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THE INFLUENCE OF RHYTHMIC GYMNASTICS ON
COORDINATION CAPACITY IN CHILDREN WITH AMBLYOPIA

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Abstract

Any loss or abnormality in the structure or function of the visual analyser represents a visual impairment. The World Health Organization considers that the term “visual impairment” refers, on the one hand, to a decrease in visual acuity, and on the other hand, to the loss of visual acuity. The research purpose consists in checking the influence of means specific to rhythmic gymnastics on some components of coordination ability (kinaesthetic differentiation, balance and intersegmental coordination) in children with amblyopia. The research methods used in conducting the investigation are the following: bibliographic study method, observation method, experimental method, graphical method and the method of processing, analysis and interpretation of the collected data. The assessment will be performed through tests or trials in order to establish the children’s reactivity, their progress/regression/stagnation as a consequence of applying some means specific to rhythmic gymnastics. The study results highlight the progress recorded by the 12 subjects with amblyopia, as an echo to the applied therapy. Conclusions confirm that the means of rhythmic gymnastics influence some components of coordination ability (kinaesthetic differentiation, balance and intersegmental coordination) in children with amblyopia and that this sports discipline finds a well-deserved place in the thematic syllabus of Physical Education as a subject taught in special schools, in lower secondary education.

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Keywords: Coordination ability, amblyopia, rhythmic gymnastics.

1. Introduction

The World Health Organization (2014) considers that “visual impairment” refers, on the one hand, to a decrease in visual acuity (amblyopia), and on the other hand, to the loss of visual acuity (blindness). It also states that the unilateral or bilateral low vision ability is equivalent to the term “amblyopia” or “lazy eye”. Another definition of the “visual impairment” states that it “is a dysfunction in which the visual analyzer is unable to receive, transmit or interpret stimuli in a favorable way for educational and social integration” (Teodorescu, Bota & Stănescu, 2003, p. 88).

The Larousse Dictionary (2015) defines amblyopia as “the partial or relative loss of visual acuity (allowing the formation of a clear, distinct, well-focused image on the retina)”.

Low visual acuity also has negative effects on the amplitude of eyeball movement, the diminution in amplitude resulting from uncorrected refractive errors or organic problems (Wright, Spiegel, & Thomson, 2006, p. 10).

The Centers for Disease Control and Prevention (USA, 2015) states that visual impairment occurs when the loss of visual acuity reaches the value of 20/70, after the correction of vision by wearing glasses.

On 30 June 2015, it was recorded in Romania a number of 103,214 people with visual impairments, of whom 2,978 children. The World Health Organization (2007) considers that if amblyopia is detected in due time, it can be treated up to 9 years of age.

Our country is currently engaged, through several non-governmental organizations, in the protection of children with special educational needs and makes considerable efforts to provide high-quality medical services, with a focus on primary and secondary healthcare, and to respect the international treaties and conventions aimed at implementing the concepts of integration and inclusion, as well as the rights of people with disabilities.

2. Problem Statement

Reflection of the topic in the national and international literature:

- National

The consultation of various bibliographic sources provided us information on rhythmic gymnastics, but without revealing the relationship between this sports discipline and people with visual impairments. Most research studies in the field of Sport and Physical Education Science deal with performance rhythmic gymnastics.

- International

Physical activities proposed for people with disabilities are mainly represented by activities aimed at improving motor skills. In this way, people with special educational needs are encouraged to regain functional independence in their relationship with the surrounding environment.

Depending on the type of disability, the hand apparatus specific to rhythmic gymnastics are adapted to the momentary capabilities of people with special educational needs.

Nevertheless, rhythmic gymnastics is a leisure activity that gives participants the pleasure of performing a motor activity able to remove stress and generate a state of well-being.

3. Research Questions

We believe that if the means specific to rhythmic gymnastics, represented by psychomotor actions with hand apparatus, can contribute to improving some components of coordination ability (kinaesthetic differentiation, balance and intersegmental coordination) in children with amblyopia, then this sport discipline should be introduced into the physical education lessons in special schools.

4. Purpose of the study

The purpose of the study is to check the influence of means specific to rhythmic gymnastics on some components of coordination ability (kinaesthetic differentiation, balance and intersegmental coordination) in children with amblyopia.

4.1. Research hypothesis

The research hypothesis states that the means specific to rhythmic gymnastics (exercises with hand apparatus) positively influence some components of coordination ability (kinaesthetic differentiation, balance and intersegmental coordination) in children with amblyopia.

4.2. Objective of the research

The main objective of the research is to improve coordination ability in children with amblyopia.

4.3. Tasks

- to choose the location for conducting the research;
- to select the subjects with amblyopia;
- to select and adapt the tests and trials for assessing the level of coordination ability in children with amblyopia;
- to design the therapeutic program applied to the research subjects and performed with hand apparatus;
- to collect, process and interpret the data for highlighting the obtained results and to draw conclusions.

5. Research methods

The research methods used to conduct the research were the following:

- bibliographic study method (by examining the various existing materials);

- observation method (by observing the motor behaviour of the selected children);
- experimental method (used to check the hypothesis and complete the research);
- graphical method and the method of processing, analysis and interpretation of the collected data (the statistical tests used were: Wilcoxon test and also computer products: SPSS, Minitab, Microsoft Office 2010, to highlight the subjects' reactivity).

The research subjects were selected among pupils from the Special Middle School for Visually Impaired of Bucharest. Thus, the research was conducted on 12 pupils diagnosed with amblyopia. The group of subjects was made up based on inclusion criteria.

Inclusion criteria: diagnosis of amblyopia; comorbidities secondary to the diagnosis of amblyopia; age: 12-15 years; regular participation in physical education classes; physical ability to perform exercise; mental ability to decode the requirements; enrolment in lower secondary education.

The research was conducted between October 2015 and May 2016. During that period, the following activities were carried out:

- in October: initial assessment (application of tests and trials to establish the motor level of the selected children);
- from November to April: application of the therapeutic program, which was focused on learning and performing simple actions of handling the five apparatus specific to rhythmic gymnastics (rope, hoop, ball, clubs and ribbon); during that period, 19 lessons were conducted at a rate of 1 lesson per week, working alternately with the hand apparatus included in the research; each session lasted 50 minutes, and the intervention had a 30-minute duration, in the fundamental part of the physical education lesson;
- in May: final assessment (to highlight the progress/regression/stagnation after applying the means specific to rhythmic gymnastics).

5.1. The assessment was achieved by:

The Kinaesthetic Differentiation Test (estimating the weight of an object), which involves arranging 7 boxes with identical exterior characteristics (colour and size), but different weights. The subject performs the test with no time limit and has to arrange the 7 boxes in ascending order, by their weight (1, 2, 3, 4, 5, 6, 7), in front of the corresponding number.

Score scale:

0 points = not arranging any box in the ascending order of numbers

1 point = arranging one box in the place corresponding to its number

2 points = arranging two boxes in the places corresponding to their numbers

3 points = arranging three boxes in the places corresponding to their numbers

4 points = arranging four boxes in the places corresponding to their numbers

5 points = arranging five boxes in the places corresponding to their numbers

6 points = arranging six boxes in the places corresponding to their numbers

7 points = arranging all boxes in ascending order

The Six-hoop stepping is a trial used to assess intersegmental coordination and balance.

The distance between hoops is 1 m, and the entire route is 5-meter long. The subject is outside the first hoop and must run to cover the route within 60 seconds. Thus, he/she must step through each hoop. The timer stops when the subject leaves the last hoop.

Score scale:

0 points = exceeds the time by 60 seconds in covering the route

1 point = performs the trial within 60 seconds and deviates from the route

2 points = performs the trial within 60 seconds, but does not deviate from the route

3 points = performs the trial in a time ≥ 50 seconds and deviates from the route

4 points = performs the trial in a time ≥ 50 seconds, but does not deviate from the route

5 points = performs the trial in a time ≥ 40 seconds and deviates from the route

6 points = performs the trial in a time ≥ 40 seconds, but does not deviate from the route

7 points = performs the trial in a time ≥ 30 seconds and deviates from the route

8 points = performs the trial in a time ≥ 30 seconds, but does not deviate from the route

9 points = performs the trial in a time ≥ 20 seconds and deviates from the route

10 points = performs the trial in a time ≥ 20 seconds, but does not deviate from the route

We mention that the score scales for the results of tests and trials have been established according to extreme results, the poorest and best ones recorded by the investigated subjects in the pre-tests.

5.2. Results

The results recorded by the subjects with amblyopia following the statistical processing are shown in Tables 01-06.

Table 01. Results for the Kinaesthetic Differentiation Test

Subject	Initial assessment			Final assessment		
	Succession of arranging the boxes in ascending order, by their weight	Correctly arranged boxes	Score	Succession of arranging the boxes in ascending order, by their weight	Correctly arranged boxes	Score
1	6354172	1	1	2431576	2	2
2	1243567	5	5	1234567	7	7
3	2317564	2	2	2314657	2	2
4	1243675	2	2	1235467	5	5
5	1253674	2	2	1243576	3	3
6	1236547	4	4	1234756	4	4
7	1235476	3	3	1234567	7	7
8	2315467	2	2	1243657	3	3
9	3124756	1	1	1243756	2	2
10	1243657	3	3	1234657	5	5
11	3241765	0	0	2134657	3	3
12	1423576	2	2	1243657	3	3

Table 02. Results for the Six-hoop stepping trial

Subject	Initial assessment			Final assessment		
	Route time (in seconds)	Deviation from the route	Score	Route time (in seconds)	Deviation from the route	Score
1	68	+	1	52	-	2
2	22	-	8	12	-	10
3	37	-	6	21	-	8
4	23	-	8	14	-	10
5	44	-	4	35	-	6
6	53	-	2	39	-	6
7	46	-	4	41	-	4
8	38	-	6	15	-	10
9	27	-	8	18	-	10
10	34	-	6	26	-	8
11	47	-	4	28	-	8
12	33	-	6	25	-	8

Legend: The sign “+” means deviation from the route, and the sign “-” highlights its absence.

Table 03. Kinaesthetic Differentiation Test – statistical indicators

Statistical indicators	Assessment	
	Initial	Final
Mean	2.25	3.83
Mean difference (F-I)		1.58
Median	2	3
Standard deviation	1.36	1.80
Coefficient of variance	60.3%	47.0%
Minimum value	0	2
Maximum value	5	7
Amplitude	5	5

The average score achieved by the studied group in the Kinaesthetic Differentiation Test increased in the final assessment by 1.58, from 2.25 to 3.83. We note an improvement by 70.37% in the degree of estimating the weight of objects, consistent with the increase in the average score. The median increased in the final test by 1.00.

The dispersion of individual points is non-homogeneous in both assessments.

The obtained points range between 0 and 5 in the initial assessment and between 2 and 7 in the final assessment. The amplitude has the value 5 in the final assessment, too.

Table 04. Kinaesthetic Differentiation Test – Wilcoxon test

Wilcoxon test	Results
Z	-2.844
P	0.004
Effect size	0.58

The significance threshold $p = 0.004 < 0.05$ for $z = -2.844$. The research hypothesis is accepted, the increase in the ability to estimate the weight of an object being statistically significant. The effect size index (0.58) shows a high to very high difference between the two assessments.

Table 05. Six-hoop stepping trial – statistical indicators

Statistical indicators	Assessment	
	Initial	Final
Mean	5.25	7.50
Mean difference (F-I)		2.25
Median	6	8
Standard deviation	2.30	2.58
Coefficient of variance	43.8%	34.3%
Minimum value	1	2
Maximum value	8	10
Amplitude	7	8

In the Six-hoop stepping trial, the average number of points achieved by the studied subjects increased in the final assessment by 2.25, from 5.25 to 7.50. It results an increase in the degree of intersegmental coordination and balance based on the increase in the average score by 42.86%. The median increased in the final test by 2.00.

The dispersion of individual points is non-homogeneous in both assessments.

The obtained points range between 1 and 8 in the initial assessment and between 2 and 10 in the final assessment. The amplitude increased by 1 point in the final assessment.

Table 06. Six-hoop stepping trial – Wilcoxon test

Wilcoxon test	Results
Z	-3.025
P	0.002
Effect size	0.62

The significance threshold $p = 0.002 < 0.05$ for $z = -3.025$. The research hypothesis is accepted, the improvement in movement coordination and balance being statistically significant. The effect size index (0.62) shows a high to very high difference between the two assessments.

6. Findings

According to the statistically processed results (Figure 01), it is found an improvement in the kinaesthetic differentiation ability, which emphasises that the means applied to the research subjects have been efficient.

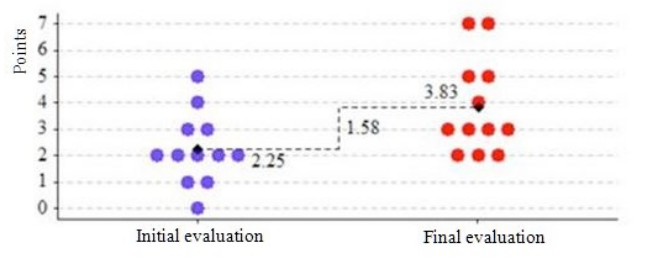


Figure 01. Kinaesthetic Differentiation Test

The statistically processed results highlight that, in the Six-hoop stepping trial (Figure 02), children with amblyopia have improved their intersegmental coordination and balance after the application of means specific to rhythmic gymnastics.

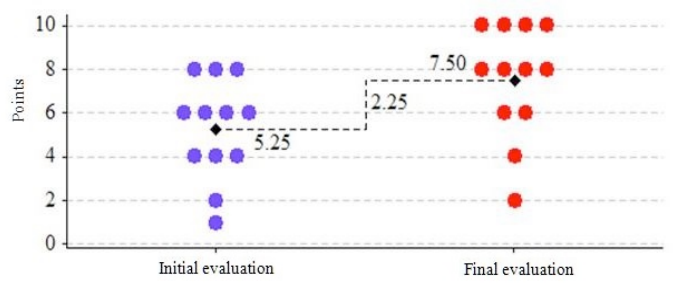


Figure 02. Six-hoop stepping trial

7. Conclusion

From the analysis and interpretation of the calculated scores, it is found that the subjects with amblyopia have recorded progress relative to the assessed components of coordination ability (kinaesthetic differentiation, balance and intersegmental coordination) following the application of the therapeutic program. Differences between the initial and final tests are statistically significant, which is also demonstrated by the Wilcoxon test at $p < 0.05$, applied in the analysis of awarded scores (for kinaesthetic differentiation $p = 0.004$, for movement coordination and balance $p = 0.002$).

After the statistical processing of the results, it is confirmed the research hypothesis that states that the means specific to rhythmic gymnastics (exercises with hand apparatus) positively influence some components of coordination ability (kinaesthetic differentiation, balance and intersegmental coordination) in children with amblyopia.

The coordination ability of children with amblyopia can be improved by introducing into the physical education lesson some psychomotor actions of handling the five apparatus (rope, hoop, ball, clubs and ribbon). Thus, we consider that rhythmic gymnastics contributes to improving the quality of life for people with special educational needs and can be introduced into the syllabus of Physical Education as a subject taught in special middle schools.

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