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Validating the Differential Approach to Physical Education of Young Students Depending On the Psychophysical State.

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ABSTRACT

In the changed ecologic, scientific, technical and social spaces of XXI century the problem of preserving a person's physical state and health is presented in a new light. World-wide, preserving human health becomes not only a personal goal, but rather a concern of the state. It became clear that it is more economically beneficial to invest in prophylactic measurements and develop a healthy lifestyle in the population, which includes physical education and sport, rather than pay for the expensive treatment and social allowance of the disabled people. Obviously, upbringing of a healthy person becomes a function and a task for the school – general-education as well as professional-education one. Our studies of the students in middle school and in higher professional school allowed as drawing conclusions about their physical development and fitness levels and comparing the characteristics of people, who do and do not do sports. On the example of a single professional educational institution we defined the relations between various characteristics of physical, functional and psychophysical development. Based on the obtained results we defined regular and non-regular development profiles and suggested the bases for differentiating physical education methods depending on a person's psychophysical state, fitness and sports level.

Keywords: students of higher professional school, physical development, psychophysical state, physical education.

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INTRODUCTION

Major changes in human motor activity in the XX century defined the decrease of human functional characteristics and, as a consequence, decrease of their health level [1, 18, 7, 8]. Because of this the questions, related not only to studying separate aspects of health and its adequate measurements in various populations groups, but also to developing mindful attitude towards it in people of different age, constantly gain significance. This especially concerns the youth, because it is the age of entering adulthood, the age of accepting the responsibility for oneself and one's own future [17, 16, 15, 5]. Discussing the definition of "health", N.N. Vizitey (2009) comes to the conclusion that one of the essential contents of this phenomenon is a "certain type of a person's self-experience" [19, p. 169]. Apart from everything else, experience implies person's understanding of mindful attitude towards one own health, which develops during the life activity. This understanding happens in the situations, in which a person experiences lack of one's health resources and physical state, e.g. during physical education lessons at school or during competitions with fitter participants. In adult age lack of physical resources is more obvious during illness, however, in young age, when the body has not yet "accumulated" chronic diseases, it is rather difficult to activate this need in using recreational technologies [10, 4, 6, 13].

METHODS

In line with the set tasks the study was conducted in several stages. During the first stage we conducted large-scale assessments of physical education and fitness of student youth with the main tests. During the second stage we performed a more thorough assessment in a relatively small subject sample from one single college; we defined the ration between non-specific immune resistance and psychomotor characteristics, as well as between immune system characteristics and student's affiliation to a certain health state group. During the third stage we validated the differential approach to physical education of student youth on the basis of attribution to a physical state profile.

We assessed 890 students of Russian Far East higher education institutions (on the example of Khabarovsk and Birobidzhan). Physical development was defined by the characteristics of height, weight and vital lung capacity (VLC), as well as by the dynamometric data. Fitness level was studied by the classical tests characteristics: 100m, 1000m, long jump from the spot, push-ups to a plank position from the floor (for the young women), pull-ups (for the young men). For a more detailed study of relation between the students' health state and their psychophysical development separate student groups were assessed additionally. In 74 college students, apart from the characteristics mentioned above, we also defined: forced inspiration, forced expiration and maximum voluntary ventilation in 1 minute (MVV) with the MicroLoop machine; non-specific immune resistance state – lysozyme, immunoglobulin A, reaction of immune adhesion; psychomotor characteristics – time of simple visual-motor reaction, reaction of choice, assessment of attention, noise-resistance, reaction for moving object and orientation visual-search reaction.

RESULTS AND DISCUSSION

Student age is characterized, on the one hand, by a relatively big development potential, especially for such physical qualities as strength and endurance, and on the other hand, height- and weight data do not usually experience major changes [20, 9, 12]. As V.K. Balsevich (2000) notes, "generalizing studies showed that growth process stops by the age of 17-18 in females and by 19 in males [1, p. 113]. Vegetative functions are also fully developed in that age: a person has relatively stable numbers of heart rate, arterial pressure and vital lung capacity.

During the analysis of the obtained results we set the task of comparing physical development characteristics and fitness in student youth, who do or do not do sports. As athletes we assessed students of Far Eastern State Academy of Physical Culture. Students, who do not do sports, were students from three colleges, who are attributed to the main medical group by the health state and who do not study at the sport divisions. In order to interpret the data we used the principle of building anthropometric data tables, levels, which were proposed for defining human physical development [2, 3] (for the convenience of description we will call them the general levels), as well as physical development and fitness levels, which we developed prior to this study in school students of various Russian Far Eastern regions [11, 12].

For the analysis we divided all of the obtained data (height, weight, body mass index, VLC, dynamometric of left and right wrists) by the development levels (low, below average, average, above average, high) separately for males and females. We compared the sub-divisions, presented in percentage proportion, with the normal distribution (anthropometric data scales), as well as with the development levels of people, who do and do not do sports, which we defined before. By the height characteristics females, who do not do sports, distributed in strict correspondence

with the defined sub-divisions. Sub-divisions of the height data in females, who do sports, were larger for the average and below-average levels. This fact is rather hard to explain, athletes do not necessarily need to have big height; moreover, in a number of sports (e.g. artistic gymnastics and figure skating) athletes of lower height continue to train for longer time. Height distribution in males confirmed the pattern, which we hypothesized earlier: athletes are people of bigger height.

In the analysis of the weight in females the attention is primarily drawn to the fact that student group, not doing sports, has a general-levels distribution that almost completely corresponds with anthropometric tables: 50% of the subjects are on the average level. In athlete-students we observe the same tendency: 52.7% of the subjects belong to the average group. Moreover, we can conclude that there are no significant differences in the weight characteristics distribution in athlete- and non-athlete female students. I.e., the weight of female athlete- and non-athlete students does not differ in the scale of the subject sample.

Analyzing the distribution of body weight characteristics of the male students, we can conclude that these characteristics reflected the expected hypothesis that the weight of athletes is slightly bigger due to the muscle mass.

Physical development balance of the participating students was assessed with body mass index. In correspondence with the existing norms (18.5 – 25 is a normal body mass index), the body mass indexes, calculated by a formula, were divided in three groups – normal, underweight and overweight. The analysis of the results primarily reveals that most of the assessed students have normal body mass index: from 73.9% of the female non-athletes to 95% of male non-athletes. The highest amount of underweight students was found in female non-athletes - 18.2%, i.e. almost one fifth of the assessed females. This number can be explained by the existing trend for a lean figure; however, such characteristic is not completely desirable for human health. Teachers of physical education classes in college, who participated in the study, received our recommendations for conducting explanation talks for female students on the topic of anorexia and human health. At the same time, the number of underweight female student athletes is only 8.5%, considering the fact that in some sports, such as gymnastics, figure skating and sport dancing, lean figure has an indirect effect on the judges' scores. Because of this, such weight characteristic is not as dangerous for them as it is for the female non-athletes students.

Vital lung capacity characteristics were also analyzed by comparing athletes and non-athletes. Among the male participants 78.8% of athletes have high-level vital lung capacity, according to the norms calculated for separate Far Eastern regions, and 15% have the above-average level. None of the male athletes has low or below-average level, whereas the characteristics of male non-athletes were distributed relatively equally on the levels of vital lung capacity – each level has a sufficient amount of the results.

Results of the females were also analyzed with regard to the levels, calculated for the Far East, based on the anthropometric data tables method, because the scientific literature mostly presents not the levels but the formulas for calculating the appropriate vital lung capacity. Firstly, the method of anthropometric data tables method is completely inefficient, because the majority of female athletes, as well as the males, have high vital lung capacity levels. In contrast with the height and weight data, analysis of which did not reveal any significant differences between the groups of athletes and non-athletes, vital lung capacity (VLC) is more flexible, and, compared to the people, who do not do sports, athletes have a major advantage.

Dynamometry characteristics were analyzed with the same interpretation procedure as the VLC characteristics. For both right and left hands there are no male athlete students in the low-level category, as well as no non-athlete students in the high-level category. The majority of the assessed students belong in the average level. Student athletes present a shift towards high and above-average levels, whereas the results of student non-athletes shift towards below-average and low levels. Generally, it can be noted that wrist dynamometry characteristics, as well as VLC, reflect the supposed tendency of characteristics growth in dependence from participating in sports.

We observe a similar pattern in females: the majority of the results of the assessed female athletes belong to the above-average level for both right and left wrists. The majority of the results for female non-athletes belong to the average level; however, compared to the anthropometric data distribution, the data shift towards below-average level. At the same time, the largest percentage of the assessed female athletes has above-average results. Relatively high percentage of assessed female athletes has high-level results – almost each fifth athlete. In regard of conventional average age dynamometry characteristics (26.24 kg), 90% of the female athletes met this criterion, whereas in the female non-athletes this criterion was reached only by 20% of the participants.

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Average age dynamometry norms in the males were reached by 79% of student athletes and by only 60% of student non-athletes. Thus, we can make a general conclusion that female athletes, in contrast with male athletes, have bigger strength capacities, compared to the non-athlete females.

Fitness level of the males is presented in table 1.

Table 1.Fitness level of the males

Tests/colleges	100 m, s	1000 m, s	Long jump from the spot, sm	Pull-ups, number of times
Student athletes	13,36±019	216,38±2,01	239,4±1,86	14,2±0,4
Student non-athletes	14,05±0,13	241,07±3,02	225,8±1,99	10,3±0,5
Difference	0,69	24,7	13,6	3,9
t	2	6,86	5,03	19,5
P	<0,01	<0,01	<0,01	<0,01

During the comparison of athletes and non-athletes students we see that the difference in all of the analyzed tests is significant. The most significant difference is found in the development of strength qualities, which were assessed by the pull-ups test. This might also be explained by the fact that this exercise is used in the educational-training process as a mean of general and special physical training. Thus, generally, the table represents the main tendency, which is observed during the entire analysis: male athletes are more fit than their peers.

Females present the same tendency as males (see table 2). The most significant difference is found in the tests, which assess the development of endurance, speed and strength qualities, defined by the long jump from the spot test. This measurement is relatively low in female non-athletes and it is close to the border of the below-average level in comparison with the levels for the Far Eastern regions. The average score in this test in female athletes is at the above-average level.

The obtained results, without doubt, confirm already well-known facts; however, we hypothesized bigger differences between the selected subject groups. The obtained scores can be explained by the fact that, firstly, athletes develop their physical qualities in a differential manner, depending on their sport, and secondly, participants in the study were athletes with adult athletic titles, as well as non-professional athletes without any significant athletic achievements. The obtained results made us create a more differential subject groups division, and during the second stage of the study we analyzed three groups: athletes, recreational athletes and non-exercising people (table 3).

Table 2Fitness level of the females

Tests/colleges	100 m, s	1000 m, s	Long jump from the spot, sm	Pull-ups, number of times
Student athletes	15,8±0,16	272±4,8	190,3±2,9	23,5±1,0
Student non-athletes	16,9±0,18	291,9±4,6	167,6±1,54	12,2±0,54
Difference	1,1	19	22,7	11,3
t	4,6	2,8	6,8	9,9
P	<0,01	<0,05	<0,01	<0,01

“Athletes” group included males, who have athletic titles and participate in competitions; “recreational athletes” group were males, who perform special motor activity for not less than four hours a week but who do not compete. The “non-exercising” group included males, who were affiliated to the main medical health group and who attend only organized physical education classes two hours a week. We assessed a total of 74 students: 41 athlete, 21 recreational athlete and 12 non-exercising people. Physical development characteristics are presented in table 3.

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Table 3.Characteristics of physical development and functional state of external breathing system of college students

Physical development characteristics	Height, sm	Weight, kg	Wrist dynamometry, kg		Back strength, kg	VLC, ml	Forced volume, l		MVV, l/min
			right	left			inspiration	expiration	
Athletes	176,7± 1,17	64,0± 1,66	36,1±1,63	32,9±1,58	129,5± 4,59	4840±120	4,18±0,08	4,65±0,1	463,2± 12,97
Recreational athletes	177,2± 1,17	62,8± 2,04	34,3±1,81	29,7±1,89	128,3± 5,88	4660±140	4,09±0,14	4,41±0,14	429,4± 21,52
Non-exercising	177,4± 1,31	59,7± 1,4	36,3±1,66	30,7±1,72	122,9± 5,98	4650±160	4,18±0,14	4,44±0,13	456,0± 30,83

The obtained results demonstrate the absence of significant between-group differences in the height, weight and wrist dynamometric characteristics. Vital lung capacity in athletes was 180 ml higher and maximal voluntary ventilation was greater by 33.9 l/minute than in recreational athletes.

We also studied immune system characteristics of 67 students of that college, of which 73.1% attended the main group in physical education classes, while 26.9% were in the special medical group. The results of the studies showed that the main group subjects have high immune-biological activity and all of the immune-biological parameters are close to normal: the level of blood plasma antibacterial activity was 98.3±0.5% (normal range — 99.3±0.7%); lysozyme titer was 79.2±2.0% (normal range — 79.5±3%); immune adhesion reaction – 22.5±1.5% (normal range — 24.5 ±1.7%). We also revealed a tendency for serum immunoglobulin activation: type A immunoglobulin concentration increased to 189.2±11.9 mg/ml (normal range — 190±18.4 mg/ml).

The results of the assessment of the students from second group revealed that immune systems parameters activation and a tendency for humoral immune factors normalization were much weaker in comparison to the main group, which was a significant difference ($p<0.05$).

Studying some of the psychomotor characteristics showed their relatively high level in the first subject group with high immune system activation, compared to the students from the second group with lower immune system activity. For example, the parameter of simple visual-motor reaction (SVMR) (ms) was 208.4±1.1 in the first group, compared to the result of 245.8±2.6 in the second group. In the reaction of choice (ms) the results of the first group subjects were significantly higher (331.3±2.6) than of the second group students (415±3.9). Reaction speed to the moving object was measured as the amount of precise reactions out of 20 trials and was 13.1±0.1 in the first group students and 9.2±0.2 in the second group. The results of psychomotor characteristics assessment in the subjects from different groups also had statistically significant differences ($p<0.05$). The studies showed that the subjects in the first group with high immune system activation usually have higher sensory-motor reaction scores than people with lower humoral immune factors activity.

Based on the conducted study and the comparison of the obtained data with the normal parameters, college students were separated into five groups, corresponding with the physical state levels: high, above average, average, below average, low. Along with the physical state level we defined the attitude towards one's own health and physical culture, and as a result we established the level of physical culture of each student: indifferent, mildly interested, active and actively-creative [16]. This level was assessed on a 20-point scale: minimal possible score was 4, the highest possible score is 20. Indifferent level – total point score from 4 to 8, mildly interested level – score from 9 to 12, active level – from 13 to 16 points and actively-creative level – 17-20 points. As a result of the conducted assessment, 71 first-year students were divided into the groups described above in the following proportion: indifferent level – 22 people; mildly interested level – 34 people; active level – 15 people; actively-creative level was not presented in this subject sample. Along with this the obtained results demonstrate that the students cannot be attributed to any single group unambiguously: high scores for one of the parameters do not always correspond with high scores for other parameters. Due to this, we defined regular and non-regular profiles of physical state and attitude towards health and physical culture.

The next stage of our study was exploration of the modern methodologic bases of physical education. Currently the theory and methods of physical culture themselves admit that the range of tasks, solved during the physical education lessons, got wider. The traditional goals were the development of physical qualities and functional capabilities of the students' bodies and the development of motor skills and abilities system. Currently there are additional goals of acquiring the experience of creative and cognitive activity, mastering the methods of managing

one's own physical state, its correction in dependence from the set professional and lifestyle tasks, individual planning of executing the healthy lifestyle and active attitude towards the information about the human health [10, 20].

Methods of physical education, used in the professional education on the current stage, have to solve the traditional physical education tasks, related to health, body functional state, physical qualities and motor abilities development, and on the other hand, to develop general cultural competencies of the prospective specialist together with the other educational courses in the curriculum.

Competencies, which are developed in the lessons on the "Physical education" discipline and especially reflect its primary specifics, also have to be evaluated in a certain way. Recreational function is the main and defining function of physical culture; therefore, the competence, developed during studying this discipline, in our opinion, also has to contain a part related to health. In the beginning of XXI century scientific methodic literature actively started to develop the concept of health preservation; however, we think that it does not completely reflect the specifics of physical culture activity. Namely, there is a goal of not only preserving a person's health but also of multiplying, i.e. developing, it. Hence, the term "health-developing competencies" seems to be the most acceptable, implicitly reflecting the essence of the concept and the underlying content. Motor activity is the most significant component of human lifestyle and behavior; it is defined by physical education organization, as well as by person's individual psychophysical characteristics [4, 14].

Thus, the developed method of health-developing competencies creation is supposed to solve the traditional "Physical education" course tasks, such as general cultural competencies development, as well as the development of conscious attitude towards one's own health. Thus, the work has to be done in three directions: improving body's physical condition, demonstrating social activity and developing subject's personality characteristics as such (mindfulness, activity, development of axiological and essential attitude towards life in general and health in particular). Along with that, the development of axiological and essential attitude towards the health is based on one's own health evaluation, its physical, as well as mental and social components.

Organizational and methodic support of the health-developing competencies creation in specialized secondary schools is: educational and methodic documentation, including study plan, active programs of educational courses, educational calendar schedule, materials, which provide the programs of educational and occupational practical courses and methodic materials, which support the execution of the main educational program. Obviously, study plan and educational calendar schedule do not undergo any changes and mostly serve as an organizing factor, whereas the working programs of educational courses start to include special modules with such types of tasks that are aimed at developing motivational, axiological, operational, emotional, volitional, and practical and activity components of conscious attitude to health. In turn, the methodic materials, supporting the main educational program execution, including the materials for educational and occupational practical courses programs, contain the explanations and instructions, which are directed at developing the elements of health-developing competencies.

O.Yu. Masalova notes, "…with student's mindful attitude towards health his inherent personality qualities begin to include self-organization and self-discipline, self-regulation and self-development" [10, p. 49]. As a result of the conducted study the author concluded that conscious attitude development occurs on different structural levels of personality, according to which the means have to be selected. The developed method includes the following blocks: theoretical, applied and combined.

Theoretical block has to be passed onto several courses of the educational curriculum: physical education, biology, fundamentals of lifestyle security and psychology of business communication. This block implies 10 hours and its material is divided into the educational methods groups the following way: explanatory-illustrational (10%), reproductive (10%), partially-exploratory (60%), problematic statement (10%) and research (10%). In the theoretic block the demonstration of verbal and illustrative information takes 2 hours (explanatory-illustrative and reproductive methods). During the films presentations and lectures after each small fragment of information there are breaks, during which the students receive and discuss the questions. The teacher is recommended to orient the students at discovering the most problematic moments in the information and to set personally significant questions. Obviously, it is possible in the comfort climate in the group, which can be achieved by giving the necessary explanations. Partially-exploratory and research education methods are executed by implying modern informational technologies, such as the Internet. It is recommended to search for information related to human health and the opportunities of its self-regulation.

Applied block is executed during physical education classes, sport sections training and participation in competitions. Apart from doing the exercises per se, the students are included in referee activities, supervising the tests of their peers, independent preparation of separate lesson parts or independent choice of warm-up exercises.

Combined block implies creating unique projects and calls for independent lessons. Students' own unique projects might be done individually or in groups of 2-3 people. The project is executed based on the principles of collaborative creative activity, i.e. the teacher provides only the topic; the main ideas of its development, means of execution, the execution itself and the analysis have to be conducted by the students on their own. The project has to be time- and effort-consuming. It is recommended to provide a few days for its execution (up to a week, because in other case the quality might decrease). An example of a project might be the preparation of a slide-show, as film, a presentation, a mini-performance, etc.

CONCLUSION

Summarizing the conducted studies, we can make the following general conclusions. Height and weight characteristics of the assessed students depend on the activity type (sports), as well as vital lung capacity and dynamometry characteristics. Physical qualities of the student athletes are developed better than of the student non-athletes. However, there are significant resources for improving these parameters. The parameters of physical qualities development in non-athlete students are at the level of middle-school students. Reaching a certain physical qualities level by the natural body development, the results of non-athlete students even decrease slightly. Physical education teachers of Far Eastern colleges, who participated in the study, achieve significant success in their activity, however, the conduction of mass studies revealed the resources of physical development and fitness in student youth.

The obtained results show the significant role of the immune system, which majorly defines and develops psychomotor activity of human body. Physical activity of a growing body and its physical qualities develop during physical education classes and athletic activity and, in turn, stimulate immune reactions and person's psychomotor activity. This has practical significance for supporting the increase of adaptive mechanisms of resistance to various infections and diseases. The conducted studies allow defining active parameters of immunologic status, which were combined with high parameter scores of psychomotor state in the assessed students, who actively participate in recreational or professional sports. The revealed high immune system parameters and psychomotor scores provide a robust adaptive mechanism in the body, which is significant for its protection from the various diseases and infections.

Thus, the bases of differential method of health-development competencies creation in students have scientifically-research and organizationally-methodic support. The method itself has to contain three inter-connected stages: diagnostic, developmental and resultative. The main bases of differential method are students' physical state and the type of attitude towards their own health. The result of the method integration, supposedly, is the occurrence of health-developing competencies, which manifest in the developed conscious attitude towards one's own health, occurrence of knowledge and abilities for regulating one's own physical state, including physical development, physical and functional fitness, as well as a conscious social position related to the professional learning.

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