

STRUCTURAL-FUNCTIONAL MODEL OF MEDICAL STUDENTS' PROFESSIONAL- APPLIED PHYSICAL TRAINING

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Abstract. *Purpose:* to work out and experimentally prove model of professional-applied physical training of medical higher educational establishments' students. *Material:* in the research 80 students participated. In questioning physical education instructors of medical higher education establishments (n=20) participated. *Results:* influence of students' professionally important characteristics on general physical fitness indicators and functional state has been shown. Directions of students' physical fitness parameters' individual diagnostic and control over physical education effectiveness have been offered. Volumes of physical exercises in the structure of training have been found: special training (15-20%) and competition exercises (20-30%). *Conclusions:* the need in raising the level of professionally important for students' abilities has been noted: speed power, static power endurance, power endurance, coordination of arms' movements, static balance.

Key words: structural, functional, model, professional, academic process, students.

Introduction

In system of students' physical training there exist certain contradictions: between modern requirements to training of compatible workers and their insufficient professional competence; demand in students' readiness and their insufficient awareness of physical component's importance in the process of their training [4, 6, and 22]. Studies of these problems and practice of students' physical education expand ideas about significance and content of students' professional applied physical training (SPAPT), especially for specialists of medical profile [25, 26]. The authors note need in the following:

- Training of physical abilities, characterizing specialist's work in static position [25];
- Formation of future specialists' professional functional competences [26];
- Raising of girl-students' psycho-physical abilities [24];
- Professional formation; formation of professionally important qualities; finding of potential for self-realization in the future [21];
- Activation of personality's internal intentions; awakening of student's will to learning during all life [9];
- Promotion of student to higher level of poly-cultural competence [7].
- Substantiation of SPAPT effectiveness criteria for future medical officers' professional functioning [20];
- Training of kinesthetic, responsive and orientation coordinations. These coordination are important for quick and effective solution of professional tasks, connected with accuracy of perception in the shortest terms and keeping great scope of space information in memory [11, 32];
- Effectively fulfill professional functioning in the aspect of health protection [14];
- Psychological readiness of modern students to professional functioning by factor of resilience [19];

In he works, devoted to training of future medical workers, the need in the following is also noted:

- Introduction of martial arts elements in professional applied training of medical higher educational establishments' students. It permits to substantiate approaches to training of future medical workers' assertiveness by means of sambo or Judo [31];
- Creation of preconditions to increase of physical exercises' practicing effectiveness and strengthening od students' motivation for health strengthening [13];
- Training of general physical workability of medical colleges' girl students [28];

Separately it is necessary to mention the researches directed at increase of medical students' academic process quality [18, 28, and 31]. Such works are closely connected with the following: general structure of future medical specialist's fitness [35, 44]; methodology of teaching, which considers professional specific [36]; forms

of distant teaching [42]. Raising of health criteria is of not less importance in such structure [34, 37; 39] as well as behavioral intentions of medical students [42].

Provisioning of conditions for realization of SPAPT program by students shall be considered an important direction. Such conditions include: students' attitude to physical loads [10, 17]; students' psycho-social health уровень [29]; possibility to choose the desired kind of sports [5, 20]; [17]; organization of sport trainings for disabled students [1]; proper pedagogic control [38, 40, 41].

Analysis of researches showed that SPAPT is not paid proper attention to. These aspects require systemizing and specifying in connection with modern technological progress and changes of specialists' functions. Such principle questions of SPAPT organization-pedagogic methodic for students (substantiation of its significance and effectiveness, didactic filling, organizational forms, control over realization) have been remaining insufficiently studied. It does not permit to simulate the system of SPAPT methodic in compliance with modern requirements [4, 27, and 33]. Besides, there are no researches, in which methodic of students' professional-applied physical training (SPAPT) would be systemically elucidated.

Hypothesis: we assumed that the worked out author's SPAPT for students will facilitate perfection of students' psycho-physical abilities, which influence on their readiness for future professional functioning.

The purpose of the research: is to scientifically substantiate, work out and experimentally prove the model of professional-applied qualities of medical higher educational establishments' students.

Material and methods

Participants: in the research 80 students participated. By testing results the students were divided into two groups: control (CG, n=40) and experimental (EG, n=40). Both groups' students were identical by physical condition and fitness. Their age was (17-20 years) and the level of psycho-physical state was approximately equal. Before experiment all students had equally low physical fitness. For determination of future medical workers' professionally oriented physical training we questioned physical education instructors of medical higher educational establishments (n=20).

Procedure (organization of the research): the research was being carried out during academic year (64 hours). Control group students were trained by traditional methodic. Experimental group students were trained by author's program. We studied influence of general physical fitness, functional state indicators on professionally important for medical workers criteria. Testing of indicators was fulfilled at the beginning and at the end of experiment. For this purpose we used standard tests [4, 11, and 18]. Diagnostic of medical students' professional-applied fitness by motivation-value criteria was realized with the help of questioning [3]. We used questionnaire for determination of criteria of professional self determination in HEE effectiveness [2].

The most adequate means of future medical workers' SPAPT diagnostic is quantitative-qualitative analysis of results of:

1) Morphological functional state: Ruffiet's test for cardio-vascular system, index of functional changers (IFC) – for determination of organism's adaptation level; Harvard step-test for physical workability [12].

2) Control testing of motor abilities' and physical condition formation [23]: test for quickness in exercise "100 meters' run"; "Shuttle run 4x9" for coordination of movements; 1000 meters' run for general endurance; test for power abilities; test for flexibility; test for balance; tests for coordination, for power endurance of legs' muscles; test for static power endurance; test "Throw of filled ball" for speed-power abilities.

Statistical analysis:

Statistical processing of testing final results was fulfilled with the help of Excel programs. We used factorial analysis.

Results

When choosing SPAPT criteria we took in consideration the content of its structure. We marked out the following criteria, which determine future medical worker's SPAPT effectiveness:

Motivation-value (firm cognitive interest, professional motivation for physical training);

Theoretical (conscious, systemic knowledge of SPAPT);

Gnostic – formation of theoretical knowledge system about SPAPT considering specificities of future professional functioning as well as completeness and consciousness in understanding of physical education role in human progress and specialist's training;

Reflexive - (readiness for independent SPAPT practicing: ability to independently organize and realize trainings, determine their effectiveness; knowledge and skills in self-diagnostic, self-control during trainings; ability to correct SPAPT process).

Analysis of higher educational students' SPAPT permitted to find the following: typical and variable physical education program has one serious disadvantage, i.e. normative orientation of training process. These programs also insufficiently consider formation influence of physical culture means with general and professional orientation complex usage. Analysis of existing physical education programs proves purposefulness of future medical workers' SPAPT perfection by introduction of special means and methods in trainings process, which would completely reproduce content and structure of professional training.

Questioning of physical education instructors pointed at need in introduction of specially worked out professionally oriented physical training programs, which would consider specificity of future professional functioning. Instructors (85.7%) think that it is necessary to form motor skills, considering specificity of future professional functioning. In opinion of 13 physical education instructors SPAPT shall be conducted not less than 4 hours a week and have orientation on formation of general endurance, special endurance, maximal strength, quickness of reaction, coordination, dexterity, flexibility, balance, decisiveness, communicability, emotional balance. More than half of instructors (8 persons, 61%) think that sport games and game exercises have the highest potential for formation of such abilities.

Common signs of physical education in the studied groups were: quantity of academic hours (64 in academic year); equal conditions of trainings (gym, facilities and etc.); system of assessment.

Distinctive signs:

1. Correlation of general physical training means (GTM) and SPAPT: in CG it was 85% : 15%.
2. In EG correlation of GTM and SPAPT varied depending on year of study (see fig. 1).
3. Variable component of EG program was based on usage of such kinds of sports as: mini-football, handball, baseball, swimming, ping-pong.

Basing on factorial analysis results we determined correlation and significance of every parameter of physical fitness (see fig.1).

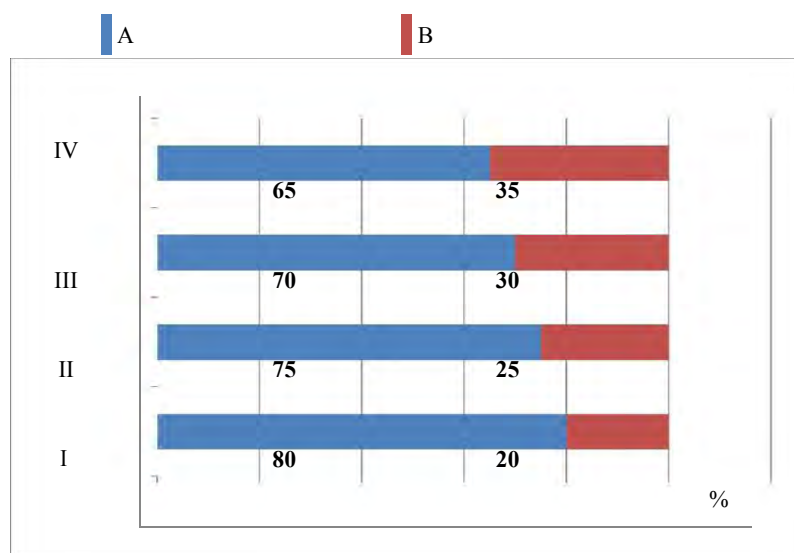


Fig.1. Correlation of GTM and SPAPT in author's program, %:

A –GTM; B – SPAPT; I – first semester; II – second semester; III – third semester; IV – fourth semester.

The content of author's differentiated program was directed at the following:

1. Development and perfection of main physical qualities at first year of study: strength, quickness, endurance, flexibility, coordination of movements. These qualities are the necessary basis for further development of special professionally important qualities.

2. Targeted training of professionally important qualities: static and dynamic power endurance, general endurance, coordination, coordination of arms' movements, balance in body static positions.

3. Training of professionally important neuro-dynamic functions: simple and complex visual-motor reactions.

4. Determination of technical sportsmanship in certain kind of sports and its further perfection.

5. Training of moral-will qualities: commitment, insistence, courage, decisiveness.

In the author's program specific means of SPAPT are physical exercises, which ensure training of general and special physical abilities. For this purpose we used general and special training methods, different training forms and SPAPT construction in compliance with tasks and purposes (in particular training system, their multiplicity, cyclicity, control and management).

The tasks of the author's programs were solved with the help of the following physical education and sports means:

1. General exercises were from 80% to 60% from general volume of exercises. They ensured comprehensive functional development of student's organism. Further, it permitted to specialize physical training on the base of high physical fitness. Such exercises completely corresponded to specificities of certain kind of sports. Though, to some extent they contradicted to them (in the aspect of comprehensive and harmonious physical development).

2. Auxiliary exercises, which corresponded to competition exercises by their content and structure. They created special base for further perfection in sport activity.

3. Special preparatory exercises were 15-20% from total volume of exercises in the structure of trainings. They took central place in system of sport training and embraced the circle of means, which, by their content and structure, are close to competition exercises. In author's program they are selected so that their content was maximally approached to professional movements of medical specialists.

4. Competition exercises were 20-30% from total volume of exercises, used in trainings, based on certain kind of sports. These exercises envisaged fulfillment of motor actions' complex, related to sport specialization.

In the author's program the following general exercises were used (see fig.2):

1. Exercises for insufficiently trained physical abilities - 60% from total volume of exercises.

2. Exercises for training other physical abilities - 40%.

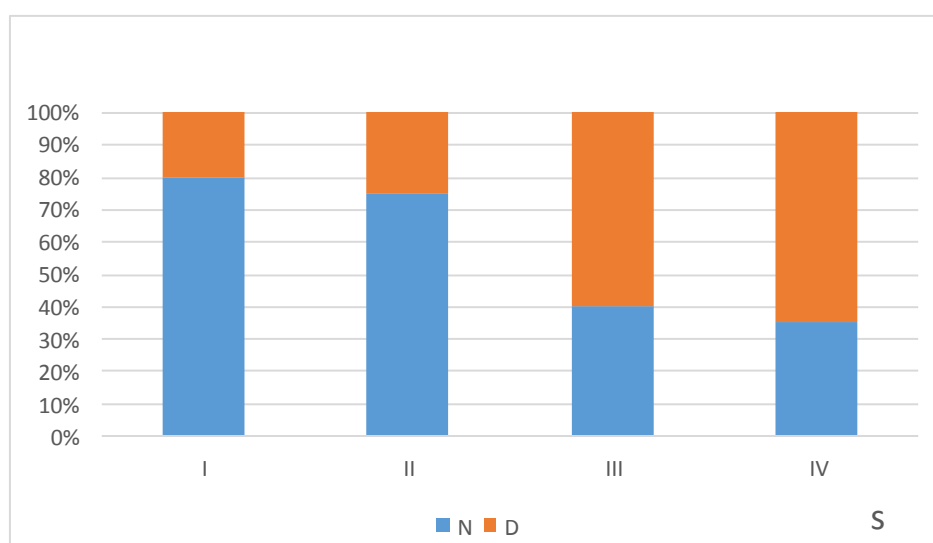


Fig.2. Structure and content of general exercises in the author's program: S – semester; N – exercises for insufficiently trained physical abilities; D – exercises for other physical abilities.

We marked out the system of SPAPT methods for higher educational establishments' students:

- 1) Cognitive (verbal, visual, diagnostic), which provide student with experience of SPAPT principles;
- 2) Organizational (practical, game, training, competition) – for practical realization of SPAPT program;
- 3) Control, owing to which it is possible to correct SPAPT methodic and stimulate further perfection (responsiveness, testing self-assessment).

Realization of the author's program took four stages. According to the worked out author's program physical education classes were conducted in the following directions:

- 1st semester – general physical training;
- 2nd semester – professionally oriented physical training;
- 3rd semester – professional-applied physical training;
- 4th semester – perfection of professional-applied physical training.

Improvement of indicators was regarded as positive result of author's SPAPT program realization.

By results of testing we found students' functional fitness. At the beginning of experiment by all tested functional parameters in EG and CG there were no any confident differences ($p < 0.05$) (see tables 1, 2).

Table 1. Indicators of EG and CG students' functional fitness at the beginning of experiment (n = 80)

	Functional tests, indices		Confidence, p
	EG (n=40)	CG (n=40)	
	X±S	X±S	
Ruffiet's test (conv.un.)	10.1±0.92	10.7±1.04	>0.05
IFC (conv.un.)	3.1± 0.14	3.1± 0.12	>0.05
IHST(cov.un.)	61.3± 8.19	60.7± 8.91	>0.05

Note: IHST – index of Harvard step test.

Table 2. Indicators of EG and CG students' general physical fitness at the beginning of experiment (n = 80)

Physical abilities	EG	CG	Confidence, p
	(n=40)	(n=40)	
	X±S	X±S	
Endurance (sec.)	248.6±6.39	244.7±5.34	>0.05
Strength (times)	31.5±0.62	31.9±0.66	>0.05
Flexibility (cm)	15.7±0.71	15.4±0.61	>0.05
Coordination of movements (sec.)	10.2±0.16	10.4±0.18	>0.05
Quickness (sec)	15.1±0.17	15.3±0.13	>0.05

Results of our research showed that the worked out SPAPT program causes more expressed positive changes in EG students' psycho-physical fitness, comparing with traditional. Its application in physical education process facilitates increase of physical fitness level and improvement of students' organism functional state.

It was found that in EG students there was confident ($p < 0.05$ - < 0.001) improvement of a number of cardio vascular system's functional indicators. Ruffiet's test indicators increased by 25.1% at ($p < 0.01$). IFC (organism adaptation level) increased by 19.3% from initial value ($p < 0.01$) in EG. IFC indicators are determined by assessment scale as satisfactory adaptation. It witnesses about students' proper health.

We also found that in EG confidently ($p < 0.01$) indicator of physical workability improved 25.5%. By assessment scale such physical workability level is good.

The adequacy of selected SPAPT means and methods permitted to achieve substantial positive changes in dynamic of all above mentioned functional tests and indices in EG. By the end of experiment average indicator of these indices' increment was 23.3% in EG.

Analysis of testing results in respect to EG students' general physical fitness showed that there are positive changes in quantitative parameters of the indicators with confident difference at ($p < 0.05$ - 0.001) (see table 3).

Table 3. Indicators of EG and CG students' physical fitness before and after experiment

Physical abilities	Before experiment			After experiment		
	EG (n=40) X±S	CG (n=40) X±S	p	EG (n=40) X±S	CG (n=40) X±S	p
Endurance (sec.)	248.6±6.3	244.7±5.3	>0.05	201.4±6.72	233.7±5.35	<0.01
Coordination of movements (sec.)	10.2±0.16	10.4±0.18	>0.05	8.4±0.14	9.2±0.15	<0.05
Quickness (sec)	15.1±0.17	15.3±0.13	>0.05	13.7±0.13	14.2±0.15	<0.05
Balance (sec.)	39.6±2.16	38.1±1.48	>0.05	54.8±1.78	41.1±2.23	<0.001
Coordination of arms' movements (sec).	10.7±0.54	10.8±0.88	>0.05	8.1±0.59	9.7±0.63	<0.05
Power endurance (sec.)	33.9±.84	34.7±1.39	>0.05	47.6±1.72	40.1±1.7	<0.001
Static power endurance (sec.)	32.6±1.40	32.3±1.64	>0.05	45.1±1.34	39.7±1.67	<0.001
Speed-power abilities (m)	6.0±0.36	6.1±0.35	>0.05	7.2±0.29	6.7±0.32	<0.05

Analysis of the received data proves effectiveness of the author's program SPAPT. It is also proved by statistically confident changes in EG students' functional fitness: Ruffiet's test – up to 25.1% (p <0.01), IFC – up to 19.3% (p <0.01), physical workability indicator – up to 25.5% (p <0.01).

Discussion

In professional training student's general cultural level is determined by future professional functioning, by his/her specialization. It is proved in other works [8, 15, 16, and 18]. Besides, it is necessary to mention interconnection of professional and general culture; students' wider involvement in educational programs, in formation of individual-personality's culturelogic attitude to the world. Thus, modern medical worker shall have professionally important personality's qualities; basis of professionally necessary knowledge of medical sciences, clinical skills; certain behavioral strategies of professional duties' realization [30].

Methodological aspect of the studied problem has the following components: 1) professional training of medical profile students as scientific-pedagogic problem; 2) applied character of content and tasks of future medical workers' physical training; 3) organizational-pedagogic peculiarities of methodic of higher educational students' professional-applied physical training in modern conditions of higher education reformation [27]. It was also proved in our research.

Important element of our research is humanistic paradigm of future medical worker professional training. In this case organization of educational process is impossible without its appealing to personality: his/her age and individual features, qualities and abilities; value orientations, educational and spiritual-cultural demands and subjective experience. That is why study of SPAPT problem of future medical workers pre-conditions usage of personality's approach. It is also proved in other works [27, 30].

Labor conditions of medical workers are regarded as the most complex and tensed. This activity is characterized by significant mental and physical loads [33]. That is why it requires stable attention, quick reaction, coordination, endurance and high workability. In such case physical training is an important component of future medical workers' professional formation. It is directed at compulsory formation of medical students' professional motor skills and applied skills. Our research proves that perfection of students' physical fitness will facilitate effective mastering of chosen profession. It will ensure optimization of students' physical and psycho-physical state as well as health preservation and formation of comprehensively developed personality.

Our researches expanded ideas about content and importance of future medical specialists' SPAPT [25, 26]. The research's results showed that the worked out SPAPT program facilitates perfection of students' psycho-physical qualities; their readiness for future professional functioning.

Conclusions

1. Testing of the offered by us SPAPT methodic showed that application of the author's program ensured confident improvement of SPAPT every component's formation in experimental group.

2. Analysis of testing results in EG witnesses about positive changes in quantitative parameters. Besides, they prove and statistically confirmed the difference between final indicators of EG and CG students.

3. We confidently proved differences ($p < 0.05-0.001$) between initial and final indicators, which characterize professionally important for students abilities: speed-power skills, static power endurance, power endurance, arms' coordination, static balance.

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Conflict of interests

The author declares that there is no conflict of interests.

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