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THE DEVELOPMENT OF SPEED AND EXPLOSIVE FORCE OF THE LOWER LIMBS IN PRIMARY SCHOOL STUDENTS THROUGH DYNAMIC GAMES

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Abstract: Play can be considered a part of the social world of both children and adults. Taking into account the playful behavior of young school students and their enjoyment of playing, the judicious application (in terms of intensity, volume, application period) of a training program consisting of dynamic games with running content and jumping, will cause a significant increase in the manifestation indices of acceleration speed, agility and explosive strength in primary school students. The subjects of our research are 171 primary school children, of which 90 children are part of the experimental group (G.E.) and 81 of the subjects are part of the control group (G.C.). The results obtained for all the control samples used by the subjects from the two experimental groups confirm the correctness of the methods and means used. The values of the effect size (E.S.) obtained in the subjects of the experimental group (both in the case of girls and boys) confirm that the difference between the averages recorded in the two tests (T.I. and T.F.) is statistically significant.

Key words: dynamic games, acceleration speed, agility, explosive strength.

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INTRODUCTION

Play can be considered a part of the social world of both children and adults. The notions of play and childhood are so closely related that we cannot think of one without remembering the

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other (Cristea, 2009). Within formative motor activities, movement/dynamic games prove to be useful for all its institutional forms, we refer here to school physical education, adapted, but also for leisure time. Regardless of the context in which movement games are approached, their effectiveness depends on the knowledge and respect of the general methodological conditions by those who use them, as a means and as a method of training (Stănescu, Ciolcă, Urzeală, 2004, Stănescu, 2002). From this perspective movement games have many approches at different levels and influences.

The application of movement games in the physical education lesson could have a positive role if they are rationally used and rigorously selected based on the set goals, to train the psycho-motor skills in primary school children (Dobrescu, 2019) and improve physical fitness and vestibular stability at students aged 6-7 years (Chanh, 2021). In addition, movement games allow you to effectively use the individual approach needed when working with children since each person is unique and has the level of development (Barker, Quennerstedt, Annerstedt, 2015; Breuer, Hallmann, Wicker, 2011; Szabo-Alexi, 2016).

On the other hand, different research showed that the results recorded during the studied physical education lessons based on the observation charts at middle school level conclude that the use of movement games did not record impressive values, and their formative value has not been exploited at its full potential. That is why one can say that the physical education teachers should make more use of their imagination and creativity in using these means during their lesson (Cristea, Lucaciu, Ștef, 2013; Dobrescu, 2016). From point of view of its features, the game is specific to a collective activity which requires relations of cooperation, harmonization of interests, personal efforts, acceptance, recognition of the leader (Cristea, D. I., Cristea A., 2008) and contributes to the development of the sense of self (Smith, Ovens, Philpot, 2021). Not without importance is the term *game sense*, which bears a particular connotation in the pedagogy of teaching games in the physical education lesson (Pill, 2016).

Furthermore, O'Connor, Alfrey, Penney, 2022, proposed the addition of lap or circuit sports, route or journey sports, rush or action sports, stunts or tricking sports and rhythmic or aesthetic sports to broaden the learning and participation possibilities for young people and tune teachers into contemporary movement forms.

Therefore, it is important to research and select the movement games suitably for the characteristics and interests of students and organize their application (Dao, Chanh. 2021).

ASSUMPTION

Taking into account the playful behavior of young school students and their enjoyment of playing, the judicious application (in terms of intensity, volume, application period) of a training program consisting of dynamic games with running content and jumping, will cause a significant increase in the manifestation indices of acceleration speed, agility and explosive strength in primary school students.

Therefore, we set out to design, apply and evaluate a program aimed at developing these motor skills in primary school students through dynamic games. We believe that a correct choice in this sense coupled with an appropriate dosage will help confirm the previously stated working hypothesis.

The subjects and the method

The subjects

The subjects of our research are 171 primary school children, of which 90 children are part of the experimental group (G.E.) and 81 of the subjects are part of the control group (G.C.).

Of the 90 subjects in the G.E. 44 are girls (age = 8.12 ± 1.52 years; body mass = 31.34 ± 6.21 kg; body height = 1.36 ± 0.09 m.,) and 46 are boys (age = 8.31 ± 1.61 years; body mass =

32.57 ± 7.44 kg; body height = 1.37 ± 0.07 m.), and within the G.C. we have 40 girls (age = 8.25 ± 1.44 years; body mass = 32.71 ± 7.63 kg; body height = 1.35 ± 0.06 m.) and 41 boys (age = 8.03 ± 1.37 years; body mass = 34.24 ± 8.13 kg; body height = 1.35 ± 0.08 m.). All subjects and their parents were informed of the benefits and potential risks of the study and provided written informed consent to participate in the current study. All procedures were conducted in accordance to the ethical standards of the 1964 Declaration of Helsinki and approved by the Ethics Committee of the University of Oradea.

Material and Methods

The setting for our study was the Pentecostal Theological High School "Betel" Oradea, Bihor County. The experiment took place during the 2021-2022 school year, in two stages (the 1st stage consisting of 2 cycles of 5 weeks each in the period 27.09.2021-17.12.2021, and the 2nd stage consisting of 2 cycles of 5 weeks each between 25.01.2022 - 01.04.2022).

During the experiment, I intervened with experiment-specific topics twice a week in each class of G.E. students. G.C. subjects. They conducted their physical education lessons in the traditional form.

The experiment actually ran over a period of 20 weeks, preceded by 2 weeks of initial testing and completed by another 2 weeks of final testing. The 20 weeks of actual activity were divided into 4 cycles of 5 weeks each.

In each training cycle we chose to use (over all 5 weeks) a number of 5 dynamic games (2 games with running content, one with jumping content and two more with combinations of running and jumping). For each of these games, we tried to obtain an adequate dosage of the effort parameters (intensity, volume, number of repetitions, duration of each stroke, of the breaks), so that their application is appropriate from a methodological point of view for the development of the motor qualities targeted in our work.

To verify the effectiveness of the activity carried out during the experiment, we chose to use a battery of tests, which included 6 tests (table no. 1).

For the 3 running tests (10m., 20m. and 505m.) we used the electronic Witty Timing System to measure performance, and for the 3 tests used to measure the vertical explosive force and the speed of reaction to visual stimuli we used the system Microgate OptoJump Next. At each control test, the students each were allowed two attempts, taking into account the best of the two.

These control tests were taken during physical education classes, in the high school gym, under similar conditions.

The order of application of these control samples was in accordance to the protocol for the administration of these samples, and the relatively large number of control samples and the need for complete recovery breaks meant that both the initial and the final testing were carried out over the course of three physical education lessons.

Tabel nr. 1 Sistemul probelor de control

Nr.	***Proba de control***	***Abreviere***	***Calitate motrică vizată***
1	*Accelerated running for 10 meters with a standing start*	**10 m.**	Starting speed
2	*Accelerated running for 20 meters with a standing start*	**20 m.**	Acceleration speed
3	*Agility test*	**505 m (s)**	Agility
4	*Counter movement jump*	**C.M.J. (cm)**	Explosive force- lower limbs

5	*Stiffness test*	**STF(w)**	Reactive force – lower limbs (anaerobic alactacid power)
6	*Visual reaction jump*	**V.R.(s)**	Speed of reaction to visual stimuli

1. Accelerated running with a standing start - for 10 meters (10m.)
The subjects cover the distance of 10 meters in the shortest possible time. They adopt the starting position behind the line, placing one foot immediately behind it. The departure is free, with self-control, the timing being carried out electronically (Witty Timing System).

2. Accelerated running with a standing start - for 20 meters (20m.)

The subjects cover the distance of 20 meters in the shortest possible time. They adopt the starting position behind the line, placing one foot immediately behind it. The departure is free, with self-control, the timing being carried out electronically (Witty Timing System).

3. Agility test 505 meters (505m.)

Subjects benefit from a 5-meter launch space, after which the actual timing begins: continue running another 5 meters, step one foot beyond the marking line, perform a 180º turn and finish with another 5 meters run in the opposite direction those completed in the first part of the test. The departure is free, with self-control, the timing being carried out electronically (Witty Timing System).

4. Counter movement jump (CMJ) test

The subjects start from the standing position, perform a knee flexion immediately followed by a vertical release, as high as possible, concomitant with swinging the arms. Performance measurement was done using the Microgate OptoJump Next system.

5. Stiffness test (Stf.)

The subjects start from a standing position, perform a sequence of 7 vertical jumps, as high as possible, concomitantly with arm swinging. The methodical indication was that these vertical jumps should be executed with a contact time with the ground as short as possible, so that the power developed (expressed in watts) would be as high as possible, i.e. to obtain an optimal ratio between the height of the jumps and the duration of the contact with the soil before each detachment. Performance measurement was done using the Microgate OptoJump Next system.

6. Visual reaction jump (V.R.) test

The subject stands in the measurement area with knees bent and arms behind, ready to jump, facing a screen on which a red circle is visible. When the subject visually notices that the red circle changes color to green, he jumps as high as possible. A test set represents 3 such visual stimuli, 2 to 6 seconds apart.

Test results were tabulated and statistically-mathematically processed with the help of Microsoft Excell 2020 software.

RESULTS OBTAINED AND THEIR INTERPRETATION

For a better and faster understanding of the data recorded in the two groups (G.E. and G.C.) during the two evaluations, we considered it useful to highlight the arithmetic averages, standard deviations and the differences between them between the two tests, for each category of subjects in part.

Table no. 1 Comparative highlighting of the arithmetic means and standard deviations of the results obtained, in each of the six control samples used, in the groups of girls.

Test	***FETE***							
	G.E. (n=44)				**G.C. (n=40)**			
	T.I.		***T.F.***		***T.I.***		***T.F.***	
	averg.	*stdev.*	*averg.*	*stdev.*	*averg.*	*stdev.*	*averg.*	*stdev.*
10 m.	2,47	0,14	2,31	0,12	2,41	0,16	2,34	0,12
20 m.	4,55	0,28	4,33	0,20	4,49	0,27	4,35	0,21
505 m (s)	3,52	0,22	3,35	0,19	3,47	0,19	3,39	0,16
C.M.J. (cm)	18,19	3,79	22,79	4,90	19,22	4,34	21,68	5,00
STF(w)	20,77	4,94	25,08	5,98	21,39	5,02	24,44	4,96
V.R.(s)	0,91	0,42	0,85	0,35	0,893	0,4	0,869	0,45

Table nr. 2 Comparative highlighting of the arithmetic means and standard deviations of the results obtained, in each of the six control samples used, in the groups of boys.

Test	***BĂIEȚI***							
	G.E. (n=44)				**G.C. (n=40)**			
	T.I.		***T.F.***		***T.I.***		***T.F.***	
	averg.	*stdev.*	*averg.*	*stdev.*	*averg.*	*stdev.*	*averg.*	*stdev.*
10 m.	2,38	0,22	2,21	0,18	2,42	0,19	2,35	0,17
20 m.	4,34	0,46	4,09	0,42	4,38	0,37	4,29	0,34
505 m (s)	3,49	0,27	3,34	0,21	3,43	0,25	3,38	0,23
C.M.J. (cm)	21,16	4,09	26,25	5,28	21,65	4,21	25,17	5,23
STF(w)	22,11	5,42	28,13	7,21	22,41	5,25	26,62	6,45
V.R.(s)	0,88	0,40	0,83	0,30	0,878	0,38	0,842	0,28

Analyzing the values from the tables above, it follows that at the initial testing for all the control samples, the average values of each category of subjects in the experimental group are comparable to those of the subjects in the control group. It can also be highlighted that in the case of the final testing we find significantly higher values in the subjects of the experimental group.

Tabel nr. 3 Progresul realizat de către fiecare categorie de subiecți, la fiecare test utilizat

Proba	*Categoria de subiecți*	*Progres*		
		±	%	E.S.
10m. (s.)	G.E. - girls	0.16	6.47	1.15
	G.C. - girls	0.07	2.90	0.49
	G.E. - boys	0.17	7.14	0.85
	G.C. - boys	0.07	2.89	0.33
20m. (s.)	G.E. - girls	0.22	4.83	0.90
	G.C. - girls	0.14	3.11	0.58
	G.E. - boys	0.25	5.76	0.87
	G.C. - boys	0.09	2.05	0.45
505m. (s.)	G.E. - girls	0.17	4.82	0.86
	G.C. - girls	0.08	2.30	0.46
	G.E. - boys	0.15	4.29	0.82
	G.C. - boys	0.05	1.45	0.41
CMJ (cm.)	G.E. - girls	4.60	25.28	1.05
	G.C. - girls	2.46	12.79	0.63

	G.E. - boys	4.01	18.95	0.85
	G.C. - boys	3.52	16.25	0.74
Stf. (w.)	G.E. - girls	4.31	20.75	0.82
	G.C. - girls	3.05	14.25	0.61
	G.E. - boys	6.02	27.22	0.94
	G.C. - boys	4.21	18.78	0.72
V.R. (s.)	G.E. - girls	0.06	6.68	0.87
	G.C. - girls	0.02	2.68	0.47
	G.E. - boys	0.05	5.88	0.95
	G.C. - boys	0.03	4.10	0.51

We chose to highlight the progress made in three forms: in absolute value (±), the difference between the averages recorded at the final test and those obtained at the initial test, in percentage (%), the difference above compared to the initial values and through the "size effect" (E.S.) between the two evaluations, for each of the 6 applied tests, both for the compositions of the experimental group and for those of the control groups. After J.R. Thomas (1996), effect size estimates the degree to which a cause influences the effect and represents the standardized difference between media.

As we can see from the table above, the values of E.S. in all 6 control samples used are greater than or equal to 0.8 (0.82-1.15 in the case of girls and 0.82-0.95 for the group of boys) for subjects in the experimental group. In the case of the control group, these values are between 0.46-1.61 in the case of girls and 0.33-0.74 for the group of boys.

These values allow us to state (according to the assessment grid stated by J.R. Thomas, 1996) that the effect size in the case of the experimental groups is large (all values are greater than 0.8) and that the effect size in the case of the control group is a medium one (values in the range 0.2-0.8).

CONCLUSIONS

Nowadays, an increasing amount children face more and more serious problems regarding obesity, Romania being no exception in this matter. This is due both to the faulty lifestyle of the younger generation and to the fact that sports in general and physical education lessons in particular are not prioritized . Thus, a more creative and attractive organization of physical education and sports classes through physical sports activities is necessary, and dynamic games can respond to this desire and at the same time can successfully contribute to the achievement of the objectives of developing motor skills.

Although the development of speed (starting, acceleration, agility), the vertical explosive force of the lower limbs, the speed of reaction to visual stimuli are important objectives of the school program for primary school students, the their fulfillment is not always achieved. We believe that one of the limiting factors is the monotony of classic physical education lessons, which are frequently encountered. This approach of ours helped us to see that dynamic games used judiciously can successfully fulfill this objective, while also achieving some attractive and enjoyable lessons for students.

From the research carried out, it follows that in all the control samples, a greater progress was found in the experimental group, between the two initial and final tests, resulting in the fact that the dynamic games used as a means of developing motor skills contributed substantially to the increase in the performance of primary education students.

The results obtained for all the control samples used by the subjects from the two experimental groups confirm the correctness of the methods and means used. The progress

recorded in these groups is clearly higher than that recorded by the subjects in the control group. The students consciously and actively participated in all the lessons, involving themselves physically and emotionally.

The values of the effect size (E.S.) obtained in the subjects of the experimental group (both in the case of girls and boys) confirm that the difference between the averages recorded in the two tests (T.I. and T.F.) is statistically significant.

The judicious planning and application of the methods and means of development of motor qualities even within the physical education lessons leads to a significant progress in terms of the level of representation of the different forms of manifestation of the motor qualities targeted by our research.

Based on the aforementioned inferences, we can state that the working hypothesis has been confirmed.

Aknowlegments All authors have equal contribution.

REFERENCES

Barker D, Quennerstedt M, Annerstedt C (2015). "Learning through group work in physical education: a symbolic interactionist approach." *Sport, Education and Society*, vol.20, no.5, p.604-623.

Breuer C, Hallmann K, Wicker P. (2011). "Determinants of sport participation in different sports." *Managing Leisure*, 16(4), p.269-286.

Cristea Dana, Lucaciu Ghe., Mirela Ștef (2013). "Studiu comparativ privind atractivitatea lecţiilor de educaţie fizică la ciclul gimnazial şi liceal." *Analele Universităţii din Oradea, Fascicula de Educaţie fizică şi sport*, 24-25 mai, ISBSN 1224-5100, p.13,

Cristea D., I., **(**2009). "Educaţie prin jocuri de mişcare la ciclul primar. *" Conferinţa Internaţională Direcţii şi Strategii moderne de formare şi perfecţionare în domeniul resurselor umane*, Universitatea Politehnică Bucureşti, DPPPD-SSU, format electronic lucrări extenso, ISSN 2067-1024

Cristea, D. I., Cristea A., (2008). "Dezvoltarea creativităţii specifice prin joc la cercetaşi." *Fascicula Educaţie Fizică şi Sport*, Editura Universităţii din Oradea, ISSN 1224 – 5100

Dao, Chanh. (2021). "Using Movement Games in Physical Education Class to Improve Physical Fitness and Stabilize Vestibule for Children Aged 6 to 7 years." *International Journal of Human Movement and Sports Sciences*. 9. 1396-1402. 10.13189/saj.2021.090636.

Dobrescu Tatiana, (2019). "Influences of Physical Education Lesson Movement Games on the Motor Behavior of Primary School Pupils", *Gymnasium, Scientific Journal of Education, Sports and Health*, issue vol. 20 No. 1

Justen O'Connor, Laura Alfrey & Dawn Penney (2022). "Rethinking the classification of games and sports in physical education: a response to changes in sport and participation". *Physical Education and Sport Pedagogy*, DOI: 10.1080/17408989.2022.2061938

Shane Pill (2016) An appreciative inquiry exploring game sense teaching in physical education, Sport, Education and Society, 21:2, 279-297, DOI: 10.1080/13573322.2014.912624

Stănescu, M., Ciolcă, C., Urzeală, C., (2004). "Jocul de mișcare, Metodă și mijloc de instruire în educație fizică și sport", Editura Cartea Universitară București

Stănescu, M., (2002). "Educație fizică pentru preșcolari și școlari mici – o abordare psihomotrică", Editura Semne București

Szabo-Alexi, P., Ilieș, A., and Szabo-Alexi, M. (2016). "The Romanian cultural-sports scenery defined by volleyball competitions through structure, dynamics and systemic functionality during 2009-2016" *GeoSport for Society*, 4(1), 51 - 68

Tatiana Dobrescu, (2016). "Aspects regarding the promotion of movement games through the structural components of the middle school physical education lesson", *Gymnasium Scientific Journal of Education, Sports and Health*, issue vol. 17 No. 1

Thomas, J., Nelson, J. (1996). "Metodologia cercetării în activitatea fizică", M.T.S., C.C.P.S., vol.I, Editor, C.C.P.S., București, p.108

Wayne Smith, Alan Ovens, Rod Philpot (2021). "Games-based movement education: developing a sense of self, belonging, and community through games." *Physical Education and Sport Pedagogy*, 26:3, 242-254.

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