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Change in indicators of the development of flexibility of students 13–15 years old under the influence of differentiated learning

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Purpose: *to determine the degree of influence of differentiated learning on the level of flexibility of students in grades 7–9.*
Material & Methods: *analysis and generalization of scientific and methodological literature, pedagogical testing, pedagogical experiment, methods of mathematical statistics. The study involved 226 children 13–15 years old.*
Results: *in the course of the initial study, a "low" level of development of flexibility of students in grades 7–9 was revealed. In the age aspect, the wave-like nature of age-related changes was revealed, however, these differences are mostly not significant ($p>0,05$). In the sexual aspect, mainly significant prevalence of girls 'indicators over boys' data was revealed ($p<0,01$; $0,001$). After the experiment, it was found that the flexibility indicators of schoolchildren of the main groups significantly improved and these differences are statistically significant ($p<0,05–0,001$).*
Conclusions: *significant changes in the indicators of development of flexibility indicate the effectiveness of the introduction of differentiated motor tasks, taking into account the individual capabilities of students in grades 7–9.*

Keywords: *flexibility, differentiation, physical education, middle school students.*

Introduction

The modern education system is mainly aimed at obtaining a significant amount of information, as a result of which the mental load and emotional stress of students are significantly increased, and physical activity is significantly reduced, which leads to a deterioration in health and a decrease in the level of physical fitness [2; 4; 23]. This problem is especially acute during the period of study at school. So, according to a number of authors [17; 22; 24], among children graduating from institutions of complete general secondary education, only 11% are practically healthy, and 89% have various deviations in their state of health, and a greater number (over 60%) have a low level of physical preparedness. One of the key factors to improve this problem is physical education. However, leading experts note that the existing system of physical education in secondary schools is not effective enough and justify this by the fact that the content of the educational process is mainly filled with generally accepted types of educational material [6]; physical education lessons are conducted according to the standard scheme [16]; the key criterion for assessing academic achievement is the achievement of program standards [5], etc. Therefore, the scientific community continues to search for fundamentally new educational technologies aimed at raising a healthy, physically prepared and socially active person.

The problem of optimizing the process of physical education in order to increase the physical fitness of adolescent children remains relevant today.

The analysis of available publications revealed a number of improvements dedicated to improving the level of physical fitness of teenage children through the introduction of various means, methods and approaches: cheerleading [3]; rugby 5 [26]; badminton, running and sports dancing classes [9]; a rational combination of variable modules [21], etc. At the same time, a number of specialists note that one of the operational methods for the formation and improvement of the motor sphere is a differentiated approach, which takes into account not only age and gender differences, but also the individual capabilities of each child separately.

Thus, the conducted studies proved the effectiveness of applying a differentiated approach in the process of motor training of schoolchildren, taking into account various criteria: the rate of biological development [20]; psychoemotional state [7]; physical health of students [25]; the level of development of individual motor abilities [14; 15] and others.

However, it should be noted that the issue of differentiating the content of the educational process in the framework of school physical education, taking into account the individual level of functional and physical fitness, directly indicators of the development of flexibility of children 13–15 years old, has not been investigated. In our opinion, the introduction of the developed differentiated individual motor tasks will positively affect the level of development of flexibility of students in grades 7–9, which determined the direction of our study.

Purpose of the study: to determine the degree of influence of differentiated learning on the level of flexibility of students in grades 7–9.

Objectives of the study:

1. Determine the level of development of flexibility of children 13–15 years old.
2. To trace changes in the obtained indicators in the process of applying differentiated motor tasks, taking into account the individual capabilities of students in grades 7–9.

Material and Methods of the research

To achieve this goal, the following methods were used: theoretical analysis and synthesis of scientific and methodological literature; pedagogical testing; pedagogical experiment; methods of mathematical statistics. To determine the level of development of flexibility of children 13–15 years old, motor tests were proposed by L.P. Sergienko [19]. Thus, the level of development of spinal mobility was determined by the performance indicators of torso forward from the initial sitting position (cm) of the shoulder joints – twisting of straight arms back and forth with a gymnastic stick (cm) of mobility in the hip joints – transverse twine (cm).

The study was conducted on the basis of secondary

school No. 150 of Kharkov. It was attended by 226 students of grades 7–9. 3 main groups were formed (66 boys, 79 girls) and 3 control groups (41 and 40, respectively).

According to the results of a stating experiment, a program was developed to differentiate the content of educational classes, taking into account the level of functional and motor preparedness of schoolchildren of the main groups. The program consists of theoretical, methodological, substantive and applied components. The theoretical and methodological component contains goals, objectives and basic methodological principles of training; the content component is divided into the main section, which meets the requirements of the state program, and the variable sections, the content of which was developed by us taking into account the functional state of the basic systems of the body and the level of development of physical qualities and contains physical exercises and outdoor games aimed at improving functional and physical fitness. The practical component reveals the features of the organization of physical education lessons in the framework of the developed program.

The innovations we proposed included: adjustments to the content of the variable section of the program based on the differentiation of educational material, taking into account the functional and physical fitness of students; the introduction of differentiated motor tasks, taking into account the individual capabilities of students in grades 7–9; improving the applied component of the program, through the organization of independent activities of students and the phased implementation of the developed program material of a variable type; improving the system for monitoring and evaluating the results of educational activities of students.

Results of the research

An analysis of the results of the stating pedagogical experiment indicates the identity of the control and main groups for all indicators that were studied ($p>0.05$). The analysis of primary data in the age aspect revealed a wave-like dynamics of changes, but these differences are mainly not significant ($p>0.05$). In the sexual aspect, it was found, mainly, that the prevalence of girls 'indicators over the boys' data is likely ($p<0.01$; 0.001). Comparing the indicators of the manifestation of flexibility to normative assessments proposed by L.P. Sergienko [19], it was found that the results of students in grades 7–9, on average, correspond to a score of 1 point ("low" level).

Analyzing the data obtained after the pedagogical experiment, it was found that the flexibility indicators of schoolchildren of the main groups improved and these changes were statistically significant ($p<0.05$–0.001) (Table 1).

So, the increase in the indicators of torso forward is: for boys of 7th grade – 0.50 cm, which is a percentage ratio (7.56%), of 8th grade – 0,83 (24.90%), 9th grade – 1,42 (46.24%), among girls – 1,27 (51.43%), 0.74 (12.91%), 1.35 (36.80%), respectively (Fig. 1) .

According to the data on straight arms twisting, the increase in the result is for boys of 7th grade – 1,11 cm, which is a percentage ratio (1,55%), of 8th grade – 1,48 (1,53%), 9th grade – 3,32 (3.42%), among girls – 2,09 (2,54%), 4.57 (6.27%), 3,57 (4,67%), respectively (Figure 2) .

The increase in the indicators of transverse twine is: for boys of the 7th grade – 2,78 cm, which in percentage terms is (7,33%), of the 8th grade – 1,34 (2,97%), of the 9th grade – 2,16 (5,19%), among girls – 1,67 (7,41%), 2,09 (8,60%), 2,52 (9,90%), respectively (Figure 3).

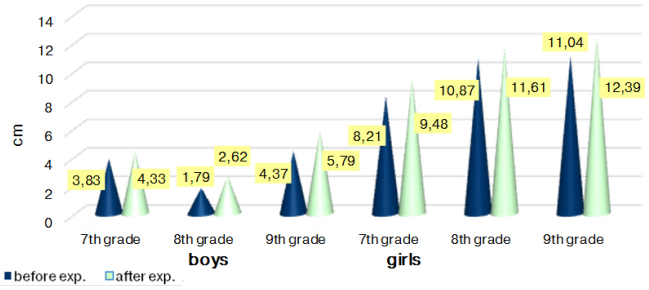

Fig. 1. Indicators of the torso forward of students of the main groups before and after the experiment

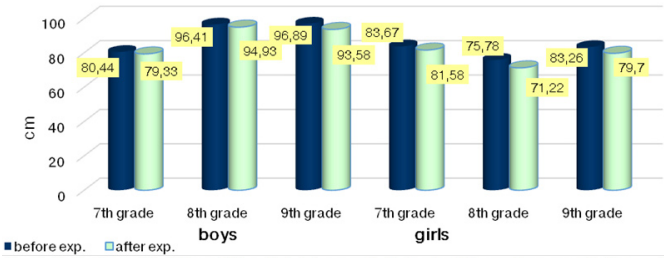

Fig. 2. Indicators of twisting of the straight arms of students of the main groups before and after the experiment

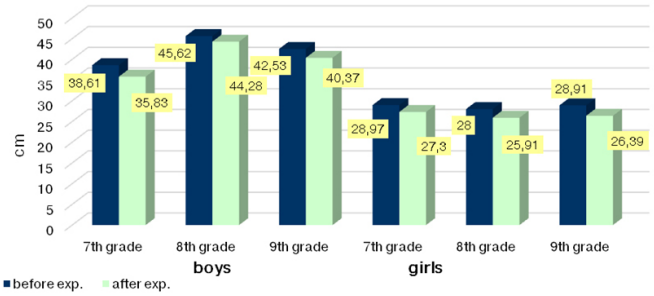

Fig. 3. Indicators of transverse twine of students of the main groups before and after the experiment

The analysis of secondary indicators of students of the main groups in the age and sex aspects did not reveal significant changes compared to the initial data, with the exception of the results of twisting the children's straight arms, where age differences began to be significant ($p<0.05$).

However, positive changes in the secondary results of students aged 13–15 of the main groups at the general level of development of flexibility did not significantly affect and it did not change ("low").

Taking into account possible changes and a rather substantial percentage increase in indicators, we came to the conclusion that the use of differentiated motor tasks, taking into account the individual abilities of students in grades 7–9, had a positive effect on the level of flexibility of students in the main groups. The indicators characterizing spinal mobility (29,97%) improved most significantly. In terms of age, the greatest increase in indicators is observed among schoolchildren of 15 years old (17,7%), according to all the parameters that were studied, while a more significant increase in results was found in girls (15,5%) than in boys (11,2%).

Table 1

Development indicators of the flexibility of schoolchildren of the main groups before and after the experiment

	7 grade		8 grade		9 grade	
	n	$\bar{X}$±m	n	$\bar{X}$±m	n	$\bar{X}$±m
Boys						
Torso forward from sitting position (cm)						
before exp.	18	3,83±0,71	29	1,79±0,33	19	4,37±0,66
after exp.	18	4,33±0,74	29	2,62±0,30	19	5,79±0,64
t		2,62		8,26		10,20
p		<0,05		<0,001		<0,001
Twist straight arms back and forth (cm)						
before exp.	18	80,44±3,55	29	96,41±0,81	19	96,89±2,28
after exp.	18	79,33±3,64	29	94,93±0,79	19	93,58±2,20
t		5,08		13,89		11,17
p		<0,001		<0,001		<0,001
Transverse twine (cm)						
before exp.	18	38,61±2,17	29	45,62±0,89	19	42,53±2,40
after exp.	18	35,83±2,25	29	44,28±0,88	19	40,37±2,36
t		3,13		11,79		8,40
p		<0,01		<0,001		<0,001
Girls						
Torso forward from sitting position (cm)						
before exp.	33	8,21±0,93	23	10,87±1,56	23	11,04±1,72
after exp.	33	9,48±0,78	23	11,61±1,47	23	12,39±1,63
t		5,14		4,71		7,94
p		<0,001		<0,001		<0,001
Twist straight arms back and forth (cm)						
before exp.	33	83,67±2,38	23	75,78±4,19	23	83,26±3,86
after exp.	33	81,58±2,43	23	71,22±4,09	23	79,70±3,91
t		3,81		4,40		16,19
p		<0,001		<0,001		<0,001
Transverse twine (cm)						
before exp.	33	28,97±2,00	23	28,00±2,31	23	28,91±2,53
after exp.	33	27,30±2,02	23	25,91±2,37	23	26,39±2,48
t		11,21		4,65		5,09
p		<0,001		<0,001		<0,001

Conclusions / Discussion

The analysis of secondary data indicates a significant improvement in the indicators of manifestation of loudness of schoolchildren of the main groups (p <0,05-0,001). So, the increase in the results of students of 13 years of the main groups is 12,97%, 14 years of age – 9,53%, 15 years of age – 17,71% (increase in the performance of students in control groups – 2.25%, 0.24%, 1.64% respectively).

The above results are consistent with data from other authors. Thus, the research of H. Dzhangobekovoi, L. Vovkanich, F. Muzyka [9] established the positive impact of sports dance classes on the development of motor qualities, direct flexibility, middle school students; A. Agippo, I. Kuzmenko [1] proved the positive impact of specially targeted exercises, taking into account the functional state of sensory systems; B.G. Zadvornaya [10] – stretching; T.N. Bala [3] – cheerleading.

The greatest increase in indicators was determined in schoolchildren of 15 years old (17.71%).

Our data are confirmed by studies of several authors [8; 11; 13; 18], according to which flexibility develops up to 14–15 and even up to 17 years. The authors attribute this to the fact that in adolescents the ossification of the skeleton is not yet complete, therefore their spine is still quite flexible and mobile; a sufficiently high mobility in the joints remains, associated with the improvement of the processes of inhibition of the central nervous system, as a result of which the muscle tone

decreases, and their elasticity improves, which contributes to the development of flexibility.

Analyzing the data of students in the control groups obtained after the experiment, it was found that they also improved, however, these changes are not significant ($p>0.05$).

Thus, it can be stated that the introduction of complexes of physical exercises of the developed variable type had a positive effect on the level of development of flexibility of schoolchildren of the main groups. In our opinion, this is due to the fact that the content of physical education lessons was supplemented by active, passive exercises and muscle relaxation exercises, which were aimed at stretching the muscles, ligaments and tendons; to increase the range of motion in various joints.

Prospects for further research in this direction are to introduce the proposed innovations into the educational process of another age group.

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