



*Asesorías y Tutorías para la Investigación Científica en la Educación Puig-Salabarría S.C.*  
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RFC: ATI120618V12

**Revista Dilemas Contemporáneos: Educación, Política y Valores.**  
<http://www.dilemascontemporaneoseducacionpoliticaayvalores.com/>

**Año: VII      Número: Edición Especial      Artículo no.:15      Período: Diciembre, 2019.**

**TÍTULO:** Enfoque diferenciado de la educación física de los estudiantes adolescentes.

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**RESUMEN:** El artículo ofrece el método de los autores de un enfoque diferenciado para la educación física de estudiantes adolescentes en clases de educación física. El método es la diferenciación de los estudiantes de una clase y género en grupos homogéneos y la diferenciación de la actividad física de diferentes orientaciones dependiendo de la edad biológica de los estudiantes. Los estudiantes (niñas de 12-13 años (n = 220) y niños de 14-15 años (n = 226)) de escuelas secundarias de Kiev (Ucrania) participaron en la investigación. Se establecen las relaciones de

tiempo para planificar el desarrollo de diferentes cualidades físicas de los estudiantes que tienen una edad biológica lenta y acelerada, y aquellos cuya edad biológica corresponde al tiempo cronológico.

**PALABRAS CLAVES:** enfoque diferenciado, educación física, edad biológica, estudiantes.

**TITLE:** Differentiated approach to physical education of adolescent students.

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**ABSTRACT:** The article offers the authors' method of a differentiated approach to the physical education of adolescent students in physical education lessons. The essence of the authors' method is the differentiation of the students of one class and gender into homogeneous groups, and the differentiation of physical activity of different orientations depending on the students' biological age. The students, girls of 12-13 years old (n=220) and boys of 14-15 years old (n=226) of Kyiv secondary schools (Ukraine) took part in the investigation. The time ratios for planning the

development of different physical qualities of students who have slow, accelerated biological age and those whose biological age corresponds to the chronological time are established.

**KEY WORDS:** differentiated approach, physical education, biological age, students.

## **INTRODUCTION.**

According to scientists (Bodnar, Stefanyshyn, & Petryshyn, 2016; Budagh'janc, 2010; Griban, et al., 2019; Prysiazhniuk, et al., 2019; Tymoshenko, et al., 2019), the system of physical education that currently exists in Ukraine does not reach the goal to strengthen the physical health of students.

The analysis of literary sources (Bulych, & Muravov, 2002; Bliznevsky, Kudryavtsev, Kuzmin, Tolstopyatov, Ionova, & Yermakova, 2016; Zavydivska, O., Zavydivska, N., & Khanikiants, 2016; Zhamardiy, et al., 2019; Mozolev, et al., 2019) shows that scientists are constantly working on finding ways to improve the efficiency of the physical education of students.

The scientists pay much attention to the development of innovative technologies aimed at updating the content of physical education. Among the reasons that prevent from the achievement of this goal, the authors highlight a standard approach to physical education methodology that does not take into account the biological age of students involved (Ghoncharenko, & Novykova, 2010; Griban, 2009); the lack of research on the patterns of interaction of the most valid criterion for the distribution of students into homogeneous in morphological and functional state groups and the indicators of their physical abilities by physical health indicators (Yedynak, 2003; Furmanov, & Yuspa, 2003; Prontenko, et al., 2019); the lack of sound information about the differentiated rational parameters of developmental physical activity for secondary school students and their impact on the health of students (Bulatova, & Usachov, 2008; Ilchenko, 2014; Shkola, et al., 2019).

The physical health and development of children and adolescents have recently been studied from the point of view of the analysis of age and gender patterns.

A great deal of material was collected on the age dynamics of the average indicators of morphological and functional characteristics, and on the basis of them, the methods of physical education that corresponded to age opportunities and social demands were developed (Tymoshenko, et al., 2019; Escaravajal-Rodríguez, Baena-Extremera, Ayala-Jiménez, & Ruiz-Fernández, 2017; Zhamardiy, et al., 2019).

The studies (Prysiashniuk, et al., 2019; Vlastovskiy, 1976; Kolokoltsev, Iermakov, & Prusik, 2018) mentioned that children of the same chronological age and gender do not account for a homogeneous group: within the same age, there are fairly large percentage of children who differ in the rates of physical development, the level of biological maturity, and the level of physical abilities displays. This diversity causes a different degree of physical capability, different rates of increase in physical characteristics, different levels of motor achievements, and consequently, the need to use methods of dosing physical activities that correspond to the actual state of the organism of children. Thus, a contrast in the individual indicators of people of the same age and gender indicates that the group-wide approach is unacceptable because of the different morphofunctional capacities of students.

According to the data of scientists (Sitovsjkyj, 2008; Arefiev, 2013), the differentiated approach which allows each student to exercise optimally and provides the best health care effect has great prospects for optimization of the method of physical education.

A differentiated approach is a didactic provision that takes into account not only gender and age patterns of the organism's development but also the individual possibilities, which are homogeneous in terms of the morphofunctional state of the groups (Kravchuk, 2010). First of all, it is related to the methods of dosing of physical activity (Krutsevych, 2008; Montesano, & Mazzeo,

2019). The basis for this statement is the results of studies of significant individual-typological features of morphofunctional indicators of the students of the same age and gender by any absolute or conditional marker (Wilmore, & Costill, 2004; Kolokoltsev, Iermakov, & Prusik, 2018) and the relevant characteristics of response to physical activity (Bliznevsky, Kudryavtsev, Kuzmin, Tolstopyatov, Ionova, & Yermakova, 2016; Prontenko, et al., 2019).

The generalization of scientific and methodological sources on the differentiation of the methods of physical education shows that the effective solution of this problem depends on the studies of the features of adaptive reactions to the proposed activity in homogeneous groups. The realization of this direction is a very important task of the physical education of adolescents because of their significant individual differences in morphofunctional indicators of people of one class and gender. It especially relates to the boys of 14-15 years old and the girls of 12-13 years old (Krutsevych, 2008;).

## **DEVELOPMENT.**

### **Methodology.**

The aim of the article is to substantiate the method of a differentiated approach to the physical education of adolescent students.

The students (the girls of 12-13 years old (n=220) and the boys of 14-15 years old (n=226)) of Kyiv (Ukraine) secondary schools took part in the research.

The research methods are theoretical analysis and generalization of scientific and methodical literature, anthropometry for the determination of the physical development level, testing the level of physical characteristics, express evaluation of the level of physical health (by the method of G. Apanasenko) (Apanasenko, 2007), complex analysis of biological age (by the method of V. Arefiev) (Arefiev, 2013) to divide the students into homogeneous groups and differentiate physical activity. Factor analysis was used to process the study materials.

**Results and discussion.**

The main principles of the authors' method of a differentiated approach to the physical education of adolescent students are presented below.

**The distribution of the students of one class and gender into homogeneous groups.**

The main problem of the implementation of a differentiated approach during physical education classes of secondary school students is a large number of suggestions for the division of students into homogeneous groups in the special literature.

Taking into account the developmental health care orientation of physical education in secondary schools, by the means of factor statistical analysis, the most informative criterion for the distribution of adolescent students to homogeneous morphofunctional groups is found to be a complex indicator of biological age which combined the level of physical development, the index of heterochrony of growth and development of an organism and the degree of expressiveness of secondary sexual characteristics. The total contribution of these indicators to the generalized sample variance accounts for 90.2 % for boys and 92.1 % for girls. On the basis of these indicators, we developed a method for dividing adolescent students into homogeneous groups, which is recommended for scientific use.

To determine the biological age of adolescents at school, we offered an express evaluation (Table 1) which allows the teacher to determine the rate of biological development quickly: slow (R), average (S) – the biological age of the students corresponds to chronological, and accelerated (A). The express evaluation contains two indicators: the body length and the degree of armpit hair development. The assessment of body length (low, below the middle, middle, above the middle, high) is determined by the developed standards for students' physical development. The assessment of the degree of armpit hair development is determined by the three-point system, namely: 0 – the

lack of hair, 1 – sparse hair, 2 – hair in the form of whiskers, 3 – hair developed over the whole armpit (Vlastovskiy, 1976; Arefiev, 2013).

Table 1. The scheme of the express evaluation of the biological age of adolescent students

Body length	The degree of armpit hair development		
	0–1	2	3
Low, below the middle	R	R	S
Middle	S	S	S
Above the middle, high	S	A	A

According to factor analysis, the efficiency of express evaluation in the determination of the biological age of girls is 83.2 %, and boys – 81.0 %.

The same efficient criterion for dividing adolescent students into homogeneous groups is their level of physical health which is determined by the method of G. L. Apanasenko (2007). According to the method of the author, the body mass index counteracts the heterochronous rate of the biological development of secondary school students, which is important for the development of adequate differentiated activities. However, as our previous studies show (Arefiev, 2013), the students with different levels of physical health can be found in 36 % cases among the students of the same biological age. It is additionally presented in the works of other experts (Yedynak, 2003; Krutsevych, 2008). It especially relates to accelerators and retardants.

**The dosage of developmental health care activities on physical education classes of the students of different biological age (through the example of boys of 14 and 15 years old).**

According to the authors' method, dosing the power load in pull-ups for adolescents of 14-15 years old and different biological ages was carried out in the following way: two sets of 5 reps with rest intervals of 60 sec for the boys of 14-15 years old with slow (R) and average (S) paces of development, two sets of 7-8 reps with rest intervals of 120-150 sec for the accelerators (A).

The method of dosing of speed-power load in running broad jump on physical education classes provides: three sets of 6 jumps with rest intervals of 180 sec and two sets of 6 jumps with rest intervals of 90 sec for the boys of 14 and 15 years old with the slow development respectively. The repetition of the jumps in a set is carried out as soon as a student returns to the starting position by walking: three sets of 6 jumps with rest intervals of 90 and 120 sec and three sets of 6 jumps with rest interval of 105 sec and 160 sec for the boys of 14 and 15 years old with average developmental age respectively; two sets of 6 jumps and one set of 4 jumps with rest intervals of 90 and 145 sec and three sets of 6 jumps with rest intervals of 130-145 sec for the boys of 14 and 15 years old with accelerated development respectively.

During the development of speed in a physical education classes while 60 m running, the optimal number of training sets for boys of 14 and 15 years old, regardless of their biological age, is 3-4 sets. The main difference in speed dosing is the rest time between sets. The rest intervals between the first and second sets are 90 sec, between the other sets – 115-135 sec for the retardant boys of 14 and 15 years old. The rest intervals are 60, 100, and 135 sec, respectively for the boys of 14 years old with average biological development, and 100 sec between the first and second sets and 140-160 sec – between the other sets for the boys of 15 years old with average biological development. The sufficient rest interval between sets is 70-75 sec for the boys of 14 years old with accelerated development, and 135 sec between the first and second sets, and 180 sec between the second and third sets for boys of 15 years old with accelerated development.

At the first physical education classes, the following distance that can be overcome during the established standard in 1500 m running, is recommended in training preparation plan: 1385-1400 m for the boys of 14 years old with slow and accelerated biological development, 1250 m – with an average development; 1300-1325 m for boys of 15 years old with a slow and accelerated development, 1475 m – with an average development.

**The differentiation of the ratio of the means of developmental health care classes in the physical education of adolescent students.**

Taking into account the content of the curriculum, sensitive periods of development of motor characteristics, as well as different biological age and students' physical health levels, we developed rational relations of the means of developmental health care classes in physical education on the basis of T. Yu. Krutsevych's researches (2008) and calculations of factor analysis. 30 % of the total duration of the lesson is devoted to power and speed-power exercises for the boys with a slow biological development. It is conditioned by the fact that the characteristic feature of retardant boys is insufficient body weight.

The power exercises allow increasing of their weight through the development of the muscular system. Another 30 % of the time is devoted to the development of speed, the level of which is also low in this group.

A considerable percentage of the time (20 %) is recommended for endurance exercises because of a sensitive period of its development. The boys-accelerators are recommended to take 40 % of the time for power and endurance training. The students whose biological age corresponds to chronological are expected to spend less time for power exercises (20 %), but slightly more time for endurance (30 %) and speed (30 %) exercises. The rational planning of developmental health care classes in physical education for girls is when muscle development takes 30 % of the time, speed-power and agility – 20 %, endurance – 18 % and speed – 12 %.

The selection of pulse regimens in the process of activities that cause training (health care) influence is important for developmental health care activities, in addition to knowledge about the rational correlation of motor activities of different directions. In national literature, such modes are recommended to be calculated according to equations developed for persons starting only with the age of 20. Therefore, calculations of effective working heart rates (HR) for secondary school

students were performed according to equations (Wilmore, & Costill, 2004; Krutsevych, 2008) that are adequate for this age:  $HR_{max} = 208 - (0.7 \cdot age)$ ;  $HR_{train}(\text{the lower level}) = 0.65 \cdot HR_{max}$ ;  $HR_{train}(\text{the upper level}) = 0.75 \cdot HR_{max}$ . The selection of these equations for students is explained by the fact that the use of limit and close to limit activities is forbidden in the physical education of students, especially during adolescence. Therefore, the pulse range which causes a health care effect on the organism is 130-150 beats per min.

### **Differentiated training in program exercises.**

The practice of physical education showed that the method of work, designed for an "average" student, makes the lesson in physical education standard, reduces the interest of students in it.

The studying develops students first of all by its content. However, the content of studying is assimilated by students differently and it influences their development depending on the method of studying.

The necessity of a differentiated approach to students' training exercises is not a new idea, but it has not been implemented in practice properly. First of all, it is necessary to find out the differences in the preferences and interests of boys and girls. It should be considered that boys are eager to learn relatively complex exercises, and simple movements are usually performed without desire and boys do not show enough interest in improving the technique of performing the exercise.

Generally, the attention of adolescent boys is attracted by new exercises, during the performance of which they should show power, agility, and courage. They are not interested in the work on motion techniques that requires special measures increasing students' activity. The interest of girls in movements is not lost with age. But unlike boys who become more courageous and confident with age, girls often show timidity, shyness, capriciousness that must be taken into account in the learning process.

Carrying out differentiated training, the lesson should be structured according to the conventional structure. The main difference is the dosage of motor activity, the improvement of the content of the training material in each part of the lesson and the teaching method. At the same time, the main thing remains the same: preparation exercises are selected to a greater extent for poorly trained students than for the strong; the activities are gradually increased, the breaks between sets are more frequent and longer for the children with reduced capacity.

Therefore, differentiated training should provide the compliance with the following rules: accounting the degree of mastering the motor actions by students concerning preliminary check of previously completed training; the selection of training materials and teaching methods taking into account the accessibility for students, grouped by the level of development of motor skills and mastering motor skills.

### **Body weight correction.**

The indicator of good health is normal body weight. Unfortunately, nowadays the number of overweight students has increased dramatically. Thus, according to statistics (Bulych, & Muravov, 2002; Grihan, 2009), 47 % girls are overweight, among them 23 % are obese. The effects of obesity are hypertension, diabetes, atherosclerosis, cholecystitis, and others.

The speed-related exercises (short distance running), jumping, endurance running are difficult for overweight students. At the same time, weight loss can be achieved through the use of exercises that increase the energy expenditure of an organism. The long exercises, performed with moderate intensity: running, walking combined with running, skiing, multiple jumps in place have the biggest effect. The duration of these exercises should be gradually increased to 25-60 minutes. During such a period of muscular work, the body gradually depletes hydrocarbon reserves and starts to use fats to provide energy for muscle activity. In one lesson, weight loss can reach 1–1.5 kg (Sitovsjkyj, 2008; Zavydivska, O., Zavydivska, N., & Khanikiants, 2016).

Planning of differentiated classes in physical education is advisable to be started with the general functional preparing of an organism. We offer physical games of developmental orientation to do this. The main time of the first quarter of the school year should be devoted to such preparation with the division of adolescents into homogeneous groups and with the use of exercises to optimize the level of physical development.

Thus, the tasks of exercise in the lesson and in the training system should first determine the object of influence (morphofunctional and mental characteristics of a teenager) and only after that the type of impact on it – the means and methods. The pedagogical conditions of a differentiated approach include the optimal condition of a student to perform the exercise, the initial conditionality of the dosage of activity (according to different parameters), the rational ratio of accessibility and difficulty of tasks.

## **CONCLUSIONS.**

As a result of our research, for the first time, the authors' method of a differentiated approach to the physical education of adolescent students, based on the differentiation of students of one class and gender into homogeneous groups was substantiated; the features of the urgent adaptation of the body of adolescent students to physical activities of different orientation were determined that became the basis for the development of adequate parameters of activities (the duration of work during sets, the number of sets and rest interval between them).

The peculiarity of the authors' method is to take into account the biological age of students. The time ratios for planning the development of different physical qualities of students who have slow, accelerated biological age and those whose biological age corresponds to the chronological time are established.

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**RECIBIDO:** 5 de noviembre del 2019.

**APROBADO:** 14 de noviembre del 2019.