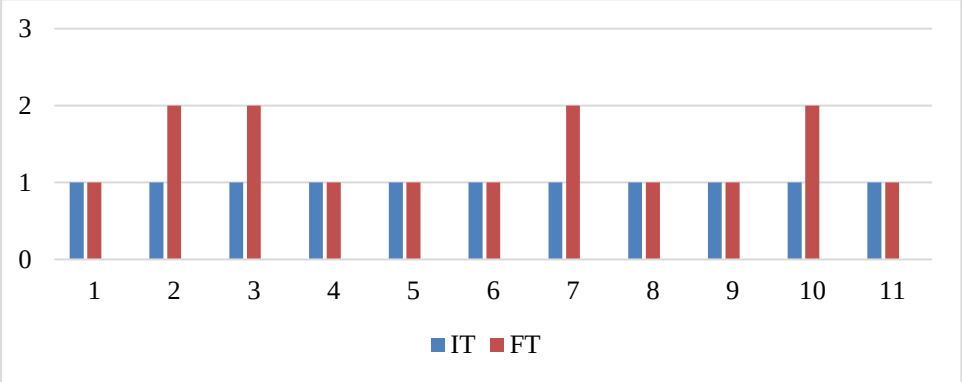

Figure 2. Results in the initial and final tests for the rectangle placed on the right side of the court – athletes aged 18 years or under; best attempt

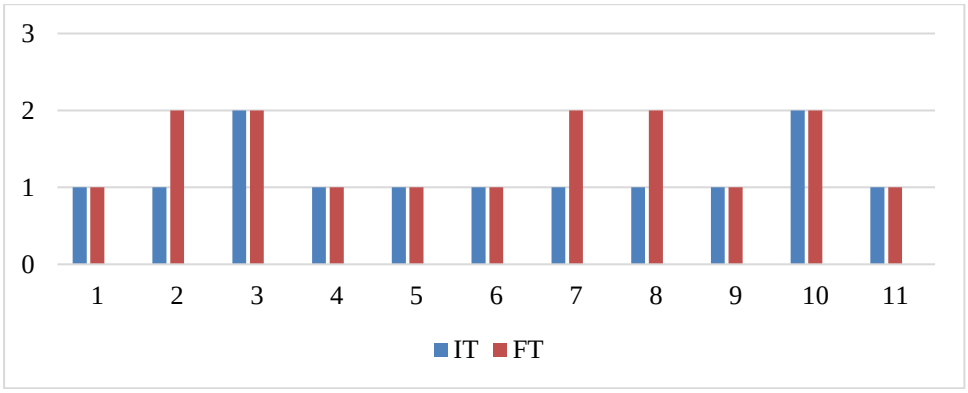

Figure 3. Results in the initial and final tests for the rectangle placed on the left side of the court – athletes aged 18 years or under; best attempt

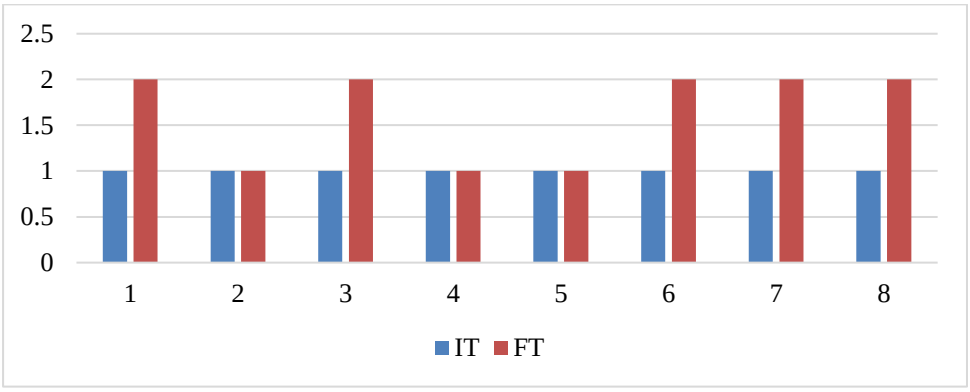

Figure 4. Results in the initial and final tests for the rectangle placed on the right side of the court – athletes aged 18 years or over; best attempt

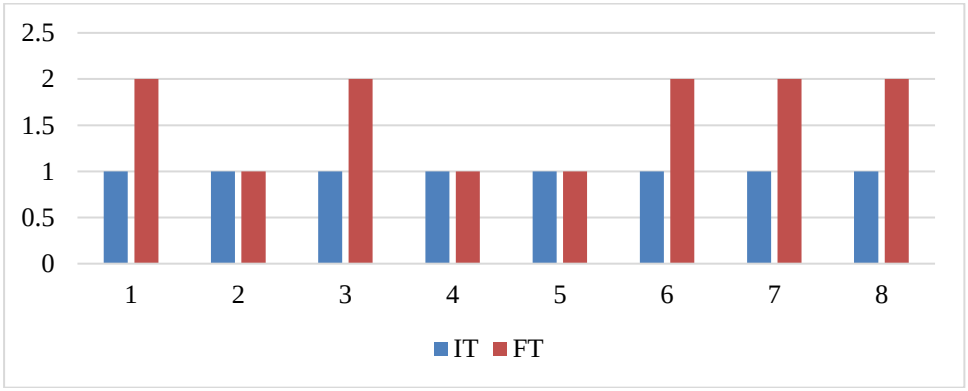

Figure 5. Results in the initial and final tests for the rectangle placed on the left side of the court – athletes aged 18 years or over; best attempt

From the analysis of the collected data, we can see that the progress of the athletes is insufficient. Although the same skills are permanently practiced during the training classes (Tables 1-4 and Figure 1), they cannot be found in their results obtained in the final test.

The statistical calculation of the results for the athletes aged 18 years or under shows:

- the rectangle placed on the right side of the court
  - arithmetic average: IT = 1; FT = 1.36
  - standard deviation: IT = 0; FT = 0.50
  - coefficient of variation: IT = 0; FT = 37.0
- the rectangle placed on the left side of the court

- arithmetic average: IT = 1.18; FT = 1.36
- standard deviation: IT = 0.40; FT = 0.50
- coefficient of variation: IT = 34.23; FT = 37.0

For the athletes aged 18 years and over, the statistical results are:

- the rectangle placed on the right side of the court
  - arithmetic average: IT = 1; FT = 1.63
  - standard deviation: IT = 0; FT = 0.52
  - coefficient of variation: IT = 0; FT = 31.85
- the rectangle placed on the left side of the court
  - arithmetic average: IT = 1.18; FT = 1.63
  - standard deviation: IT = 0; FT = 0.52
  - coefficient of variation: IT = 34.23; FT = 31.85

The statistical data show that there is no homogeneity either in the initial test or the final test. The Pearson correlation coefficient also indicates low association.

Conclusion

According to this study, we can conclude that the systematic practice of the physical exercise by children and young adults with Down syndrome has a positive effect at a bio-psycho-social level. It improves the indices of the different components of their coordination skills, but this improvement is influenced by a series of variables: the athlete's interest in the sport discipline practiced during the intervention programme, their enjoyment during the training class, the presence of friends in the training class, etc.

During the learning process of a motor skill, the parallel practice with another person with or without a disability is useful (Pagnoni, 2010, p. 56). Also, using competition whenever possible is an opportunity of stimulating the athletes, forcing them to pay more attention and have more precision in their movement. The results obtained by the athletes during both the training classes (for the means practiced as a competition) and the actual testing depend on the court surface, material, as well as the way it is built.

Authors' Contributions

All authors equally contributed to this study and should be considered as main authors.

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