

Informatization on the physical culture of students using the «physical education» computer program

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Abstract:

Purpose: To analyze the possibilities of using computer programs for informatization of physical culture of students 8-16 years old. *Research materials:* physical education lessons for students 8-16 years old (girls n = 78, boys n = 82); individual models of physical activity planning taking into account indicators of physical development and students' health status. *Results:* computer program that allows recording and analyzing individual indicators of the physical development and state of health of students has been developed. The computer program performs the distribution of physical loads on the basis of individual regression models. *Conclusions:* Experiment showed significant differences in the students participating in the study, in terms of strength development (p<0,05), speed (p<0,01), speed-strength qualities (p<0,05), agility (p<0,05) unlike other students who did not use the computer program "Physical Education".

Key words: physical education, computer program, students, health, physical activity, physical development.

Introduction

The problem of using information technology in physical education is the need to monitor the level of students health, their physical development and physical preparedness. Famous specialists believe that physical training positively influences the level of physical development of students 8-16 years old [11]. Nyak Amir, Saifuddin (2017) point out that the teacher and the coach needs to educate a healthy, vigorous and successful nation with the help of physical culture and sport [12]. Information technology allows to automate the work of a teacher, trainer, sports doctor. Computer programs provide information about the level of physical development and health of students. Aghyppo A. et al. (2016) indicate that the physical education teacher owns information about the state of children through computer programs that contain data on which of the students had diseases, chronic diseases, surgeries, injuries, contraindications for classes [1]. This information allows the teacher to plan individually for each student levels of physical activity, to pick up the necessary exercises. Podrigalo, L., Lermakov, S., Rovnaya, O., Zukow, W., & Nosko, M. (2016) indicate that modern information technology can improve the level of intellectual and mental abilities of students by means of physical activity [15].

Scientific novelty of the research is that for the first time a computer program for the automatic analysis and processing of indicators of the physical development of students 8-16 years old was developed and experimentally introduced into the educational process.

Practical significance of the development lies in the fact that the physical education teacher can automate the process of selecting individual physical activities for each student. This allows to eliminate the overload and injury of students in physical education classes.

Materials and methods

The study was conducted on the basis of the Kharkiv State Academy of Physical Culture and Kharkiv gymnasium №172 (Ukraine). Terms of the research: september 2016 – june 2017. The study involved 78 girls and 82 boys.

A research design.

The study used the following methods and techniques: Content analysis of electronic resources, processing of scientific articles, analysis of information on Internet sites about physical education; control tests (push-up, pull-ups, bench sit-up, standing long jump and running broad jump, shuttle run, running at 30 and 60 m, throwing the ball at the range); methods of information modeling and programming (development of program algorithm, creation of computer program in PASCAL 7.0 programming language in Delphi 7.0 virtual environment).

Methodology of the study was to conduct an analytical review of the problem of using information technologies in physical education and sport. Based on obtained results, the algorithm and structure of the

computer program "Physical Education" have been developed. After this, a study was conducted of individual indicators of physical development and the state of health of students 8-16 years old. Results were included in the computer program, which allowed to create individual programs of physical activities for each student. Within the framework of the experiment, computer models of physical activity were used in physical education classes. The experiment lasted for 6 months. According to the results of the experiment carried out a comparative analysis of the studied parameters of students of different age groups. For this, the methods of mathematical statistics were used.

Statistical analysis

Generalization of the studied characteristics was assessed by mean arithmetic value, standard deviation and error of mean arithmetic. Confidence of differences between mean values was stated by Student's t-criterion. Assessment of statistical hypotheses based on 5% significance level. For statistical processing of data we used licensed program Microsoft Excel (2010), Statistics7, SPSS. Statistical analysis of the received results was conducted, considering recommendations on Microsoft Excel tables' usage for computer data analysis.

Regression analysis was used to identify individual models of physical training for each student. This analysis made it possible to identify factors affecting the health status of students aged 8-16 years old.

The study was conducted in accordance with the Helsinki Declaration. The study was approved by the ethics committee of the Kharkov State Academy of Physical Culture (Ukraine). All participants gave informed consent and were acquainted with the procedure of the study.

Results

The computer program "Physical education" consists of modules: physical development; physical preparedness; functional indicators; psycho-physiological indicators; psychological indicators. The module "Physical development" includes indicators of body length standing, sitting, body weight and chest circumference. The module "Physical preparedness" includes the indicators of bench sit-up for 1 minute, standing long jump, backward running on 10 m, running on 10 m with flying start, shuttle run, throwing the ball at the range, push-ups, pull-ups. The module "Psycho-physiological indicators" allows to record the time indicators of simple and complex reactions of a person, reaction on a moving object, tactile indicators. Figure 1 shows the introduction of data into a computer program.

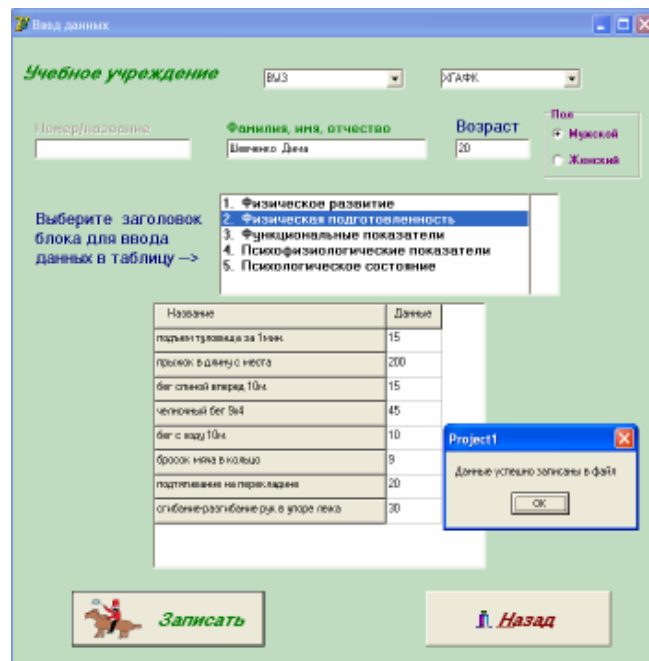


Fig. 1. Window of the computer program module "Physical Education".

During the experiment recorded in the computer program "Physical Education" and Microsoft Excel spreadsheets included individual indicators of students 8-16 years old. The regression models of each student were developed on the basis of the obtained indicators and had the form of mathematical equations (formula 1) and graphs (Fig. 2).

$$Y = -4,156 + 0,416x_1 + 0,372x_2 - 0,091x_3 + 0,227x_4 + 0,462x_5 \text{ (formuls 1)*}$$

* Y= physical state, x_1 – bench sit-up, x_2 – running broad jump, x_3 – shuttle run, x_4 – run on 30 and 60 m, x_5 – throwing the ball at the range.

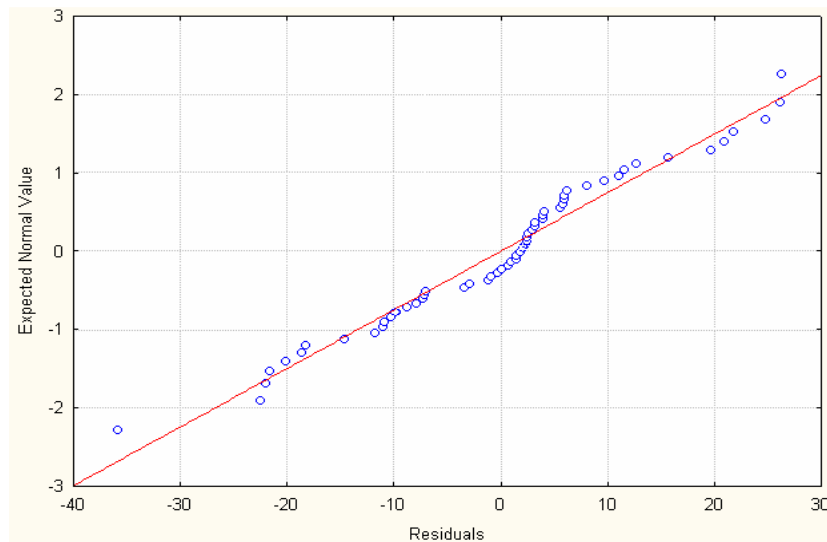


Fig. 2. Regression distribution of individual indicators of physical development and state of health of the student under study*

*figure was received through the program STATISTICS 7

Such models were created for each student under study. Regression model allows to form an individual physical load plan for each student in the computer program "Physical education", as well as their evaluation (Fig. 3).

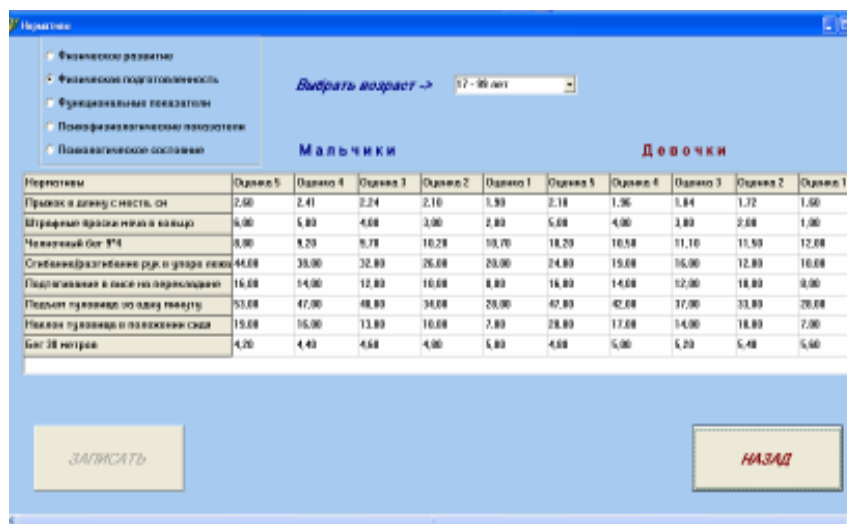


Fig. 3. Window of standards and assessments of the computer program "Physical Education"

During classes planning physical exercises were carried out in accordance with the individual capabilities of the child. The factor of intensity and rate of performance of physical exercises was considered. Indicators of the physical development of strength, speed, agility and speed-strength qualities were fixed for 6 months in girls ($n = 78$) and boys ($n = 82$). Comparative analysis of the Student's t -test was carried out after the end of the experiment.

Time of overcoming the 30 m distance by girls on average in the group is indicative of (Table 1) a reliable increase in the result between 8-9 years and 10-12 years of life. This increase is explained by a latent form of the development of speed and is physiologically justified (Rovniy A., 2017) [17, 18], (Yefremenko A. and others, 2016) [23]. At that time, there were no significant differences between the other age intervals of the study, although there was a slight improvement in the result by 0,1 s every year.

Table 1. Statistical indicators of the test run at 30 m by girls 8-16 years old ($n = 78$) using individual models of physical activity

Age, years	$\bar{X} \pm m$	Mo	Me	σ	v	$t; p$	$t; p$	$t; p$
8-9	$6,1 \pm 0,11$	6,4	6,05	0,58	10%	2,82;		
10-12	$5,7 \pm 0,10$	6	5,6	0,56	10%	<0,05	0,78;	
13-14	$5,6 \pm 0,10$	6,1	5,5	0,55	10%		>0,05	0,85;
15-16	$5,5 \pm 0,10$	5	5,5	0,54	10%			>0,05

The results presented in the table indicate a normal distribution of sample data and the presence of a variation of the indicator within 10%, but more accurate factors are the individual indicators of each girl being studied, which are presented in Figure 4. Thanks to the petal histogram, one can see how significant the increase in the result of the development of speed in the 5 investigated, stable indicator is manifested in 4 female students, in the other studied we see a gradual increase in the speed.

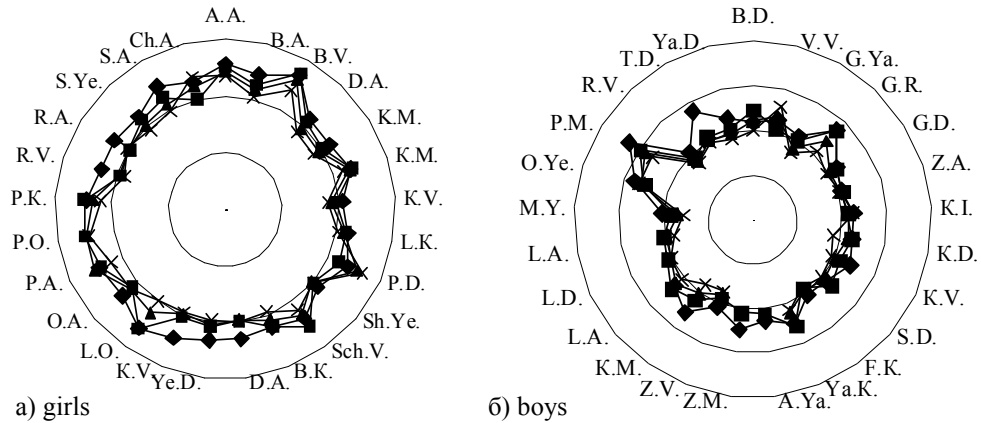


Fig. 4. Comparative analysis of individual indicators of running at 30m in girls and boys 8-16 years old

An analysis of cover 30 m distance between boys is shown in Table 2, where the normal distribution according to the sample and presence of significant differences in the indices between 8-9 and 10-12 years, which corresponds to the age range of speed development in young men.

Table 2. Statistical indicators of the test run at 30 m by boys 8-16 years old (n=82).

Age, years	Class	$\bar{X} \pm m$	Mo	Me	σ	ν	t, p	t, p	t, p
8-9	8-9	6,0±0,09	6,0	6,1	0,48	18%	3,01; <0,01		
10-12	10-12	5,6±0,11	5,4	5,45	0,58	10%		0,35;	
13-14	13-14	5,5±0,16	5,0	5,3	0,81	15%		>0,05	0,67;
15-16	15-16	5,4±0,11	5,5	5,3	0,58	11%			>0,05

Unlike girls, boys have a significantly higher percentage of variation in the indicator, which we explain by individual characteristics of the level of speed development (Rovniy A., 2016) [16]. This indicates the need to take into account the individual factor of development of speed in each child separately, because single standards are not suitable for all students.

The study of the level of development of speed-strength qualities in students aged 8-16 years indicates the existence of a reliable growth trend for this indicator when performing a running broad jump both for girls and boys (Table 3).

Table 4. Comparative analysis by Student's test results in running broad jump of girls (n = 78) and boys (n = 82) 8-16 years old

Age, years	$\bar{X} \pm m$	Mo	Me	σ	ν	t, p	t, p	t, p
girls								
8-9	247,0±5,95	230	245	32,60	13%	2,36; <0,05		
10-12	268,5±6,93	310	260	37,95	14%		2,49;	
13-14	293,1±7,02	300	300	38,45	13%		<0,05	2,39;
15-16	316,6±6,85	350	330	37,49	12%			<0,05
boys								
8-9	267,7±10,83	290	290	55,21	21%	1,83; >0,05		
10-12	294,6±9,98	300	300	50,87	17%		3,13;	
13-14	333,3±7,26	320	320	37,00	11%		<0,01	2,67;
15-16	359,3±6,49	340	345	33,10	19%			<0,05

Dynamics of individual changes in the development of speed-strength indicators in girls and boys indicates the presence of deviations in the variation of this indicator in individual student. When performing physical loads of the speed-strength level, it is necessary to take into account the individual development factor of the child and to select exercises with such dosage that are suitable for the individual abilities of the child. General methods for identifying indicators of physical development by standard criteria and standards are not

effective and can not be used for all children equally. For students who show the results of the development of speed-strength qualities at the assessment level of 2-3 points, the greatest achievement is each additional centimeter in result, while as students with high physical development may show ratios more than 11-12 points.

Strengths development of boys and girls of 8-16 years during schooling as a whole for the group of subjects vary with significant deviations from the norm in the range of up to 23% (Table 4). To identify the factor of the level of development of strengths, exercises were taken to throw the ball at the range and bench sit-up for 1 minute.

Table 4. Comparative analysis by Student's test results of throwing the ball at the range of girls (n = 78) and boys (n = 82) 8-16 years old during the experiment

Age, years	$\bar{X} \pm m$	Mo	Me	σ	ν	t; p	t; p	t; p
girls								
8-9	16,0±0,68	17	16	3,73	23%	0,67; >0,05	0,18; >0,05	2,54; <0,05
10-12	16,6±0,63	14	16	3,44	21%			
13-14	16,5±0,62	13	16	3,38	21%			
15-16	17,9±0,74	22	18	4,05	23%			
boys								
8-9	22,9±0,99	21	21,5	5,02	22%	1,94; >0,05	0,04; >0,05	2,21; <0,05
10-12	25,6±1,00	26	26	5,12	20%			
13-14	25,7±1,00	25	25	5,08	20%			
15-16	27,4±1,01	25	27	5,17	19%			

The obtained indicators of the mathematical and statistical analysis of the performance of ball throwing at the range for students aged 8-14 years old are heterogeneous and statistically unreliable that the factor of strengths development in a child is unstable and still uncertain for a given age group. In some children puberty occurs more quickly, and they already have high strengths capacities at the age of 13-14 years old, but in the majority of the studied students (84%) the indicators of development strengths level of are unsuitable even for their age and do not meet to the criteria and standards. This indicates a low level of physical development of the child and an unsatisfactory condition of the muscular system of the body. The obtained indicators can be explained by the inactive way of life of modern students, by the large volumes of educational tasks for which the child loses more than 50% of the daily time, almost complete absence in most of the students studied, additional physical training in sports sections. A modern child should be relieved of inefficient tasks and more attention should be given to motor activity, physical development and a healthy lifestyle.

Exercise for bench sit-up for 1 minute also indicates the strength preparedness of children (table 5).

Table 5. Comparative analysis by Student's test results of bench sit-up for 1 minute of girls (n = 78) and boys (n = 82) 8-16 years.

Age, years	$\bar{X} \pm m$	Mo	Me	σ	ν	t; p	t; p	t; p
girls								
8-9	25,5±0,75	29	26	4,09	16%	2,00; >0,05	1,54; >0,05	11,35; <0,001
10-12	27,9±0,93	30	28,5	5,07	18%			
13-14	47,1±1,42	49	48	7,79	17%			
15-16	50,6±0,97	54	52	5,34	11%			
boys								
8-9	26,5±1,35	17	29	6,86	26%	0,63; >0,05	0,58; >0,05	10,96; <0,001
10-12	27,6±1,11	30	28	5,65	20%			
13-14	49,0±1,64	50	50	8,20	17%			
15-16	50,2±1,39	50	50	7,07	14%			

According to the indicators of this exercise, there is a significant increase this index in children 13-16 years old. If in the fifth and sixth grade both girls and boys performed an average of 25-26 bench sit-up in 1 minute, then in the seventh and eighth grade this indicator almost doubled in all students – up to 50-55 times per minute. This can be explained by the fact that as homework assignments the students received an exercise to bench sit-up, contributed to a significant increase in the rate of its implementation.

Given the individual factor in the strength development of students, we found that 20% of girls and 38% of boys have an unsatisfactory state of strength training (grades 3-5), 60% of girls and 42% of boys – average strength indexes (grades 8-6) of 20% and girls and boys found sufficient for their age and a high level of strength training (grades 10-11).

The analyzing the individual strengths of each child, whose results ranged from 12 to 56, show the instability of this factor with variability of 26%.

Many of the studied girls did not complete some test tasks, for example, there were no indicators in throwing the ball for the sixth grade, or a bench sit-up in the eighth grade was not performed. This shows the negative attitude of the studied school girls to perform strength loads. The boys show unstable performance of a strength orientation exercises. But unlike girls, indicators below 15 points are found to a lesser extent, while the indicators above 30 points prevail in most. Also, the majority of boys (40%) showed a stable result and have a high and stable dynamics of strength development. In general, the received indicators of strength training of

pupils of 8-16 years indicate the need to revise the norms and general approaches to assessing this factor among student. That is, despite significant differences and variations in the strength exercises in secondary school students, it can be argued about their positive influence on the overall physical development of the child. This suggests that it is necessary to increase attention to the quality of strength training for students when planning physical activities in school, and also to adapt the requirements of the standards to the individual capabilities of the modern child. The experiment showed significant differences in the students who participated in the study on the development of strength ($p < 0,05$), speed ($p < 0,01$), speed-strength qualities ($p < 0,05$), agility ($p < 0,05$) unlike other students who did not use the computer program "Physical Education".

The obtained results of the research correspond to the achievements Benjumea José Manuel Cenizo; Afonso Javier Ravelo; Hurtado José Manuel Ramírez; Truan Juan Carlos Fernández (2015) [3].

Discussion

Purpose of the study was to substantiate the possibilities of using computer programs to improve the efficiency of physical education for students 8-16 years old. Scientific developments [9] devoted to the problems of improving information support in pedagogy and education and sport. The authors of [24] believe that it is necessary to improve the information support of education by means of modern computer technologies. In scientific works [4] new ways of development and the concept of the formation of electronic information resources are considered. Thus, V.A. Kashuba (2013) with co-authors justified the use of computer technology to improve training and educational processes [10]. In studies Filenko L. (2007) found that the uses of information technologies contribute to optimizing the educational process of students of universities of physical culture [6].

In the opinion of Ashanin V. (2013) and other scientists, information technologies make it possible to optimize the interaction between the physical education teacher and the medical worker, systematically regulate the level of physical development of children and their health [2].

Filenko Ludmila, Poltorackaya Ganna, Sadoviy Andree (2014) say that properly selected interactive learning tools can improve the quality of physical education classes [7]. Pasko, V. (2016) notes that at the present stage of the development of physical education, multimedia can combine text, sound, video, graphics and animation [13]. Filenko L., Filenko I., Martirosyan A. (2013) note that the student may be provided with additional information by using a computer program [5]. According to Podolyaka O., Pasko, V. (2011), a computer program is necessary for more successful physical development of students and athletes in achieving high sports results and formation of a healthy lifestyle [14]. The materials of our studies confirm the data [21], which indicate, that the introduction of modern information technologies and modern means of communication is of particular importance for improving the system of physical education.

At the same time, fundamental studies [19] show that during performing physical exertion it is necessary to take into account the individual factor of child development. The authors indicate that it is necessary to select such exercises and such dosage that are suitable for the individual abilities of the child [8]. In studies [22] it was proved that the general methods for detecting indicators of physical development by standard criteria and standards are not effective and can not be used for all children in the same way.

Confirmation of our studies are the results of the authors [20], which point to need to take into account the individual factor of child development during physical education and sports using information technologies.

Conclusions

Analyzing the obtained results of the study, it can be concluded that the use of information technology in the physical education of students 8-16 years old is appropriate and contributes to the increase in the level of physical development in students. A teacher of physical culture, a coach can automate and improve his activities using the computer program "Physical Education".

Taking into account the individual factor of the physical development of students, it was revealed that 20% of girls and 38% of boys have an unsatisfactory state of physical development; 60% of girls and 42% of boys - average; by 20% and girls and boys have found a sufficient and high level of physical development.

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