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Spatial - Temporal Orientation and Balance Ability among Primary School Students: Comparative Analysis According to Gender

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Abstract: *Spatio-temporal orientation and balance ability at certain ages show the superiority of a certain gender type in terms of the level of performance recorded. The aim of this study was to investigate whether performance in spatial-temporal orientation and balance ability differs by gender. In order to determine the differences between genders, an analysis was carried out on a sample of 120 primary school pupils who were divided by gender into two groups: 58 girls (M=27,13, SD=6,50 kg; M=129,07, SD=6,58 cm) and 62 boys (M=29,39, SD=7,90 kg; M=130,92, SD =7,02 cm). The following tests were applied: Matorin and Flamingo Test. For the interpretation of the results the Independent Samples T Test was used. According to the results of the research, in the case of the Flamingo Test - the handy leg, the values (M=4.48, SD=4.21) are significantly higher (t=2.21, DF=118, two-tailed p=0.28) than those of boys (M=3.06, SD=2.62). Regarding the Matorin Test - skill part, boys' values (M=283.06, SD=82.04) are significantly higher (t=3.50, DF=118, two-tailed, p=0.001) than girls' (M=232.55, SD=75.35). It is recommended to develop spatial-temporal orientation and balance skills because these skills play a considerable role in sports and technical games where they are in high demand.*

Keywords: *static balance; general coordination; primary school; physical education.*

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Introduction

Various factors influencing the development of spatial-temporal orientation and balance skills at certain ages have made this topic the focus of much discussion in the literature, which has established an undeniable link between them, highlighting the superiority of a particular gender type in terms of performance levels (Baveles & Chovil, 2006; Beetz et al., 2005; Blei et al., 2003; Borgatti, 2005).

Professionals in the area believe that balance is the capacity to hold a steady posture by making adjustments with one's own body. The infant must learn to balance and to orient his motions in space in order to develop it. This will allow him to understand how his body and head relate to each other and to the surroundings.

In this context, specialists consider that the following notions can be worked with: balance; verticality and inclination of the body; rectilinear movement; rotation of segments, separately or considered as part of the whole (Camerino et al., 2012; Duch et al., 2010; Shortridge et al., 2014).

Postural stability and dynamic balance can be gradual indicators of neurological dysfunctions or exceptional skills for performance shooting, circus arts or special professions, provided they are objectively measured. In their measurement, pertinent questions can be asked about the position of the landmark and the way of scaling. Measurable parameters of oscillations, by convention, can label instability into several categories. It is understood that zero instability is equivalent to perfect equilibrium, and the most unfavourable category of instability is unstable equilibrium" (Gagea, 2010; Ricotti, 2014; Arnold & Schmitz, 1998; Ashton-Miller et al., 2001, Colby et al., 1999).

It is often considered that the postural balance regulatory system is treated as a mathematical model of the inverted, double-jointed pendulum. Dynamic balance can improve the diagnosis and prognosis of recovery or recuperation in neuropsychological and non-humoral disorders. Objective postural stability and dynamic balance can improve diagnosis, and dynamic balance performs the same role. The training process of athletes focusing on balance and performance can be influenced, positively of course (Gagea, 2010; Pehoiu, 2010; Bressel et al., 2007; Cambier et al., 2001; Davlin et al., 2004).

Movement performed in a coordinated way focuses on combining motor and sensory factors. Proprioceptive excitations reaching the bark, via the pathway of deep, conscious and unconscious sensitivity in the muscles, produce movement through a conditioned reflex.

The coordination of an individual's movements improves as the body grows and develops through constant repetition (Mountifield, 2023; Nath & Chowdhury, 2024).

Movement is the set of functions that maintain posture and the execution of movements necessary to relate to oneself, others and the environment. The nervous command acts on the skeletal muscle system and the efficiency of movements is given by the coordination of the body segments.

Humans are endowed with: reflex movements, elementary and rapid, based in the spinal cord; automatic movements, based in the brainstem and basal ganglia (consisting of elementary motor functions as a manifestation of sensory stimulation); voluntary movements, based in the central nervous system, determined by the cognitive component of the individual, the motivational and affective component (Pehoiu, 2010; Reilly & Ekblom, 2005, Wright et al., 2002).

In other sports, where seamless movement execution manifests general coordination, this psychomotor component is also present. Considering this psychomotor component in a variety of sports will enhance the movement's expressiveness, efficiency, and fluidity (Pehoiu, 2010; Guy, 2001; Hirtz & Starosta, 2002; Van Dongen, 2004).

Through its objectives and curriculum, school physical education effectively develops the students' skills, particularly the coordinative skill component, which is the foundation for learning to move, for developing daily motility, and for developing the specialized, refined motility needed for participating in particular sports. The neurological and motor foundation necessary for the development of complex motor habits - a foundation that is crucial for the coordinative skill - is provided by middle school age. Individuals vary in terms of how well this function is carried out and how much it helps a person become flexible and adaptive to a wide range of challenging circumstances. In addition to movement combination and coupling, kinesthetic, balance, motor response, movement transformation, and spatiotemporal orientation, together with movement combination and coupling, and with kinesthetic, balance, motor reaction, movement transformation and rhythm differentiation form the coordinative skills (Pehoiu, 2010; Matchock, 2010, Balkundi & Harrison, 2006).

In order to ensure the best movement control and response to environmental fluctuations, coordination - which is a complex and multifaceted phenomenon - represents the qualitative component of psychomotor activity (di Cagno et al., 2012, Vandorpe et al., 2012).

In many sports, especially in limited skill disciplines, coordination abilities are crucial for success. When it comes to the relationship between circadian cycles and coordination abilities, there is still a dearth of understanding, according to a review of the literature. Furthermore, there hasn't been much research done on how children's and adolescents' performance varies during the day. Coordination, flexibility, and reactive strength are crucial performance-enhancing factors in among the younger students from the first gradeand may help identify potential talent (di Cagno et al., 2012; Miletic et al., 2004; Forsman et al., 2007; Souissi et al., 2010a,b; Wright et al., 2002; Douda et al., 2008).

Objectives

The aim of this study was to investigate whether spatial-temporal orientation and balance performance differed by gender.

Material and methods

Experimental design

The tests listed below were used in this investigation: The ***Matorin Test*** is used to determine overall balance, coordination, and orientation in space and the ***Flamingo Test*** to establish static balance. ***The Independent - Samples T Test*** was used to interpret the results. These tests were performed by primary school students who do not practice any competitive sport.

Procedures

Matorin Test
Materials needed: chalk, teaching protractor.
Time/subject: 3 minutes / pupil.
Protocol: draw a circle on the ground with a diameter of 35 cm and a line dividing the circle into two equal halves. The students stand with their arms lowered and their feet on either side of the line painted on the ground. They execute a straight jump followed by a turn around the body's longitudinal axis to the right, and then another jump followed by a turn to the left. Students are not allowed to lose their equilibrium during the jump. The students are required to land inside the circle with their feet close together after each jump. This will stay where it is until the examiner determines the turn's angle. The jump will be canceled if the student falls outside the circle. Establishing overall balance, direction, and cooperation in space is the goal. Subjects take the test twice in order to record the results, and the best (Tudor, 2013)

Flamingo Test

Materials needed: stopwatch; balance stand (50 cm long, 4 cm high and 3 cm high).

Time/subject: 3 minutes / pupil.

Protocol: The student is standing on their preferred leg, which is aligned with the balance stand's longitudinal axis. The second lower limb, which is bent at the knee joint, will be grasped by the hand on the same side while the other arm is held front and extended. Static equilibrium establishment is the goal. Subjects take the exam twice in order to record the results, with the best score being recorded (Gavojdea, 2016).

Statistical analysis

In order to determine gender differences, an analysis was carried out on a sample of 120 primary school pupils who were divided by gender into two groups: 58 girls *(M = 27.13, SD = 6.50 kg and M = 129.07, SD = 6.58 cm)* and 62 *boys (M = 29.39, SD = 7.90 kg and M = 130.92, SD = 7.02 cm).*

A series of methods and indicators were used: *descriptive statistics* including ***arithmetic mean*** and ***standard deviation*** and computer graphing method for which Microsoft Office Excel was used.

The tests were carried out on both the skill and non-skill sides of the students.

For the interpretation of the results for the comparison of the sample means, ***the Independent - Samples T Test*** was used and a comparison between the results was made.

The data were statistically analyzed using ***SPSS version 23.***

Results and discussions

Table 1 and Figures 1 and 2 compare the results of the two tests taken by primary school students in our research. The table shows the results obtained by boys and girls separately, both on the skill and on the skill part for both tests.

Table 1 Results obtained at the tests applied

Test applied	Girls		Boys		*t*	DF	*two-tailed p*
	n	Mean (Std. Deviation)	n	Mean Std. Deviation			
Height	58	27,13 (6,50)	62	29,38 (7,90)	-	-	-
Weight	58	129,07 (6,58)	62	130,92 (7,02)	-	-	-
Flamingo Test (Skillful Foot)	58	4,48 (4,21)	62	3,06 (2,62)	2,21	118	0.028
Matorin test (Skill part)	58	232,55 (73,35)	62	283,06 (82,04)	3,50	118	0.001

Source: authors own conception

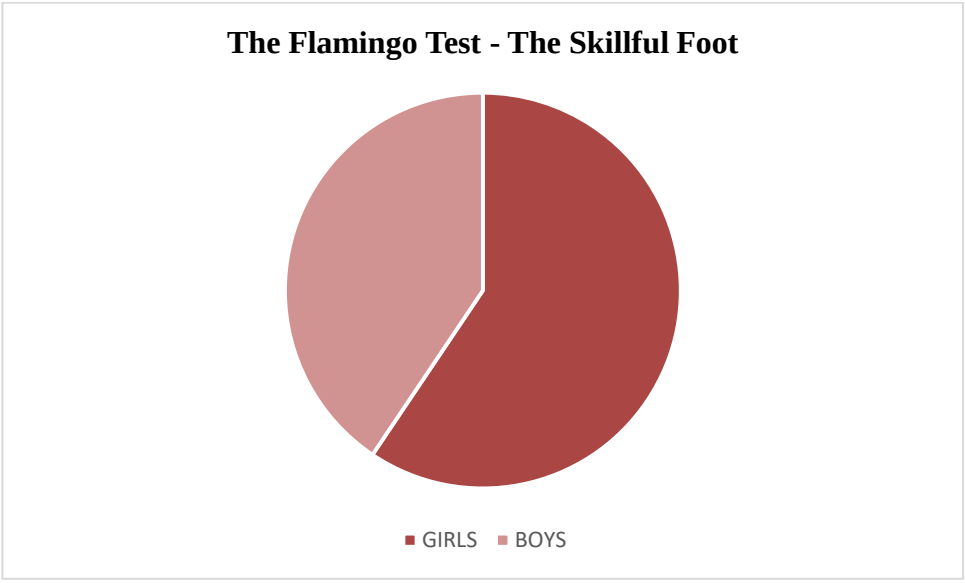


Fig. 1 The Flamingo Test - The Skillful Foot

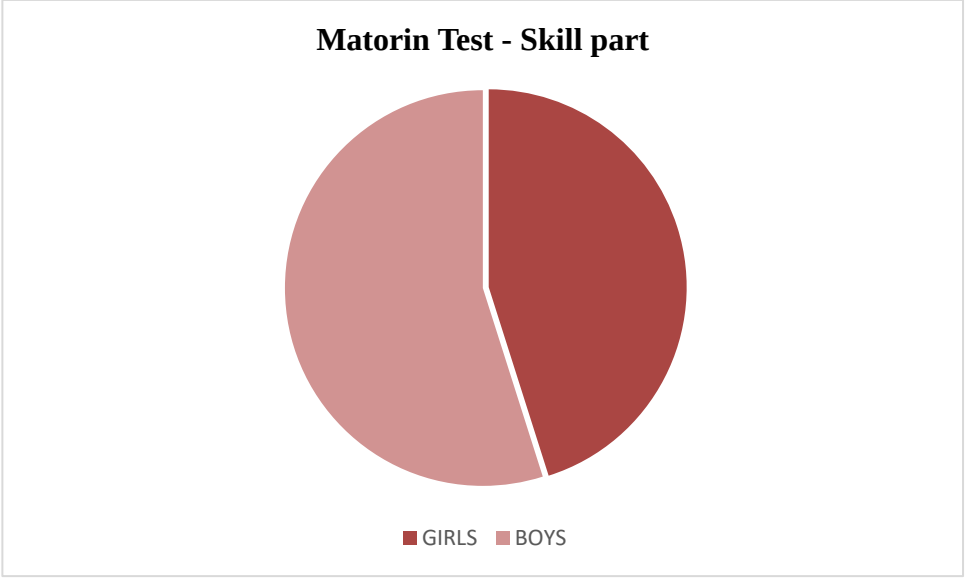


Fig. 2 Matorin Test - Skill part

According to the research results, in the case of Flamingo Test - girls, the clumsy leg, the values *(M = 4.48, SD = 4.21)* are significantly higher *(t = 2.21, DF = 118, two-tailed p = 0.28)* than those of boys *(M = 3.06, SD = 2.62)*, being statistically significant, in the case of the non-clumsy leg the data are statistically insignificant. As for the Matorin Test, the dexterous part, boys' values *(M = 283.06, SD = 82.04)* are significantly higher *(t = 3.50, DF = 118, two-tailed p = 0.01)* than girls' *(M = 232.55, SD = 75.35),* being statistically significant.

Discussion

Given that obesity, lack of exercise and teenage interest in technology seem to be taking over their lives, the authors believe that addressing these issues is both necessary and topical. Researchers (Popovici et al., 2018), believe that motor skills - with all its components - contribute to enriching the biological and psychological heritage of adolescents through a systematic and continuous action. Physical exercise, as the main tool, is the biological stimulus that through accumulation ensures both a harmonious physical development and a balanced education of motor qualities. In research studies, the aim was to influence the body shaping of secondary school students according to their level of psychomotor development. In order to carry out the research, it was assumed that applying an aerobic gymnastics program would highlight the role of psychomotor components in body shaping. The

research subjects were 13 female students (11th grade) from a high school in Iasi. The researchers applied the following motor tests: the Flamingo balance test, and the Matorin test. The independent variable of the study was represented by aerobic gymnastics programs at an average level, according to the level of psychomotor development of high school students. Aerobic gymnastics sessions were held three times a week and lasted 50 minutes each. The statistical-mathematical interpretation of the data shows that in the Flamingo test, the subjects recorded an increase in values from 27.07 seconds to 34.61 seconds; in the Matorin test, they observed an improvement in the values recorded on the right side (360.38 degrees) compared to the left side (347.30 degrees), given that most of the subjects are right-handed. Exercises performed mainly using this side also had higher values. The test showed an increase in values from 2.75 movements to 5,625 movements performed correctly to the left and from 3,875 to 7,571 movements performed correctly to the right. In line with the above-mentioned statements, the researchers concluded that the aerobic gymnastics routine was effective, thus improving the psychomotor components, namely the basic motor, neuromotor, perceptual-motor structures and ducts (Popovici et al., 2018).

Conclusion

The findings demonstrate that early acquisition of spatial-temporal orientation and balancing skills is necessary for optimal motor performance, as these abilities are highly valued in sports and technical activities.

We were also able to create a general picture of the motor skills of primary school students thanks to the results of the psychomotor tests. It can be concluded that all sports and technical games, by nature, necessitate a sufficient degree of balance because both static and dynamic balance are present in their composition.

We think that following the implementation of a training program, student outcomes can demonstrate improved overall coordination, spatial-temporal orientation, and evolution at the level of static and dynamic balance. These outcomes can be used to gauge how effective the training process was and how much sports performance increased.

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Other specifications

All the authors had equal contributions to this research.

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Informed Consent Statement: Through their legal representatives, informed consent was acquired from each participant engaged in the research.
Data Availability Statement: Consultation of the data is possible upon request to the corresponding author.
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