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**METHODOLOGICAL BASES OF CREATION OF
INFORMATION SYSTEMS AND TECHNOLOGIES OF
MANAGEMENT OF THE STATE OF HEALTH OF THE
STUDENT**

Abstract. Methodological approach to process of an individualization of management by a state of health of students is considered. Approach uses the analysis of a wide range of indicators of a state of health with their subsequent generalization for the purpose of formation of an integrated index of estimation of level of health of the student and splitting a great number of students into groups in which various techniques, complexes of exercises and their intensity are applied.

Keywords: health, indicators of a state of health, integrated index of an assessment of level of health.

Introduction. The difficult complex of various factors among which the special place belongs to the academic load connected with intensive cerebration, violation of a mode of work and rest, a hypodynamia, a psychoemotional pressure, stressful situations has impact on a state of health of younger generation. At the same time modern society needs harmoniously developed, competent experts having high level of health and good physical readiness. In this regard in many countries of the world students, as the social group subject to danger of development of many diseases, is allocated in separate group of risk. Management of physical development of students and improvement of their health in the course of physical training represents undoubted interest [1-4].

Work purpose. The assessment of a state of health of each student allows to allocate groups of students which need special approach to occupations by physical culture. For carrying out a practical training on physical training in higher education institutions students taking into account a floor, states of health, physical and sports readiness are distributed in various groups: sports skill, the main, preparatory and special. Chronic diseases cause deterioration of physical development [5]. The purpose of work is consideration of methodological bases of creation of information systems and the technologies providing to the teacher of physical training in higher education institution options of division of students on groups, recommending for each group a complex of exercises and their intensity on the basis of information on a physical state

and functionality of an organism of a concrete individual.

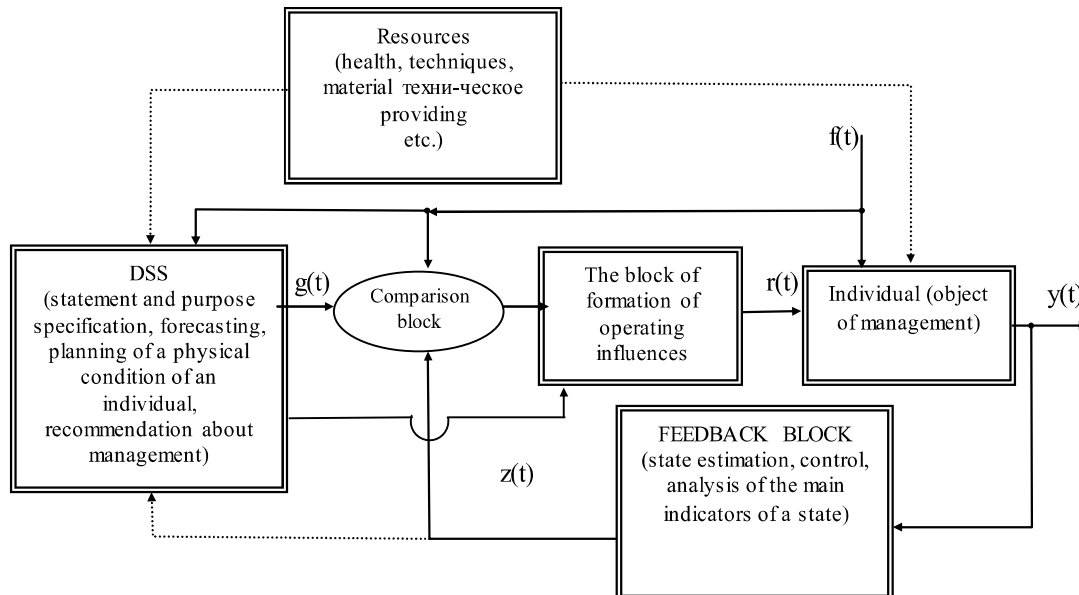
Statement of the main results. Level of a computerization existing today doesn't allow teachers to trace quickly a state of health of students and to accumulate information on each individual. The control system, allowing to automate processing of information is necessary and to operate a state of health of the person. Such system will be capable to develop effective managing directors of influence only in the presence in its structure of a peculiar mechanism of the adaptation providing the adaptation of system to change as object of management, and environment. Formation of model and algorithm of management is offered to be realized by means of the system of support of decision-making (SSDM). SPPR realizes control system adaptation that allows to minimize number of problem situations in which the system isn't able to propose the satisfactory solution. SPPR presents opportunity to the teacher to organize and store individual data of the specific student, to show compliance of its physical condition of the planned trajectory of development and to make the program of correction of health, to carry out necessary imitating modeling, to receive information in a convenient form, etc.

The analysis of opportunities and technology of impact on an individual from positions of the theory of management, allowed to offer the scheme of management of such class of objects (pic. 1). It is known that the control system always has to achieve the objectives of management $g(t)$. In management process control of values of operated parameters and their comparison with the set is exercised. The condition of management is reflected by output indicators at (t) of object of management. The external indignations influencing object, we will designate $f(t)$, to them carry diseases, weather conditions, stresses; $r(t)$ are variable managements, for example, motive exercises; $z(t)$ – variable conditions of object the managements which have taken place preliminary processing in the block of feedback; (t) – mismatch between the actual and desirable state of object of management.

Planning of values of indicators of a condition of a concrete individual has to be real and accepted for it. At development of decisions on management of a condition of the person it is necessary to consider opportunities for their realization and the actions made after decision-making. The major is definition of criteria of adaptive system which can be defined, for example, by means of the function of a penalty considering duration of a deviation of indicators of a condition of object of man-

agement from norm. Except noted features, the system has to give opportunity of estimation of effect from its functioning.

The accounting of the listed requirements to a control system allows to develop the corresponding algorithms of adaptation and mechanisms of management of a physical condition of the person and improvement of its health.



Picture 1 – General scheme of a control system of health of the student

Receiving objective estimates of parameters of health is an important indicator of an assessment of a condition of the person. Such assessment allows to allocate groups which are in a condition of risk, and it in turn plays an important role for diagnostics and prevention of diseases by selection of an individual complex of physical exercises.

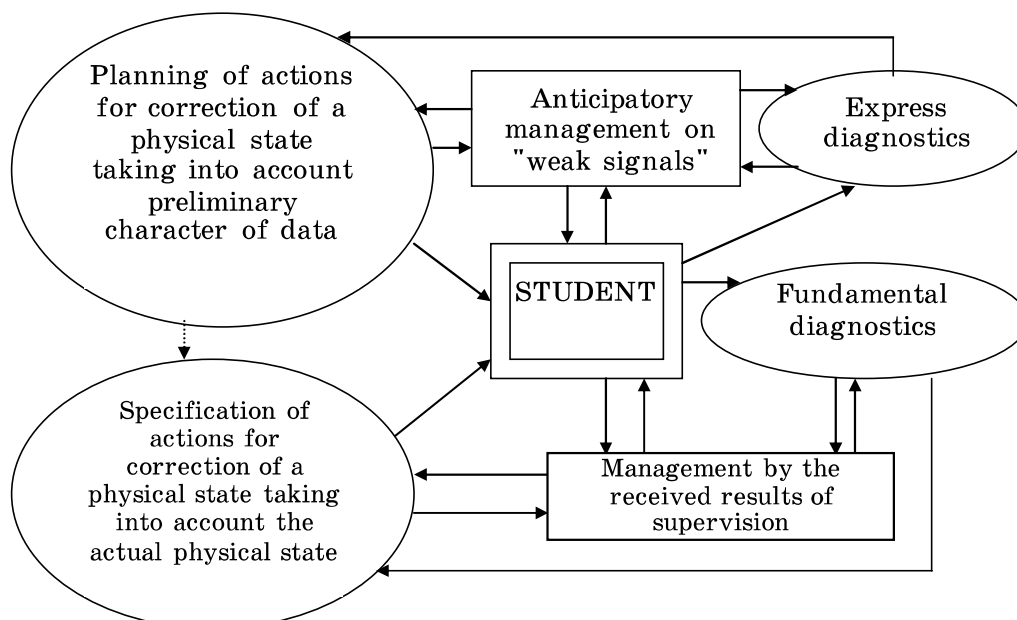
It should be noted that rather difficult to measure health level. Therefore for an assessment of health by WHO recommendations indirect indicators such, as physical readiness, adaptation, the psychological and psychophysiological status are used. Given a number of authors, our researches and practical experience testify that among simple and easily available indicators at students the most informative are Robinson, Ruffe, Quetelet's indexes, the EVROFIT tests, etc. These indexes are closely interconnected with the size of the maximum consumption of oxygen, and also with other indicators of physical readiness and are used by us for express diagnostics of physical health of students. As such indicators are measured in different units, the separate system is developed for estimation of each indicator in points. Belonging of the student to this or that group and his disease that allows the teacher to

pick up values of parameters of the corresponding tests is thus considered. Following the results of testing the student can get 100 points. Testing is held in two stages: the first – on the speed, force of feet and endurance; the second – on force of hands, dexterity, flexibility. For example, for track and field athletics exercises (run of 100 m, young men) the standard following: 13,2 with – 5 points; 13,9 with – 4; 14,4 with – 3; 14,9 with – 2; 15,5 with – 1 point. Similar scales are created and for other tests.

Students of special medical groups for academic year keep self-checking diaries, hand over educational standards and tests of physical readiness which consider a disease of the student and are modified taking into account specific features of students.

The obtained data allow the teacher of physical culture to select a rational improving and training motive mode that gives the chance to optimize developments of an organism of the student, to level negative influence of a high school mode and the organization of educational process, and also other negatively influencing factors of the environment.

The conducted researches allowed us to offer use of the combined management uniting compensating management on indignations with management by received results of supervision (pic. 2).



Picture 2 – The scheme of the combined management of a functional condition of the student

In this case the operating subsystem beforehand, express diagnostics method, finds an initial stage of influence of destabilizing factors

and tries to eliminate them. Upon termination of a certain period more careful diagnostics of a condition of an organism of an individual which allows to receive objective information is carried out and to make the decision on further operating influences. Such approach to management of a physical condition of an individual allows to minimize both losses from influence of destabilizing factors, and costs of their compensation.

Taking into account diagnostics opportunities in the conditions of a higher educational institution as sources of "weak signals" us testing of motive abilities of students is certain. For the same purpose pulse diagnostics is used.

It is quite easy to enter the offered system of express diagnostics into the information system and to carry out the forecast of a condition of physical health individually for each student and on this basis to plan and choose the relevant activities for their improvement by non-drug means and to select training programs.

Any problem of an assessment of health and diagnostics can be considered as search of display of a formula of a look

$$X^* = (x_1^*, x_2^*, \dots, x_n^*) \rightarrow d_j \in D = (d_1, d_2, \dots, d_m) \quad (1)$$

where – X^* set of parameters of a state investigated;

D – set of possible complexes of exercises.

Difficulties of the solution of problems of an assessment of health are caused by the following reasons:

–for the correct selection of a complex of exercises it is necessary to consider a huge number of parameters of a state surveyed;

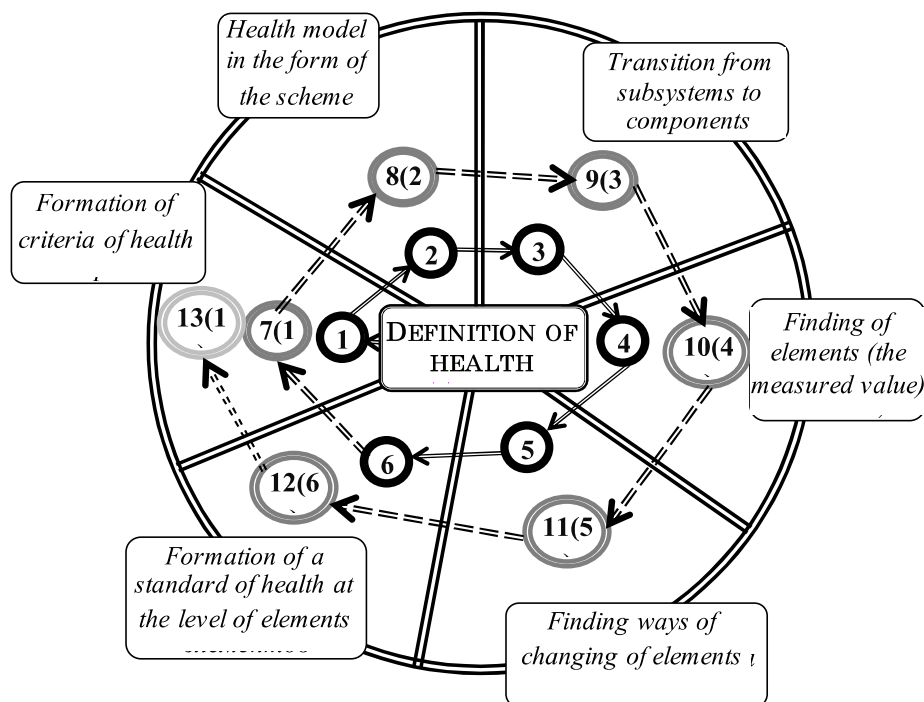
–there are no analytical dependences between parameters of a state surveyed (reasons) and a complex of exercises (consequence).

Complexity of creation of such dependences is defined both a large number of parameters, and their diverse character. They can be as quantitative (age, pressure, pulse, etc.), and qualitative (pain, a state, etc.). In these conditions actual there is a problem of creation of the models used by teachers of physical culture in systems of intellectual support of decision-making.

The spiral model of life cycle of realization of development stages (pic. 3) in which on each spiral turn stages of formation of model of an assessment of health of the student and selection of a complex of physical exercises are realized is put in a basis of development of model of estimation and correction of health of the student. With each subsequent

round quality of development improves and, at last, the acceptable option of model turns out.

The analysis of medical characteristics of an individual allowed when developing model of estimation and correction of health of the student to create four subsystems (pic. 4) which define the main components entering definition of health. Use of the constructed structural model of structure of health of students assumes formation of information and analytical base for adoption of administrative decisions and creation of the relevant system of information support of decision-making.

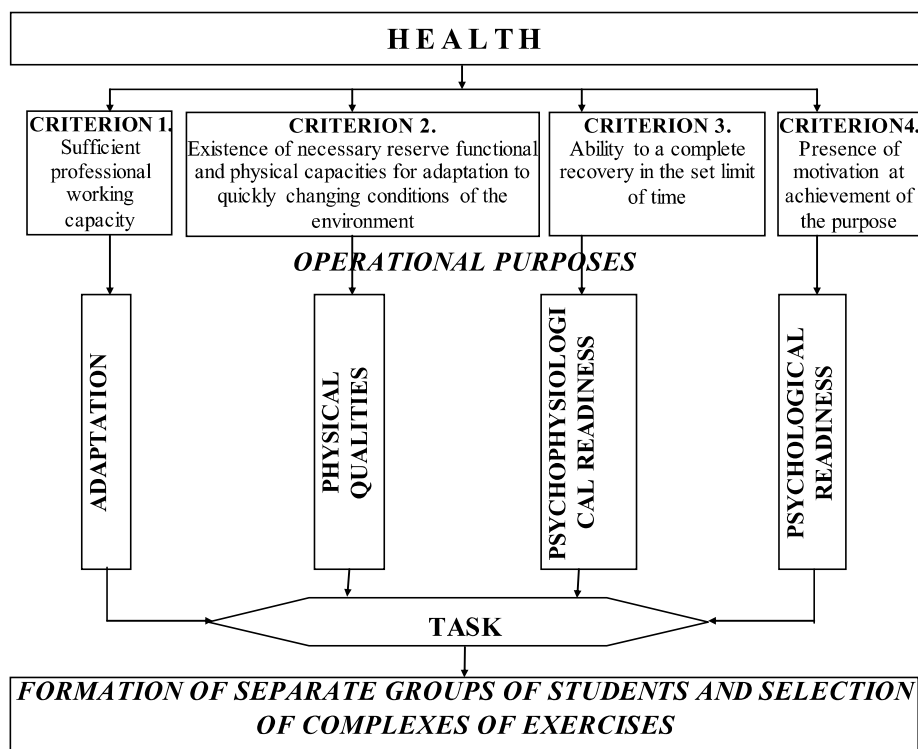


Picture 3 – Development stages of model of an assessment and correction of health of the student

The main form of application of such estimates are physical exercises and natural factors. As organizational bases of correction of health are considered: theoretical preparation, methodical preparation, practical preparation and control. Complex initial his belonging to a certain group allows to define estimates of a condition of the student before occupations. Carrying out classes in the certain program received on the basis of an assessment of a condition of the student, is based on the following principles: continuity; systematic alternation of loadings and rest; gradual increase in loadings and adaptive balance of their dynamics; traditional and nonconventional methods and means of physical im-

provement. Control of efficiency of occupations allows to make recommendations on further grade levels.

Nowadays it isn't present ideal for students of different special groups of integrated indicators of an assessment of health. The problem of selection of students in groups is multicriteria. Characteristics of various components of health belong to selection criteria. Process of selection becomes complicated also that often it occurs in the conditions of incomplete information. It is in advance impossible to call one characteristic according to which selection of an individual will be made. The person making the decision is very frequent, operates with concepts "is healthy", "it is almost healthy", "it is conditionally healthy", "it isn't healthy", etc. Multicriteria on the essence the problem of selection needs development of a method of the decision, allowing to develop effective policy in the matter [7].



Picture 4 – Strategic objectives of improvement of health

Selection of the student in concrete group is offered to be carried out on the basis of expert estimates. During the analysis experts should face such problems, as incompatibility of medical indications of various students, uncertainty of data from a position of their treatment the certain student and the teacher in view of various vision of ultimate goals and so forth. To balance these divergences, rating estimation of health of the student here is used.

To formalization of a problem of selection of the student in concrete group which needs to be solved for all great number of students of higher education institution, it is offered to apply the following scheme of procedure of selection: formation of a set of criteria of estimation of health of a separate individual; data collection about participants of process of selection; development of mathematical models of ranging; formation of an integrated index of estimation of health of the student. Such procedure gives opportunity to calculate a rating of analyzed individuals and to have them in a certain order on a rating scale.

The global criterion of a rating is defined on the basis of primary medical information about health of the student. It is expedient to group primary information in blocks of indicators – set of indicators which define making states of health of the student (for example, "Bone and muscular system", "Cardiovascular system", "A gastrointestinal path", etc.). For each block primary data will be transformed for the purpose of possibility of their comparison, thus rating indicators which for each block of indicators of health of the student then unite in a uniform indicator – an index I turn out. As global criterion on the basis of which the general assessment of health of the student is carried out, the integrated KI index determined by indexes I is applied.

Algorithm of determination of parameters of system of rating estimation of health of students the following.

1. On the basis of available medical indications of analyzed individuals the base of primary indicators of system of rating estimation is formed. Indicators characterizing a state of health are parameters which are based on use of authentic, objective and exact data which are confirmed by the relevant documents.

2. Relative values of indicators (rating indicators) as the relations of primary indicators to the corresponding indicators of comparability of subjects of ranging are defined. Here they paid off, as private from division of each primary indicator into average values following the results of testing of group of analyzed students. It provides compatibility and comparability of indicators.

3. Rationing of indicators and linear convolution in which the model is based on the weighed sum of estimates is made. Rating indicators are normalized for each j-go of an indicator by division of the rating indicators received in item 2 into the sum of the corresponding rating indicators of this indicator on a formula:

$$RN_{ij} = \frac{R_{ij}}{\sum_{i=1}^M R_{ij}}, \quad i = \overline{1, M}; \quad j = \overline{1, N} \quad (2)$$

4. On the basis of a matrix RN_{ij} of rated rating indicators it is carried out calculations of indexes of each block of indicators of health of students. Indexes pay off as

$$I_{ti} = \frac{1}{m} \sum_{n=1}^{n=b} RN_{ni}^t, \quad (3)$$

where I_{ti} – the t-go index of the block of indicators of health of i-go of the student; RN_{ni}^t – n-y rated rating of t-go indicators of the block of indicators of health of i-go of the student; b – number of rated rating indicators in the separate block of indicators of health of the student, $1 \leq n \leq b$; m – total of rated rating indicators of the certain student.

5. The global criterion of a rating for each student, as the sum of indexes of blocks of indicators of health of each student is defined:

$$KI_i = \sum_{t=1}^{t=d} I_{ti}, \quad (4)$$

where KI_i – global criterion of a rating of health of i-go of the student; d – number of blocks of indicators of health.

6. Ranging of students on the basis of sizes is carried out and the place of the student corresponding to his level of health is defined. Students with the highest value of global criterion are applicants for transfer in group of sports skill, according to the lowest values – in preparatory medical group.

The considered procedure can be added with application of a hierarchical agglomerative clustering [8] or introduction of integrated criterion of the entropy type, allowing to estimate a condition of biosystem at any moment:

$$IG = \sum_{j=1}^n P_{0j} \ln \frac{P_{0j}}{P_{1j}}, \quad (5)$$

where n – quantity of the considered signs characterizing a condition of object;

P_{0j} – the aprioristic probability characterizing "preferable" probability of a condition of object;

P_{1j} – a posteriori probability. The probability of that value of a sign X meets "standard". The probability of P_{1j} is calculated on a formula (2):

$$P_{1j} = P(|X - a| < \delta) = 2\Phi\left(\frac{\delta}{\sigma}\right) - 1 \quad (6)$$

where - a population mean of a studied sign of x_j ;
 – the size of deviations of the current x_j value from;
 – dispersion of a sign of x_j ;
 Φ – the standardized function of normal distribution.

In expression (2) probability of $P_{0j}=1$ as, as a "preferable" condition of object we accept a reference state, at which a deviation =0, therefore:

$$P_{0j} = 1 - \left[2\Phi\left(\frac{0}{\sigma}\right) - 1 \right] = 2 - 2\Phi(0) = 2 - 2 * 0,5 = 1. \quad (7)$$

Having substituted the received value in a formula (2), we will receive

$$IG = \frac{1}{n} \sum_{j=1}^n \ln \frac{1}{P_j}. \quad (8)$$

In this case the integrated indicator of IG allows to estimate degree of a deviation of a condition of biosystem from some (reference) state. So, for example, as a reference state at an assessment of level of physical health the state meeting "physiological standard" was chosen.

Thus, definition of groups of students (sports skill, the main, preparatory and special) for classes in different techniques and physical activities can be carried out according to the offered approaches. If it is necessary, primary data are specified, and procedure is carried out repeatedly.

Conclusions. The researchers conducted by means of complex testing of motive abilities of students, showed that level of physical readiness of students of technical university is low and, as a rule, during training doesn't raise. Introduction in educational process of system of diagnostics of a physical condition of the student and management of this state in the course of classes in physical training will allow to improve indicators of physical readiness of the student and a functional condition of separate systems of its organism, to increase efficiency of diagnostics and adoption of necessary decisions that will promote expe-

ditionous correction of a technique of teaching and dispensing of physical activity. Methodological approach to process of an individualization of management by a state of health of students is offered. Approach uses the analysis of a wide range of indicators of a state of health with their subsequent generalization for the purpose of formation of an integrated index of estimation for definition of level of health of the student and splitting a great number of students into groups in which various techniques, complexes of exercises and their intensity are applied. Approach is adapted for opportunities of practical application in the system of support of decision-making providing to the high school teacher of physical training versions of decisions on the organization of work with students and will promote introduction of individual programs of correction of health of students.

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