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Improving secondary school curricula through the development of agility

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Abstract

Aim: The goal of this research is to improve the educational training process in Physical Education and Sport through the development of agility. *Methods:* The research was conducted in two secondary schools in Mures County (Măgherani Secondary School and "Mátyus István" Chibed Secondary School) during February and April 2017 on a class of 32 pupils. Subjects were divided in two groups, the control group and the experiment group. As Agility Testing Methods we used the Compass Drill Test and the Arrowhead Drill Test; both tests are part of "SPARQ" - the acronym for Speed, Power, Agility, Reaction and Quickness. *Results:* Our results indicate that by using specific agility development exercises, the results of experiment group have increased significantly ($p = 0.0000103$) compared to control group. In the latter case we used speed exercise only and therefore the increase of results was insignificant ($p = 0.17$).

Key words*: speed, agility, curricula.*

Rezumat

Scop: Scopul acestei cercetări este acela de a ameliora procesul instructiv educativ în orele de Educaţie Fizică şi Sport prin dezvoltarea agilităţii. *Metode:* Cercetarea a fost realizată în două şcoli gimnaziale din judeţul Mureş (Şcoala Gimnazială Măgherani şi Şcoala Gimnazială „Mátyus István" Chibed) în perioada Februarie-Aprilie 2017, pe 32 de elevi. Subiecţii au fost împărţiţi în grupa martor şi experiment. Ca metode de testare a agilităţii am utilizat testul Compass Drill şi testul Arrowhead Drill; ambele teste fac parte din "SPARQ" - acronimul pentru Viteză, Putere, Agilitate, Reacţie şi Rapiditate. *Rezultate:* Rezultatele indică faptul că, prin utilizarea unor exerciţii specifice de dezvoltare a agilităţii în cadrul grupei experiment, s-a înregistrat o creştere semnificativă ($p = 0.0000103$) comparativ cu rezultatele obţinute de grupa martor unde s-au folosit doar exerciţii de viteză, creşterea aici fiind nesemnificativă ($p = 0.17$).

Cuvinte cheie*: viteză, agilitate, curriculum.*

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Introduction

Agility is defined as "Ability to change direction with maximum speed" [5] and "Ability to change direction quickly and precisely" [4]. In recent publications, some authors improved these definitions, by adding that agility includes changes in the direction of the whole body, as well as rapid action of the limbs in order to perform directional changes [1]. However, these definitions can be considered vague, briefly detailed in respect of terms such as "speed", which is defined by terms similar to agility: acceleration, reaction to stimuli, cognition, and the ability to make decisions in the shortest time possible. A complete definition must recognize the physical requirements, cognitive processes, the involved technical skills found within agility. In particular, two major components are emphasized, both of them having subcomponents, namely: the speed of direction change with the subcomponents: execution technique, anthropometry, the speed of movement in open space and the development of the muscles of the lower limbs. The second one is aimed at the cognitive and decision factors with the sub-components: visual scanning, anticipation, awareness of situations, pattern recognition. Therefore, the following definition is recommended: "Whole body fast activity by speed or direction changes in response to a stimulus" [3]. Concerning the relationship between movement speed without direction changes and movement speed with direction changes, Young et al. [6] conducted a study regarding the relationship between movement speed and speed of changing direction at football players in Australia. The result of the research proves that the correlation between the sprints and the agility tests was very low, indicating that running and running with ball dribbling, respectively running with directional changes are distinct and specific qualities. Some authors, e.g. [2], [6], claim that the running technique plays a key role in speed running performance with directional changes. In particular, forward torsion of the body trunk and low center of gravity, are essential in optimizing acceleration and deceleration, as well as for more effective stability. To change the direction of movement, the person in question must first decelerate and lower its center of gravity, and the length of the stepping is recommended to be shorter [2].

Aim of the research

The aim of this research is to analyze the evolution of the educational training process in the Physical Education and Sports classes by introducing a new study topic: developing agility in the experiment group compared to the lessons following the classical model, respectively the development of speed and coordination capacity (laterality and coordination of the limbs). The evolution and progress made by students were observed based on these premises.

Research theory

It is assumed that by using combined specific means of developing agility, the students included in the experiment group can reach a higher level of development of this psychomotor quality compared to the students of the control group that will use exercises for the development of speed and coordination capacity (laterality and coordination of the limbs) executed separately.

Place, subjects and time of performing the research

The research was conducted in two secondary schools in Mures County (Măgherani Secondary School and "MátyusIstván" Chibed Secondary School) during April and May 2017 on a group of 32 students forming the experiment group (mixed group boys and girls consisting of Vth, VIth and VIth grade students) and 32 students forming the control group (identical to the experiment group).

Research methods ~~used~~

Two tests were used to test the agility: Compass Drill and Arrowhead Drill Test. Both tests are part of "SPARQ" - the acronym for Speed, Power, Agility, Reaction and Quickness. The results were recorded and analyzed using Microsoft Excel® . The Compass Drill test is a test used to determine the speed, sprint, body control, and the ability to change direction, namely the agility. The Compass Drill test involves placing a first cone in the center and the other four cones ahead, behind, left and right, ~~at~~ 3 meters away from the first cone. The student's initial position is squat behind cone number 1, the

left hand being in contact with the cone and with the body facing cone number 5. The pupil runs towards cone number 2, touches the cone, returns to the cone in the center, runs towards the cone number 3, from there returns to cone no. 1, runs to the left at cone no. 4, returns to cone no. 1, from where it runs and passes beyond cone no. 5. The student must touch each cone. The timer starts when his left hand no longer touches the center cone, and stops when the chest passes beyond the cone no. 5.

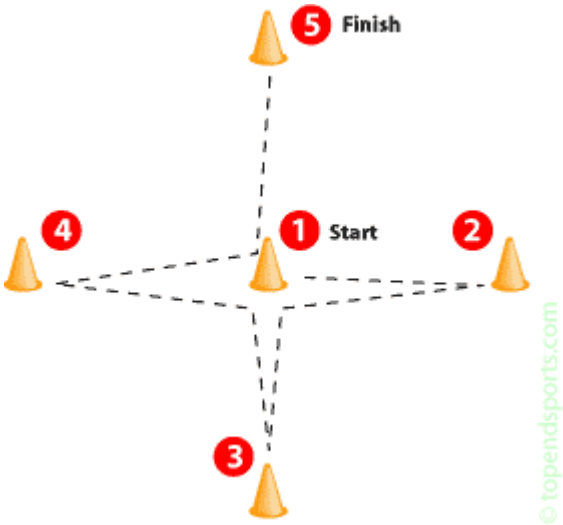

Figure 1. Compass Drill Test

The Arrowhead Drill test measures the agility of the student, involving speed running, acceleration, deceleration, and directional changes. In this test, the cones are positioned according to the diagram below. Two cones represent the start and end of the exercise, and the 4 cones A, B, C, D are placed in a triangle shape. Cone A is 10 meters away from the start, and cones B, C, D are positioned to the left, in front and to the right of cone A, at 5 meters each. The Performer begins with both feet behind the starting line. At the beep sound, he runs as fast as possible towards cone A, passes by the cone to the left and runs towards C or D cone, after passing by the C or D cone, he runs towards the B-cone, passing by it and returning to the starting line. Once he reached the starting line, he runs back to A, and repeats the exercise, but this time the A cone is passed by to the right towards cone B. The cones must be passed by accordingly, jumping over or sidestepping them is not allowed.

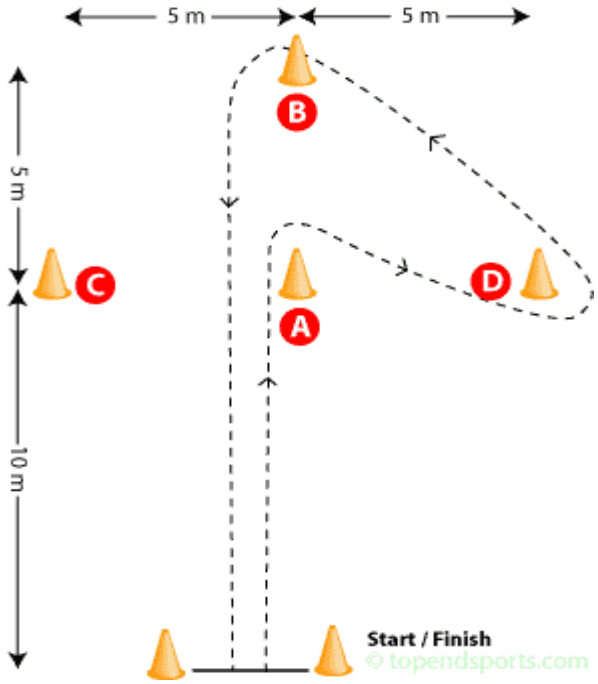

Figure 2. Arrowhead Drill Test

Results

Compass Drill Test

By comparing the results of the two schools, we notice that both groups are progressing. These results both from the arithmetic mean and the following graph: the control group shows a 0.22 seconds progress and the experiment group shows almost triple progress: 0.65 seconds. At the same time, it is noticed that at initial testing, the experiment group had much better results compared to the control group.

Considering the coefficient of variability, we can state that the group homogeneity is average, in all groups, at both tests. The Student test proves that progress is significant in both the control group and the experiment group, but the progress of the experiment group is much more significant.

Table I. Results and calculations of the Compass Drill Test in the fifth grade

		Mean	S	CV	T test
Control	Initial	10.48	1.62	15.39	0.12
	Final	10.00	1.13	11.30	
Experimental	Initial	9.46	1.08	11.41	0.000
	Final	8.65	1.16	13.46	182

SD – standard deviation, Cv – coefficient of variation

If we analyze the results of 5th grade students, we notice that in the control group, the final test results are normal: 80%, but the final test results of the experiment group show an abnormal distribution: 60%. Homogeneity is average in both groups.
However, the Student test proves that the progress of the control group is not significant (p = 0.12) while the progress of the experiment group is highly significant (p = 0.000182).

Table II. Results and calculations of the Compass Drill Test in the sixth grade

		Mean	S	CV	T Test
Control	Initial	9.68	1.35	13.89	0.41
	Final	9.63	1.39	14.42	
Experimental	Initial	8.21	0.86	10.49	0.001
	Final	7.68	0.98	12.71	

If we analyze the results of the 6th grade students, we notice that in the final test of the control group, the distribution is normal, because 76.9% of the cases are included in standard deviation. Similarly, the results of the experiment group are normally distributed within the arithmetic mean: 69.2%.
The arithmetic mean of the final test of the control group is better with only 0.05s. In the experiment group the mean was 0.53s.
However, the Student test clearly and objectively shows that the progress of the control group is insignificant (p = 0.41), while the experiment group progress is highly significant (p = 0.00119).

Table III. Results and calculations of the Compass Drill Test in the seventh grade

		Mean	S	CV	T test
Control	Initial	8.16	0.74	9.13	0.01
	Final	7.97	0.68	8.59	
Experimental	Initial	8.33	1.19	14.3	0.000
	Final	7.72	1.25	16.26	807

If we take into consideration the results of the 7th grade pupils, the distribution of the control group in final testing is not normal because it does not include over 68% of the cases: 50%. Neither is the distribution of the experiment group to final testing: 55.5%
The arithmetic mean of the control group at final testing is better with 0.19s, while the arithmetic mean of the experiment group at final test is better with 9.61s.
Progress of both groups is highly significant: control group p = 0.01, experiment group p = 0.0008.

Arrowhead Drill Test

Comparing the results of the two schools, we notice that both groups are progressing. This is shown both in the arithmetic mean and in the graph below: the control group shows a progress of 0.57 seconds and the experiment group shows almost double in progress: 1.13 seconds. At the same time, it is noticed that at the initial testing, the experiment group had much better results.
Taking into account the coefficient of variability, we can state that the group homogeneity is average, in all groups, at both tests.
The Student Test proves that progress is significant both in the control group and the experiment group, but the progress of the experiment group is more significant.

Table IV. Results and calculations of the Arrowhead Drill Test in the fifth grade

		Mean	S	CV	T test
Control	Initial	26.83	2.21	8.22	0.66
	Final	26.69	2.18	8.19	
Experimental	Initial	25.04	1.62	6.45	0.0039
	Final	23.85	1.57	6.57	

If we analyze the results of the 5th grade students, we notice that in the control group the results of the final tests show that the distribution is not normal: 50%, same as the results of the final test of experiment group: 60%. Homogeneity is very high in both groups.
However, the Student test proves that the progress of the control group is not significant (p = 0.66) while the progress of the experiment group is highly significant (p = 0.003987).

Table V. Results and calculations of the Arrowhead Drill Test in the sixth grade

		Mean	S	CV	T test
Control	Initial	26.5	2.04	7.69	0.17
	Final	25.75	2.13	8.27	
Experimental	Initial	23.82	1.63	6.85	0.0001
	Final	22.93	1.66	7.25	03

If we analyze the results of the 6th grade students, we notice that in the final test of the control group, the distribution is normal, because 76.9% of the cases are included in the standard deviation, while at the experimental group the distribution is not normal: 53 %.

The arithmetic mean of the final test of the control group is better with 0.75s and for the experiment group with 0.89s.

However, the Student test clearly and objectively shows that the progress of the control group is insignificant (p = 0.17), while the progress of the experiment group is highly significant (p = 0.0000103).

Table VI. Results and calculations of the Arrowhead Drill Test in the seventh grade

		Mean	S	CV	T test
Control	Initial	23.84	1.41	5.92	0.08
	Final	23.07	1.92	8.3	
Experimental	Initial	23.69	1.98	8.34	0.0009
	Final	22.31	1.85	8.27	04

If we consider the results of the 7th grade students, the distribution of the control group at final testing is normal, because it accounts for over 68% of cases: 77.7%. The distribution of experiment group at final testing is not normal: 55.5%

The arithmetic mean of the control group at final testing is better with 0.77s, while the arithmetic mean of the experiment group at final testing is better with 1.38s.

Even if there is noticeable progress in the control group, the student test shows that the results of the final test, although close to being significant, do not reach the threshold of 0.05, whereas in the experiment group the final test results are highly significant compared to the original test results.

Conclusions

After analyzing the results and calculations presented above, the theory was confirmed. The exercises used are necessary for agility development. Following specific exercise practicing, the experiment group achieved a superior progress compared to the control group. Some students have progressed more, others less, depending on their psychological, morphological and functional particularities.

Regarding school curriculum, we found that it does not focus on developing agility. The reason for this is probably the fact that agility can develop in the secondary plane during the development of motor qualities speed and skill. However, our study shows that the focus on the main development of agility helps in achieving results sometimes ten times more significant.

Agility is a motric quality of interest among students, fact emphasized by the great progress achieved at the experiment group vs. the control group, which uses separate exercises to develop speed and coordination capacity.

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