Methodology of Differentiation of Health-Improving Classes in Physical Education for Primary School Students

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Abstract

The article presents a methodology of differentiated approach in the physical education classes for modern school students. The differentiated approach is a didactic provision that takes into account not only gender and age regularities of organism development but also individual capabilities, homogeneous according to the morphofunctional state of groups. The adolescent students (girls of 12-13, Kyiv, Ukraine) participated in the study. An experimental (EG, n=28) and control (CG, n=30) groups were formed. The EG students were studying according to the original methodology of differentiation of developmental and health-improving classes in physical education, the CG students – according to the traditional methodology of physical education classes for primary school students. The research methods included anthropometry to determine the level of physical development; testing the level of physical qualities; express assessment of the level of physical health (the methodology by G. L. Apanasenko) and a complex indicator of biological age (the methodology by V. G. Arefiev). The technology of differentiated approach in physical education for adolescent students consists of the methodology of differentiated training of program exercises in physical education taking into account the degree of mastering motor skills, differentiation of the students of one class and gender into homogeneous groups, differentiation of the activities of different orientation (power, speed, speed and power, endurance) taking into consideration the biological age of students. The results of the study showed that at the end of the pedagogical experiment, the physical health level of 57.1 % of EG

students and only 13.3 % of CG students increased; the increase in results in motor tests of the EG was 5-12 %, of the CG – 2-4 %. The analysis showed the preponderance of the original methodology in comparison with the traditional one, which indicates the possibility of its widespread introduction into the process of physical education for modern school students.
Keywords: physical education, differentiated approach, adolescent student

1. Introduction

The idea of a differentiated approach in physical education is not only theoretically substantiated but it is practically realized in the content, forms, and methods of this process [1, 2]. However, neither official science nor pedagogical practice formed a holistic picture of the essence of differentiated training in physical education classes. In our opinion, this task is solved by the concept of differentiating developmental and health-improving classes, called to professionally develop a modern Ukrainian who is a patriotic and physically advanced citizen of the independent state [3, 4].

Extremely contradictory changes in the socio-economic development of Ukraine, building a democratic society and a significant reorientation of humanitarian policy to the individual one with its needs and abilities, on the one hand, destroyed the known stereotypes of collective consciousness, on the other hand, laid the foundations of humanization and democratization. Therefore, the main direction of the modern school is the individualization and differentiation of the educational process.

2. Literature Review

In the pedagogical higher education institutions, they teach taking into account the age and individual characteristics of students with the help of empirical methods. This knowledge is further used so that no student stands out from the rest because of one's peculiarities [5, 6]. The same applies directly to the faculties (institutes) of physical education. Except for the recommendations on the obligatory didactic principle of accessibility, the need to take into account differences in physical development, health status, and physical fitness level of students of the same age and gender, no differentiated methods are taught [7, 8]. It is conditioned either by the lack of scientific validity or by their absence in the program [9].

The individualization of studying is especially relevant today. The new educational system of Ukraine must be individualized and focus on those forms of collectivism that create conditions for the full realization of the individual's potential. Naturally, this implementation is vital for the formation of the physical health of students in the process of applying physical exercises [10, 11, 12, 13].

The second important argument in favor of the individualization and differentiation of school education in general and physical education, in particular, is the awareness of the historical limitations of the class-and-lesson system, which is a concrete expression of the pedagogy by J. A. Comenius [7]. The didactic program by J. A. Comenius was fully implemented only a few centuries later when the problem of standardization first arose at the state level. It was later found that 25 % of students were not able to study under such a system, and it was necessary to lower educational standards [7].

A similar situation threatens the domestic general education school today. Therefore, the Ministry of Education of Ukraine strives to improve the situation by establishing alternative educational institutions (gymnasiums, lyceums, colleges), carefully ranks the standards of secondary education. The individualization and differentiation of education are not self-sufficient scientific and technological procedures. In physical education, they are justified only in the context of implementing the idea of developmental and health-improving training [14, 15]. Therefore, our conceptual approach [9, 16] proposes the predominance of developmental goals over information and cognitive, when the rational parameters of physical activity solve the problems of the total individual physical health of the individual.

Thus, we can conclude that the current trend towards the individualization and differentiation of school education, including physical education, is caused, on the one hand, by the socio-cultural logic of world educational systems, and on the other hand, by the need to humanize social relations in the national educational sphere, improve the physical health of the growing generation through the development of individual physical capabilities of each individual. These priorities in the development of physical education at schools require the reevaluation of the goals, objectives, and content of physical education classes and the development of organizational and socio-pedagogical conditions for their implementation.

3. Method

The aim of the study is to develop a model of differentiating the content of physical education classes for adolescent students and test its efficiency.

The objectives are

1) to substantiate the original model of differentiating the content of developmental and health-improving classes in physical education for adolescent students;

2. To introduce the proposed model into the physical education practice and test its efficiency.

The research methods are determined by the purpose, tasks, and factual material: theoretical (the analysis and generalization of literature sources); empirical (anthropometry to determine the level of physical development, testing to determine the level of physical qualities, the express assessment of physical health by the methodology of G. L. Apanasenko [17], the express evaluation of the biological age of girls between the ages of 12 and 13 by the methodology of V. G. Arefiev [18]); the methods of statistical data processing (selective method for proving the reliability of the results of a pedagogical experiment).

The adolescent students (girls of 12-13, Kyiv, Ukraine) took part in the study. The choice of the study participants is conditioned by the fact that their physical health is worse than the one of boys. In addition, this age is the most variable in terms of functional indicators. An experimental (EG, n=28) and control (CG, n=30) groups were formed. The efficiency of the proposed model was tested during a formative 5-month experiment. The EG students were studying according to the developed original methodology, and the CG students – according to the traditional methodology of physical education classes. The purpose of physical education classes in the CG was to prepare students to meet the educational standards for satisfactory grade, and the EG students – to develop the physical qualities associated with the indicators of the medium level of physical health for the subjects who participated in the study. The processing of the obtained results, their discussion, and conclusions formulation was carried out at the Department of Theory and Methodology of Physical Education of National Pedagogical Dragomanov University.

During the examinations, the authenticity of the difference between the students' indicators at the beginning and at the end of the experiment was determined due to the Student's t-test. The significance for all statistical tests was set at $p<0.05$. All statistical analyses were performed with the SPSS software, version 21, adapted to medical and biological researches.

This study complies with the ethical standards of the Act of Ukraine On Higher Education No. 1556-VII dated 01.07.2014 and the Letter from the Ministry of Education and Science of Ukraine On the Academic Plagiarism Prevention No. 1/11-8681 dated 15.08.2018, and also the principles of the Helsinki Declaration of the World Medical Association – ethical principles for medical research involving human subjects. Informed consent has been obtained from all individuals included in this study.

4. Results and Discussion

In the process of scientific research, various methods of cognition were used, the study of which is carried out by a special science – methodology, i.e. the doctrine of the rules of thinking in the process of creating science theory [19, 20]. The question of methodology is quite complex because this concept is interpreted in different ways. Many foreign scientific schools do not distinguish between methodology and research methods [2, 21]. The domestic scientific tradition considers methodology as a doctrine of the scientific method of cognition or as a system of scientific principles on which the study is based and the choice of a set of cognitive tools, methods, techniques of research is made [22, 23].

The educational institutions, classes, subjects, pedagogical technologies, organizational forms, assessment systems, etc. are subject to differentiation. The variability of the content of education allows the teaching staff of schools to take into account regional and local traditions, to create optional courses, to practice individual and group classes both within one class, several parallel classes, and in different age groups. This is well proved by the analysis of the scientific achievements of teachers [4, 20, 23, 24, 25].

The methodological analysis showed that to solve these problems, the general scientific category "model", which provides a theoretical description of the prototypes of differentiating the real educational process, should be used.

Table 1 presents the models of differentiating the educational process, grouped binary, depending on the conceptual approach to the issues. The first pair of models is distinguished according to the nature of

the educational process differentiation, i.e. when preference is given to external or internal indicators of differentiation. The essence of external differentiation is that the individual characteristics of students are taken into account experimentally, on the basis of what they are combined into special groups (classes). The internal differentiation involves the educational process organization, which takes into consideration the age and individual characteristics of students in the class-and-lesson system (the so-called intra-class differentiation). The consideration of the characteristics of each student is carried out mainly through the empirical means of pedagogical influence (observation, pedagogical testing, etc.). On the one hand, this binary group of models is simple and accessible for a teacher, and on the other hand, it is the least perfect and reliable from the applied scientific perspective. However, in our opinion, it is necessary because it creates an important basis for a teacher for fruitful educational interaction. Obviously, it is effective in combination with other models that have a more thorough supply.

Table. 1. *The systematic of educational differentiation models in modern school (according to Furman, 1997)*

Binary group	No.	Model	The leading criterion of differentiation
I	1	External	The level of academic success, manners
	2	Internal	An empirical approach to taking into account the individual psychological characteristics of students
II	3	Level	The quality of students' mastering the knowledge and skills at the individual level
	4	Profile	The volume and complexity of the content of education, the predominance of some information
III	5	Rigid, selective	Centralized curriculum specific to a particular educational institution
	6	Flexible, selective	The possibilities of choosing the content, methods and organizational forms on the basis of several obligatory disciplines
IV	7	Individualized	Intensive individual continuous contacts of a teacher with students
	8	Accelerated	The intellectual and social development advance of a student
V	9	Specialized, professional	Steady professional inclinations, interests, conscious desire to get a profession
	10	Deepened, enriched	Exceptional cognitive abilities, high ability to study, accelerated social development of a student
VI	11	Structural	Stable structural organization of the school education system (public and private schools, general and specialized schools, etc.)
	12	Systemic	The differentiation of the educational process according to socio-pedagogical and psychological-didactic aspects

The second pair of models develops the ideas of study differentiation, underlying the first pair. The main indicator of distinguishing this pair is the volume and quality of mastering education content by students. However, according to scientists, the efficiency of this model is low because it does not rely on solid diagnostic tools [13, 20]. The profile differentiation acquires a systemic character at the senior level of school.

The third pair of models is built over the previous two. "Flexible" and "rigid" models of differentiation are available in the education systems of different countries. Thus, the first one is typical for the United States, Great Britain, and Bulgaria, the second one – for France, Sweden, and Poland. The modern Ukrainian school is inclined to a flexible, democratically oriented model. The world practice accumulated considerable experience in applying various forms of study individualization and differentiation: schools and classes with accelerated and decelerated studying, intra-class differentiation, alternative schools, and subjects, individualized forms of studying, etc. Each of these forms gives a student more or less freedom to choose and act that stimulates one's interest. The fourth pair of models develops further the ideas and principles of differentiation and is more complex than the previous ones. It is distinguished on the basis of reliable

knowledge of the individual psychological characteristics of students, especially their mental, social and creative potential. The main mechanism for the development of these abilities is the use and improvement of human inclinations, their transformation into abilities that contribute to the capabilities realization of the individual through developmental interaction. The fifth group of models concretizes and deepens the content and structure of previous models: deep individualization is mostly associated with special training in a particular direction. This group of models differs significantly from the original ones because it implies specialization on a professional basis, i.e. it is associated with a high level of scientific and practical training, which allows each graduate to choose a profession consciously. Combining the advantages of previous models, the sixth group reflects developmental differentiated study comprehensively as an educational system. The first subgroup reflects it from the socio-managerial perspective, the second – in the completeness and interdependence of models, levels, and stages of differentiation.

On the basis of the research by many scientists [26, 27, 28, 29] and our previous research [9, 16, 18, 21], we substantiated the development of the original methodology of differentiation of developmental and health-improving classes in physical education for primary school students. The model of the original methodology is presented in Fig. 1. To implement the targets of the model (the formation of physical fitness of adolescents), two organizational and pedagogical projects, taking into account the biological age and the level of physical health, were proposed. The basis for the second one was the different physical health levels of the students of the same biological age.

The procedural and activity block provided a selection of active games of developmental orientation as an adaptation stage before applying differentiated methods of developmental and health-improving exercises to increase the manifestation level of basic physical qualities of adolescents (power, speed, speed and power, coordination and endurance), and the systematization of exercises for the formation of posture and foot during the school year.

The content of differentiated methods of developmental and health-improving exercises was developed activity parameters, adequate to the physical capabilities of students (the number of corresponding movements in a series, the number of series, and rest intervals between them). On the basis of determining the maximum allowable and optimal levels of developmental and health-promoting activities, the duration of their performance, the rational correspondence of the exercises of various orientations, differentiated models of developmental and health-improving classes in physical education on the example of girls of 12-13.

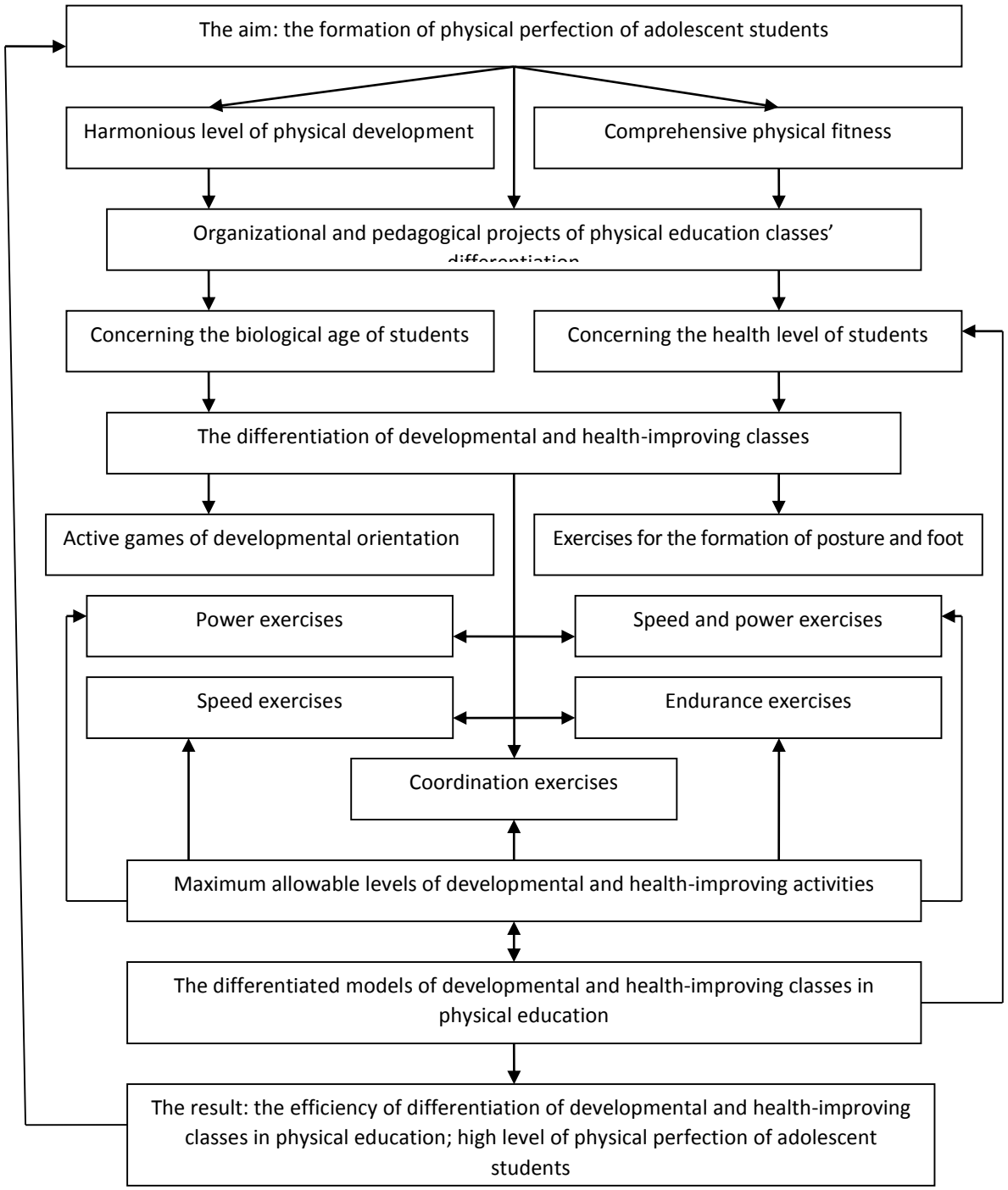

Fig. 1. *The model of the original methodology of differentiation of developmental and health-improving classes in physical education for adolescent students*

The results of the pedagogical experiment in terms of testing the efficiency of the original methodology showed that the designed model contributes to a significant improvement of the students' physical state. The indicators of physical health were assessed according to the methodology of G. L. Apanasenko, and physical fitness – with the help of control exercises from the curriculum of physical culture in primary school. To determine the biological age of girls in school, we developed the express assessment (Table 2), which allows teachers to distribute students according to the rate of their biological development:

a slower rate of biological development (R), corresponding to chronological age (S), and accelerated rate of biological development (A). The express assessment contains two indicators: body length and the degree of armpit hair development.

Table 2. *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

It is important to choose pulse regimes, which determine the training (health-promoting) effect, for developmental and health-improving classes, in addition to knowledge about the rational correspondence of physical activity of different orientations. According to our previous study, the developmental and health-improving range for the girls of 12-13 with the low and below the middle physical health is 140-155 bpm, and for the students with the middle physical health – 156-165 bpm.

Taking into account the content of the school curriculum, the sensitive periods of motor skills development, as well as different biological age and level of physical health, we developed a rational correspondence of the means of developmental and health-improving classes in physical education. Thus, 30 % of the total duration of the class for the girls with a slow pace of biological development was devoted to power and speed and power exercises. It was determined by the fact that the characteristic feature of retarded girls is underweight. Power exercises make it possible to increase their weight by developing the muscular system. Another 30 % of the time was devoted to the development of speed, the level of which was also low in this group. 20 % of the time was recommended for endurance exercises due to the sensitive period of its development. It was recommended to spend 40 % of the training time for power and endurance exercises for accelerant girls. Less time was planned for power qualities (20 %) for the girls whose biological age corresponded to the chronological age, but slightly more – for endurance (30 %) and speed (30 %).

The practice of physical education showed that the methodology of work, designed for an "average" student, makes a physical education class standard, reduces the interest of students in it. Training develops students primarily through its content. However, the content of the training is assimilated differently by students and affects their development depending on the method of teaching. The need for a differentiated approach to students when teaching exercises is not a new idea; however, it has not been properly implemented in practice. First of all, it is necessary to find out the differences in the tendencies and interests of boys and girls. It should be considered that boys are glad to learn relatively complex exercises, and usually perform simple movements reluctantly and do not show enough interest in improving the technique of performing the exercise. Generally, adolescent boys are attracted by new exercises, during which they are able to show power, agility, and courage. The work on the technique of the movements does not meet their interests and requires special measures that increase students' activity. Girls do not lose interest in movements with age. But in contrast to boys, who become more courageous and self-confident with age, girls are often timid, shy, capricious, which must be taken into account in the training process.

Carrying out differentiated training, a class should be built in terms of a common structure. The main difference is in the dosage of motor activity, the improvement of the educational material in each part of the class and teaching methods. At the same time, the main thing remains unchanged: preparing exercises are selected in a larger volume for poorly prepared students; the activity is gradually increased and the rest intervals between repetitions of tasks are made more frequent and longer for students with reduced working capacity. Therefore, differentiated training should provide the following rules: accounting the degree of mastering motor actions by students after a preliminary check of previously completed educational material; the selection of educational material and teaching methods taking into account accessibility for students, grouped by the level of motor skills development.

The planning of differentiated physical education classes should begin with the general functional training of the body. We propose active games of developmental orientation to implement this task. The main time of the first quarter of the school year should be devoted to such training with the division of

adolescents into homogeneous groups and the exercises to optimize the level of physical development.

Thus, first of all, the task of applying physical exercises in class and in the system of classes should determine the object of influence (morphofunctional and mental characteristics of the adolescent) and only then – the type of influence: means and methods. The pedagogical conditions of the differentiated approach should include the optimal state of a student to perform this exercise, the initial conditioning of the activity dosage (according to various parameters), the rational correspondence of accessibility, and the difficulty of tasks.

At the beginning and after the end of the pedagogical experiment, the indicators of physical fitness of the EG and CG students were tested and the results were compared with the standards for the girls of 12-13 (Table 3). There were positive changes in the CG in all seven tests. An increase of 2-4 % was recorded in control exercises. However, only in the 1500 m run and in the 4 × 9 m shuttle run it was statistically significant (t=2.0-2.4; p<0.05).

Table 3. *The dynamics of the physical qualities development level of the EG (n=28) and CG (n=30) students in the process of pedagogical experiment*

Power			Speed	Endurance	Agility	Flexibility
Push-ups, reps	Long jump, sm	Sit-ups, reps	60 m run, s	1500 m run, min, s	4×9 m shuttle run, s	Side bends, sm
The level of physical fitness of the CG students at the beginning of the experiment						
10.6	162.3	26.2	10.5	9.08	12.1	8.6
The level of physical fitness of the EG students at the beginning of the experiment						
11.5	154.3	25.4	10.4	9.15	12.5	8.3
The standards for physical fitness for the girls of 12-13						
10	144	31.0	11.2	9.20	12.4	10.5
The level of physical fitness of the CG students at the end of the experiment						
10.9	162.8	27.1	10.3	8.52	11.8	8.8
The level of physical fitness of the EG students at the end of the experiment						
14	160	32.0	9.7	8.05	11.4	10.7

In contrast to the CG students, the changes in motor tests of the EG students were much more significant. The increase in speed and agility was 5-6 % (t=3.6-6.2; p<0.01-0.001), in the development of speed and power qualities – 10 % (t=5.0; p<0.01), power qualities – 8-12 % (t=6.1; p<0,01).

The final assessment of the physical health level of the students indicated the efficiency of the developed methodology. Thus, 4 out of 30 CG students (which accounted for 13.3 %) and 16 out of 28 EG students (57.1%) achieved the middle level of physical health.

5. Conclusions

1. The consequence of analytical thought is the creation of different models of the educational process differentiation, which is specifically expressed in the forms, levels, stages, and other types of scientific distinction of the educational space. In this regard, educational differentiation in physical education is not only a fact and technology that takes into account the individual characteristics of students but also a conceptual description of the continuous individual growth of the individual in the school space, one's objective and subjective capabilities.

2. The model of the proposed differentiation of physical education classes for adolescent students involves the consideration of the biological age, the use of appropriate differentiated methods of developmental and health-improving activities in the process of forming physical health (the number of exercises in series, the number of series and rest intervals between them).

3. The results of the pedagogical experiment indicated a significant improvement in the physical state of students. The increase in motor tests of the CG students accounted for 2-4 %, the EG students – 5-12 %; 57.1 % of the EG students reached the middle level of physical health, in comparison with 13.3 % of the CG students.

The prospects for further research include the development of differentiated programming of health-

improving classes in physical education for junior students.

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