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CONCEPTUAL MODEL OF HEI EDUCATION QUALITY MONITORING BY PRINCIPLE OF COMBINED CONTROL

In the article are developed the models of monitoring of quality of education in Higher Educational Institutions (HEI), built up in accordance with the state requirements and standards in the field of quality of education that can exist in the educational process of HEI. The analysis of developed models was conducted. The developed model of monitoring of quality of education in HEI will help the head of HEI to correct an educational process and as a result, will allow to meet a demands of the state in the field of increasing the quality of specialists training

Keywords: management system of higher education quality, educational process, monitoring/

Problem statement in general, its connection with significant scientific or practical tasks. Obtaining of high-quality education directly depends on the quality of requirements to education (goals, standards and norms), quality of resources (programs, human resource potential, applicant contingent, material and technical support, finances, etc.), and quality of educational processes (scientific and educational activity, management, educational technologies), which directly ensure training of specialists [3, 5].

Problem of education quality is nation-wide, on which the competitive ability of the state and entry of Ukraine on the world educational market depend. One of the most important aspects of

solution of this problem is introduction of modern high-technology adequate system of higher education quality management at the state and regional level, and at the level of higher education institution (hereinafter HEI). The goal of education quality management system is to increase efficiency of training of highly qualified specialists in accordance to the requirements of state and international standards at the level not lower than the specified.

Analysis of the latest studies and publication on topic. The quality of specialists training is "an integral index of education state and students' level of knowledge" [8]. It includes a number of features which characterize the mastering of knowledge system and the ability to use it in course of activity.

The quality of educational result is "personal qualities that are fixed through the categories of culture, civil maturity, levels of knowledge, skills, creative abilities, motivation, i.e. levels of professionalism and universalism" [8].

One of the most important characteristics of educational process management is the quality of specialists training. It is determined by the degree of soundness of three main positions: goal of study (what for to teach), content of study (what to teach), and teaching measures and principles of process organization (how to teach). The success and efficiency of teaching process is determined by the content of education and technology of activity of both scientific and educational personnel and commanders, and the students as well.

V.P. Bespalko [1] underlines that the main characteristics of education quality are: quality of knowledge and satisfaction with the educational process of students (and not teachers!). S.E. Shyshov and V.A. Kalney distinguish such main characteristics of the education quality [4]:

- progress of students in acquired knowledge, abilities, and skills;
- study skills (observance and search of information, search of analogies and understanding of essence, transfer of information, evaluation of performed work, etc.);
- attitude to study, including motivation, interest, ability to focus, cooperate, and work efficiently.

By quality of education we understand the characteristic of educational process which determines its state and efficiency according to the requirements of the customer and expectations of educational process subjects with observance of the requirements of higher education state standard [6]. The quality of education is determined by a number of indices which characterize various components of educational process and its results. In our opinion, the main factors which affect the quality of educational process may be:

- teacher – the base of the process since he/she transfers not only knowledge but experience, skills and life position;
- student;
- study and life environment, including information environment;
- study motivation;
- study and response of educational process to the change of external environment;
- modularity of study (as an instrument of innovative process);
- competitive ability of educational cycle on Ukrainian and foreign markets which is connected with recognition of specialist's qualification;
- creation of conditions for cyclic update of knowledge in course of life (the person being taught shall remain the student of HEI even after graduation).

The key chain in education quality control is educational institution, since it bears responsibility for the quality of education of its graduates with the possibility for HEI manager to adjust his/her activity in order to achieve the level of education quality of graduates not lower than the specified. Therefore, in order to ensure the high-quality level of education it is reasonable to consider adjustment of teaching and educational process (hereinafter – TEP) at two levels – at the level of state and at the level of higher education institution. Fig. 1 shows basic quality indices which affect obtaining of high-quality education by HEI graduates by two-level distribution.

Education quality at the state level [5] is achieved by fulfillment of state requirements to personnel, educational and methodological, material and technical support of study process,

creation of efficient and adequate normative and legal support of educational activity. At HEI level it is achieved by observance of the requirements to qualitative and quantitative composition of research and educational staff, educational and methodological support, TEP planning and organization (ensuring of high-quality level of educational and vocational qualification (hereinafter – EVQ) of graduates), material and technical support, study of labor market for future graduates, analysis of their professional activity by references from the army.

Normative and legal support of higher education consists in corresponding laws of Ukraine, Decrees of the President of Ukraine, resolutions of the Cabinet of Ministers of Ukraine, orders of the Ministry of Education and Science of Ukraine, orders of the Ministry of Defense of Ukraine, standards of higher education (state, branch, HEI standards), and other normative and legal documents.

TEP planning and organization in HEI presupposes availability of all types of study – auditorium, practical, courseworks and diploma projects, independent work of students with introduction of up-to-date educational technologies, advanced experience, etc.

Control of EVQ realization in HEI is carried out at the stages of internal and external control, including in course of accreditation and state certification. Due to the fact that TEP realization control is an integral part of educational process, it is reasonable to consider adjustment control of the mentioned process from the point of view of improvement of teaching quality, and TEP monitoring will give the HEI manager the possibility to determine its compliance with the desired result and to detect the trends toward development (degradation).

Also, forming of boundary (reference) values of the graduate's education quality is affected by both external and internal factors. External factors include state demand, condition of labor market, demographic situation in the country, customer's requirements to graduate, etc. Internal factors include internal guiding documents of HEI, list of qualifications and specializations, qualitative and quantitative composition of staff and their qualifications, HEI rating, staff list, etc.
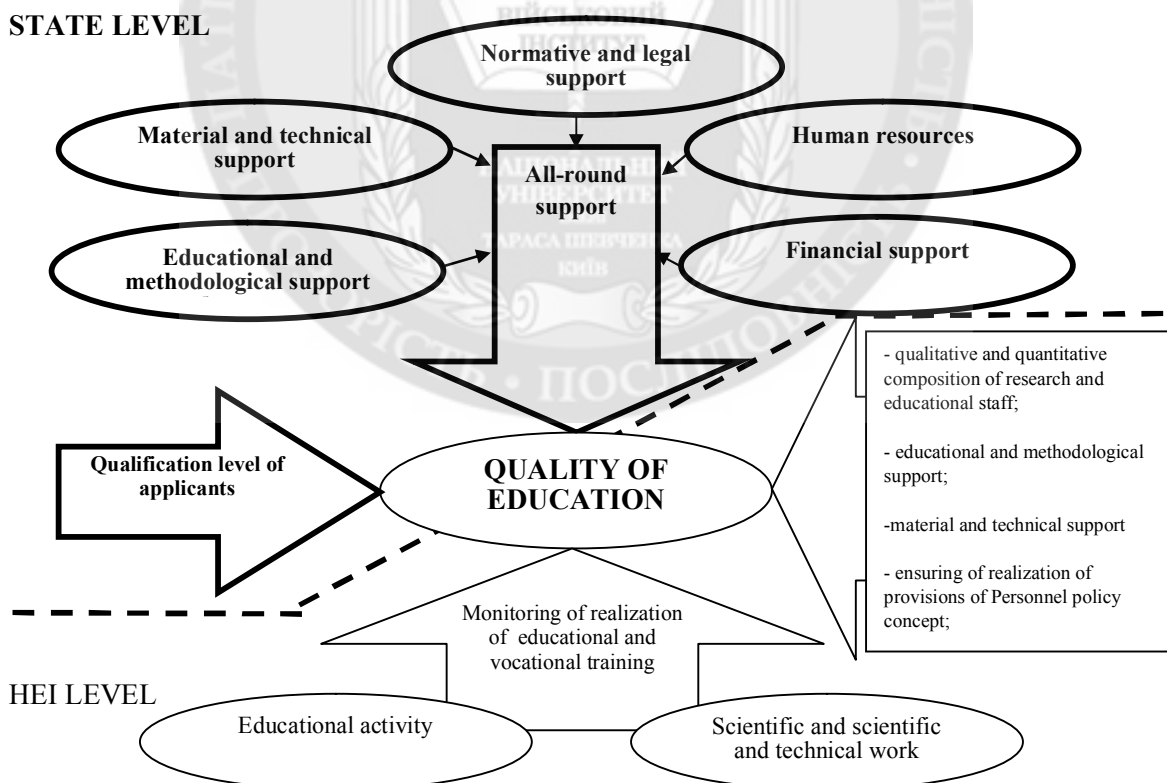

Fig. 1. Indices which affect obtaining of high-quality education by HEI graduates

Since HEI is directly responsible for high level of graduate's EVQ, the article offers to consider (at HEI level) the following basic indices of education quality: quality of study activity,

and quality of scientific and scientific and technical work Fig. 2 represents quality indices of educational activity with decomposition into lower levels: quality of study results (concerns students) and quality of discipline teaching (concerns teachers).
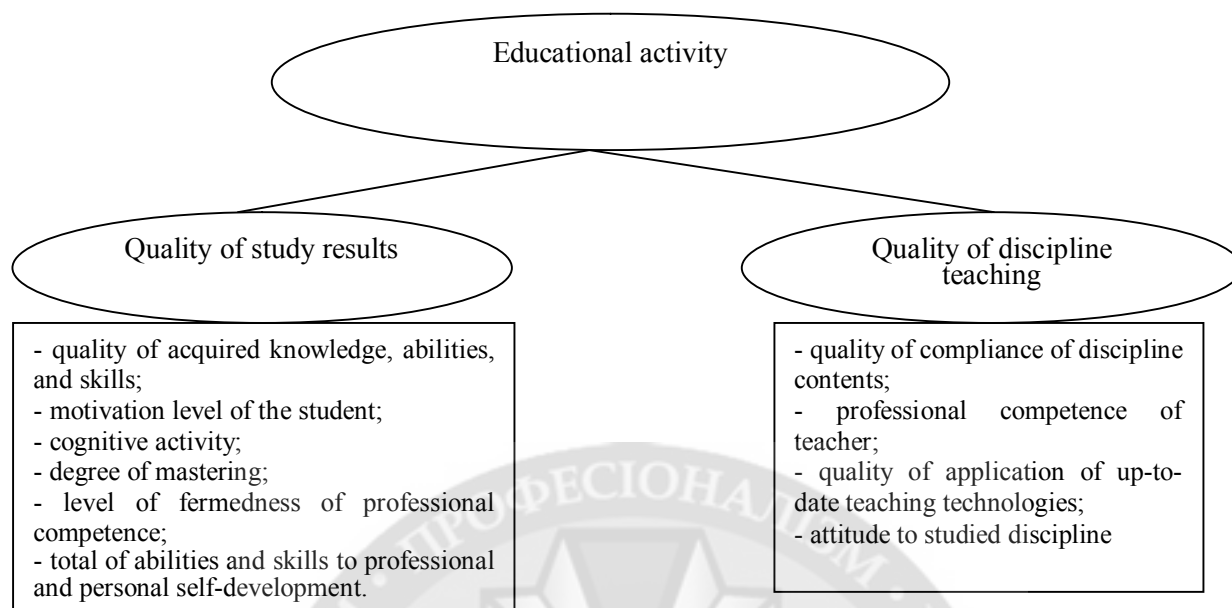

Fig. 2. Quality indices of educational activity

Fig. 3 shows quality indices of scientific and scientific and technical work which concern both the teacher and the student.
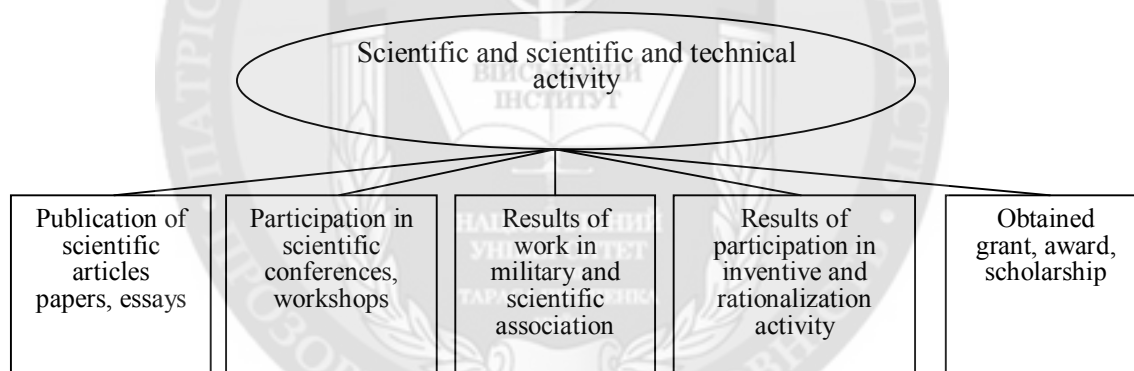

Fig. 3. Quality indices of scientific and scientific and technical activity

Adjustment control system implemented in course of educational process and quality of teaching are closely interdependent. Adjustment control, being the part of TEP, shall comply with quality requirements; at the same time complex system of adjustment control, maximally realizing teaching and educational functions, gives the possibility to improve the start and to increase the efficiency of TEP according to the requirements of the state standard.

Formulation of article goals. The goal of this article is to develop the conceptual model of HEI education quality monitoring which will give the possibility to formalize and typify analytical information about the state of teaching and educational process which take place on HEI, and to give and offer to HEI manager alternative decisions needed for prompt making of efficient decision of timely taking of adjustment measures in order to achieve the education level not lower than the specified.

Presentation of basic material. Main conditions for normal functioning of HEI consist in maintenance of education quality indices $y(t)$ at the level not lower than the specified. If one or several indices start deviating from the specified level of approximation $y_n(t)$, it is necessary to detect in time t_1 and to remove the reason of such deviation Δ in the shortest time t_2 by forming the

control action on separate part of teaching and educational process. The task consists in **continuous control (monitoring) of quality indices of education on HEI,** and, in case of their degradation, to find the reason of such deterioration, and to give to the manager alternatives for making of adjustment decision. Fig. 4 shows possible process of knowledge acquisition with the corresponding process of TEP adjustment for achievement of knowledge acquisition level not lower than the specified $y_{\text{п}}(t)$.
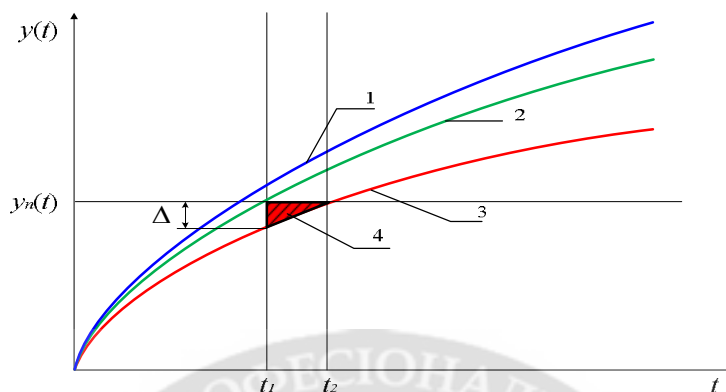

Fig. 4. Education curve, where: 1- ideal educational process; 2- expected (planned) educational process; 3- educational process requiring adjustment; 4- part of teaching and educational process which is being adjusted

Reasons for deviation from the specified level of knowledge acquisition $y_{\text{п}}(t)$ at control time point t_1 are possible duet to action of different disturbing activities which lead to deterioration of educational process quality [6]. Deviation Δ due to various reasons may reach inadmissibly high values which result in disturbance of TEP ensured by management object. Therefore, there arises the task of decrease of deviation of initial values of objects from the values required. Since this task is the main one, it can be solved with the help of methods of management theory.

It is clear that TEP organization control is only the part of management process which develops study, cognitive and intellectual capabilities of students. Important is not only the fact of teaching and educational activity management, but the specific type of management system.

Education quality management system in HEI shall consist of four interdependent subsystems:
- quality planning – setting of TEP parameters;
- quality ensuring – setting of TEP adjustment area;
- quality control – TEP shall be measured;
- quality improvement – TEP shall be improved.

An important characteristic of TEP management is the type of information process used for transfer of management signals which may be scattered or addressed.

In case of scattered information process, information from teacher id directed at all students without account of whether each of them is able to understand it or not (information without specific address). Educational methods and organizational forms used by now are based mainly on scattered information processes: professor teaches students assuming that all of them are listening to him and understand him. The majority of methods presuppose application of scattered information processes. When using such processes, most of time is dedicated to explanation of the material by the teacher. All modern textbooks are based on scattered information processes.

At the same time, didactics has long time ago formulated the principles of individual approach to every student in course of teaching and education. In order to solve this task, it is necessary to substitute scattered information processes with addressed ones.

In case of addressed information process, the teacher forwards information to one specific address with account of personal characteristics and abilities of the student: his qualifications and motivation. Work of a tutor with individual student is a typical example of addressed information

process. Addressed information process can be realized only in individualized ty of teaching which is carried out with the help of tutor or computer. There is a possibility of partial application of addressed information process when teaching process is partially individualized, i.e. teaching quality is controlled by one or several parameters. For instance, only "level of mastering" parameter is observed. Total of this information is reduced to content modules.

Content modules formulated in such manner may then be combined into separate blocks, and further into teaching disciplines by unity of education goals. At the same time, it is necessary to accurately determine the subject of each teaching discipline, not to make mistakes that occurred earlier, and to determine the position of this discipline in the system of continuous training. Each content module includes corresponding set of teaching elements (questions), the total of which determine the scope of each teaching discipline.

TEP control may be classified as open and closed type.

As a rule, open control is carried out by means of control and adjustment of the process of study of teaching discipline (hereinafter – TD) by its final result (correspondence of the coefficient of mastering of teaching discipline K_α to the specified level $y_n(t)$). An example of TEP open control may be the work of student according to ordinary, previously written algorithm which has specific order of actions and final result. If the student faces any difficulties in course of work, he is usually unable to find the way out of complicated (non-standard) situation. In this case the control action depends on whether the complication is standard for the student, i.e. provided for in the algorithm, or not. If it is not provided for, and the algorithm has no indications on what to do, the control action is absent, and the student addresses to the teacher, or makes mistakes of which he becomes aware at the end of work.
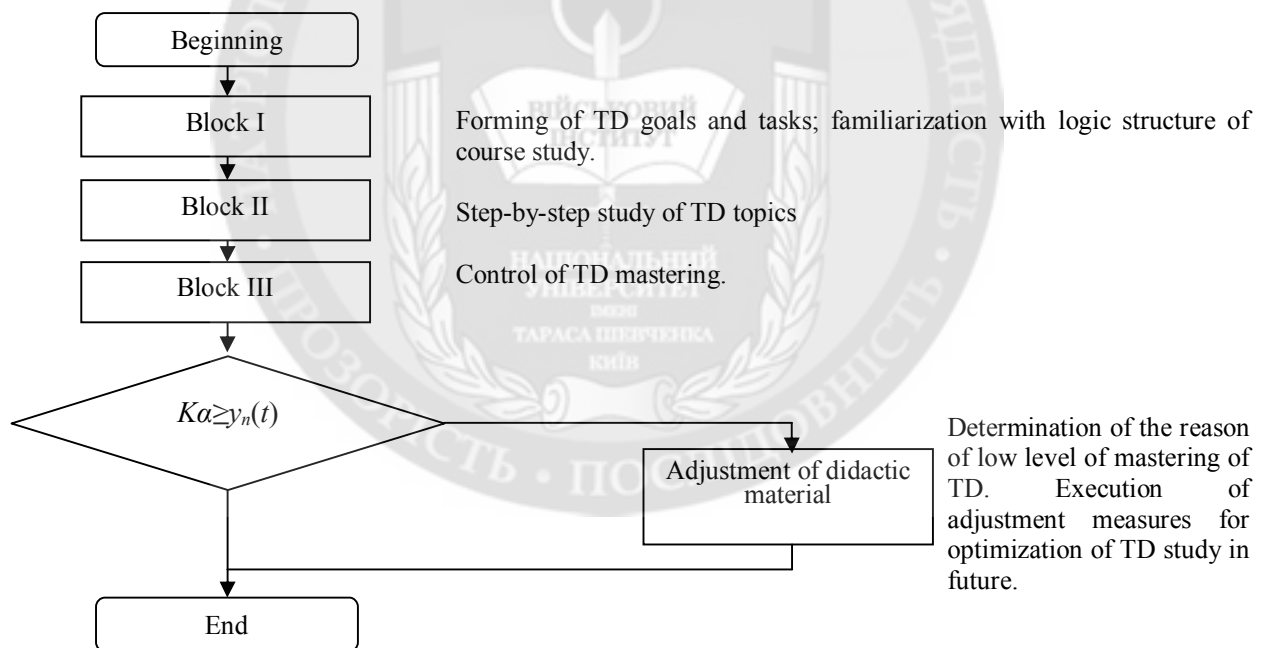

Fig. 5. Generalized algorithm of teaching discipline study control in case of open management of educational process

In case of open control of educational process there is no diagnostics of interim states of the process of discipline study, because it is assumed that, under the condition of correct observance of algorithm, all the students achieve the specified goal. Fig. 5 shows the generalized algorithm of teaching discipline study control by teacher which may exist only in case of open control of educational process.

The final goal of education shall consist in achievement of the quality level of specialists' training by their educational and vocational qualification (hereinafter – EVQ) which includes α content modules in course of discipline study, in the process of mastering of k teaching discipline,

which will give them possibility to qualitatively fulfill *j*-respective functions of professional activity. It is reasonable to check the above-mentioned with the help of evaluation calculation algorithm [7] by 100-point scale (Table 1).

Evaluation table

100-point scale	Mark under national scale and University scale	
90 – 100	5	excellent
85 – 89	4	good
75 – 84		
65 – 74	3	satisfactory
60 – 64		
1 – 59	2	unsatisfactory

Comparison of the final rating R for discipline (module, block, etc.) study to maximum rating for discipline study R_{max} ($R_{max} = 100$) gives the possibility to obtain the coefficient of teaching discipline (module, bloc, etc.) mastering K_α :

$$K_\alpha = \frac{R}{R_{max}}$$

Finding of K_α is an operation for determination of the quality of teaching discipline (module, block, etc.) mastering. Coefficient of mastering is subject to normalization $(0 \leq K_\alpha \leq 1)$. By coefficient of mastering one may judge about the completion of discipline (module, block, etc.) study. The study results [1] show that at $K_\alpha \geq 0,75$ the process of study may be considered as completed the student is able in his further activity to improve his knowledge in course of self-education. At $K_\alpha \geq 0,74$ the student makes systematic mistakes in his further activity and is not able to correct them on his own. Thus, the process of study can be considered completed only at $K_\alpha \geq 0,75$. If not, going to new material is the same as training an "undertrained". There is nothing worse than undertrained a proverb says, and it is true, since the undertrained has no doubts in his incompetence and does not want to upgrade his skills.

Value of $K_\alpha \geq 0,75$ as an indicator of discipline (module, block, etc.) study completion and beginning of self-education corresponds to the didactic idea of these processes, but does not take into account social peculiarities of studied activity and formed mastery of the student. At the stage of self-education $(0,75 \geq K_\alpha \geq 1,0)$ the student improves his skills but making his own mistakes. In some types of activity such self-improvement is inadmissible because it can be socially dangerous, for example in work of a driver, pilot, doctor, etc. [1]. In such cases the lower permissible boundary of completion of the discipline (module, block, etc) study shall be raised.

It is known that for any information process the necessary and integral components are channels and means of information receipt by the subject (student) or computer system. Channels of information receipt (or information channels) are the sense organs with the help of which the subject receives the information. In this context the means of information receipt are any means which give the student the possibility to activate the suitable information channels.

For the study process, the main information channels are optic, auditory, tactile, taste, etc. Each of them may become the priority channel in course of study depending on goals, content, character, and method of organization of TEP.

Depending on means of forming of control action we may distinguish the following principles of control [2]: by disturbance, by deviation of controlled value from the required one; combined control. All these types of control also concern the organization of TEP in HEI.

Using fundamentals of automatic control theory and expert evaluation method [2] let's build the models of TEP monitoring system in HEI by the specified graphical description of teaching and educational process [1].

Using fundamental provisions of automatic management theory and expert essesment method [2] by defined graphical description of teaching and educational process [1] we shall build monitoring system models of TEP and HEI.

If under the factor which causes deviation of controlled value from essential value it shall be understood as any disturbance and it is corresponded by management principle by disturbance if this factor is represented as change of essential value of controlled value, we have management principle by assigned action [2]. When managing by disturbance there shall be assigned a task for compensation of influence of disturbance action on controlled value and in case of assigned action management the task consists in achievement of more definite reproduction of this assigned action or its functions by this value.

In system with disturbance management principle for formation of managing action is used direct information on disturbance action (i.e. information on reasons causing deviations). That's why in such systems there possible full compensation of influence of disturbance action on controlled action, i.e.possible achievement of invariant (independence) of controlled value relative to given disturbance action. With analysed method it is possible to compensate influence each of disturbance actions separately. However, in practice [1, 2] it is cannot be obtained to compensate influence of all disturbance actions as major part of actions are not defied measuring and under compensation of all disturbance actions a complicated system is obtained. In practive only major disturbance actions are compensated which are mostly influence controlled value. System with disturbance management principle is open automatic management system (hereinafter – AMS). In this system management process does not depend on results (value is controlled is not measured and there no actions performed if it does not respond essential value) and there is observed only direct action

AMS with disturbance management princiole has the following disadvantages:

1) it removes influence only of major disturbance action under which compensation channels are built;

2) there appear deviations of controlled value from essential value with change of other disturbance actions under which there are no compensation channels;

3) in these systems as in open there appear deviations of controlled value with change of object characteristics and system elements;

4) applying of disturbance management principle is limited by objects characteristics of which are known (they can be define).

Management principle under assigned action is used when essential value of controlled value is changed (TEP) and by main factor which causes significant deviation of this value from the essential value, is change of assigned action on the input of inertial object (initial system).

Management principle by assigned action (fig. 6) consists in that for removing and reducing of deviation for controlled value from essential value appeared due to object inertia (of initial system) when changing of assigned action, managing device forms management action $\mu(t)$ of the same assigned action including statistic and dynamic characteristics of the object (that who is teached). Under the influence of the latter controlled value $y(t)$ tries to change itself in accordance with changes of essential value (assigned action).

Let's build functional scheme of ideal "ідеального TEP" by management principle of assigned action.

This process may be described as integral dynamic link where $x(t)$ is assigned action (is formed according to state requirements on eduction quality, standards); managing device – TEP (teacher's knowledge), forms managing action $\mu(t)$ on management object (who are teached); $y(t)$ – object output value which shall be remain to be equal to essential value $y_n(t)$, e.i. $y_n(t)=y(t)=x(t)=x_n(t)$. It is constant and is described by linear function $y = K_\alpha x, (x \in R, x > 0)$

where K_α is coefficient of mastering of educational subject (modules, block, etc.). For our case $K_\alpha = 1$. Graph of linear function $y = f(x)$ is line. Equation of link dynamics:

$$x(t) = k\int_0^t y(t)dt,$$

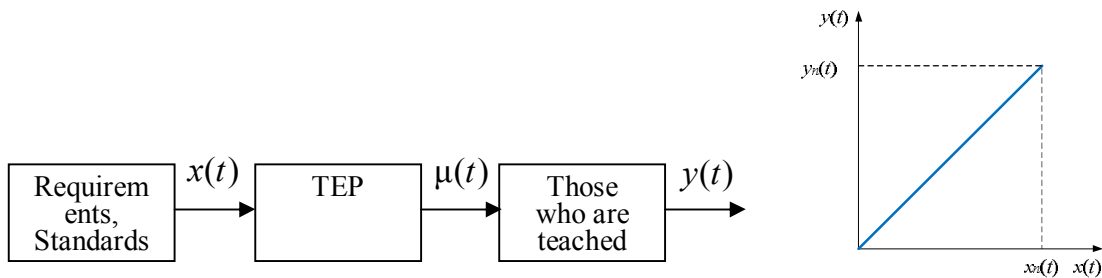where k – coefficient of link strengthening.

Fig.6. Functional scheme of "ideal TEP" and its function graph

In this system control of TEP organization is performed on the final stage, has situational character and is nondurable by realization time.

SAC with control principle by assigned actions is considered to open system. Accordingly, disadvantages specific for SAC with principle by disturbance-stimulated control specific for SAC with control principle by assigned actions.

Closed management presupposes continuous monitoring (individually to each element) according to basic characteristics of study during studying process of student and correction of this activity in case of deviation of set points of characteristics from prior specified reference value. Monitoring precedes planning and decision making, and is aimed at basic parameters of educational institution and has the research status but not empirical collection of material. It is realized by means of complex of methods and strictly developed procedures. Opposed generally accepted understanding of control educational monitoring is represented as form of organization, collecting, storing and processing of information on education quality on IHL which provide continuous monitoring of its status and gives opportunity to forecast development of education quality.

By its internal constitution monitoring binds three important managing components: analysis, assessment and forecasting of processes in achievement of set education quality; complex of techniques for monitoring the processes in education; collection and data processing with the purpose of preparing recommendations for advisor concerning development of researched processes and making corrections.

The simplest example of using closed management methods in studying of ND – means questioning of that who studies and immediate explanation his mistakes in mastering educational material, making additional exercises taking into account questioning results.

In closed management may be distinguished _direct relation_ which means informational massage from controlling device (TEP, teacher, etc.) to controlling subject – to whom is teached with the help of which instructions on necessary educational actions are transferred (studying algorithm) and _feedback_ by means of which information is transferred from that who is teached to managing device (TEP, teacher, etc.) on results of fulfillment of basic operations for management algorithm (regulation) of TEP and its compliance with quality of educational material acquisition (existence of deviation from essential level of knowledge mastered).

Management principle by deviation involves measuring of controlled variable (TEP status) then is compared with essential (reference) value (national standard for education quality) and determined hereat deviation turns into control action; latter, influencing TEP, tries to reduce or dispose this deviation.

Initial value of TEP object $y(t)$ is influenced by disturbance action $L(t)$, put to specific point of the object and causes undesirable change $y(t)$ from relevant value (fig. 7). To disturbance actions

should belong actions directly and negatively influence TEP, for instance – miss of classes due to following reasons: dismissal from classes due to recovery from an accident, being in duty, student's illness, vacation for family reasons, etc. In other words such that cannot be foreseen and as consequence compensated during studying.

Channel through which disturbance action $L(t)$ influences initial value $y(t)$ of TEP we shall designate as disturbance channel (DC) of the object. From the other side, $y(t)$ may be influenced by presenting of corresponding control action $\mu(t)$ on TEP entry obtaining reduce or remove of deviation $y(t)$ from essential value. Action channel for entrance action on initial value we shall designate as control channel (ConCh) of the object. Channel of initial values sre summarized (deducted) by means of summarizer (Σ).

Essential value of TEP $y_n(t)$ is determined by assigned action $x(t)$ which is formed on the basis of "reference" values of training quality for military expert. Minimum permissible values of boundary requirements of national standard for achievement of minimum level of education quality for graduate is achieved in case when $y(t)=x(t)$. Deviations of controlled value $y(t)$ of essential value may be determined by any kind of disturbance actions (on fig. 7 is displayed one disturbance $L(t)$), as well as by change of assigned action $x(t)$. Assigned action may be changed due to specification (correction) of national requirements concerning training of military expert.

To reduce or remove deviations of controlled value $y(t)$ of essential value it is necessary to develop corresponding control action $\mu(t)$ and give it to entrance of managing object (TEP). Controlled action when using management principle by deviation is made due to transformation of measured deviation $\beta(t)$ of controlled value from essential value. Analytical dependence of TEP by management principle by deviation is as follows $\mu(t) = f[\beta(t)]$ i.e. control action is deviation function $\beta(t)$ of controlled value. Model consists of (fig. 7) of following blocks: "Requirements, standards"; "Management", "Teaching and educational process". Block "Teaching and educational process" is object of management.

Using principle of system approach we shall consider each block separately.

Block "Requirements, standards" forms assigned action $x(t)$. It determines boundary (reference) values of training level of military expert which he shall master $y(t)$ for the studying period at IHL. Boundary values are assigned by Executive Board of IHL on the basis of current governing documents. Corresponding model of military-professional activity [5] is developed for each OKR; it represents the list of j- service and fighting and social functions, respective i-military and professional, socio-professional, socio-domestic tasks, which military expert shall resolve in the process of fulfillment of the above functions, list and maturity level of l-skills necessary for resolving these tasks.
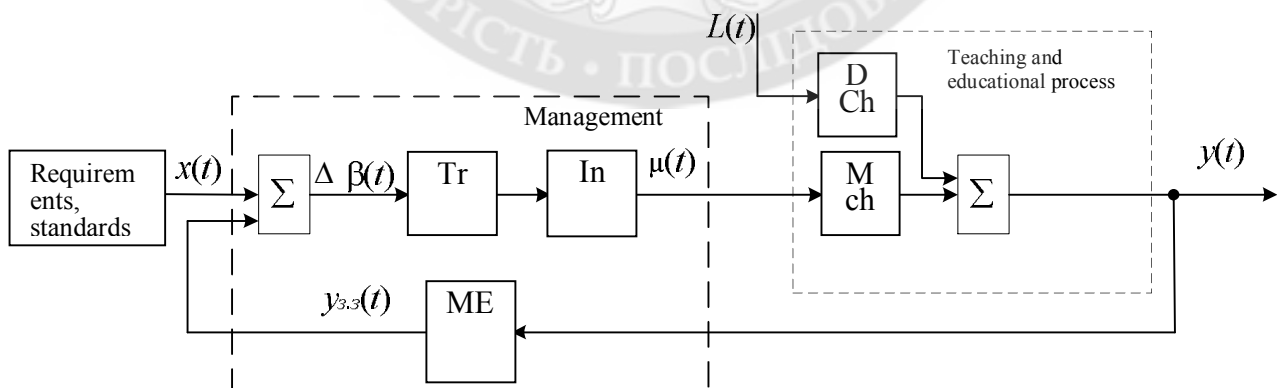

Fig. 7. Model of monitoring system for teaching and educational process in IHL according to management principle by deviation

Models for training of military experts shall include:
– list of modules concerning resolving tasks of militaty activity;

    – list of studying elements providing attachment of specific skills to cadets (listeners);

    – list of courses which involve specific blocks of modules combined by common studying goals;

    – normative forms of state exams (attestation).

Block "Management" involves following elements: transducer (Tr), intensifier (In), measuring element (ME), comparing element (Σ).

Measuring element (ME) connects to output of managing object – teaching and educational process and measures controlled value $y(t)$. Measured value of this volume $y_{3.3}(t)$ is added to comparing element.

Comparing element (Σ) compares measured value of controlled value $y_{3.3}(t)$ with assigned action $x(t)$ and specify deviation between them: $\beta(t) = x(t) - y_{3.3}(t)$. Invert input of comparing element that signal $y_{3.3}(t)$ is subtracted.

In transducer (Tr) under appropriate deviation transdusing, including object characteristics and system elements, is formed managing action on TEP. This action may be value proportional to deviation. In general, managing algorithm is more complicated function which stipulates introduction of both derivative actions and integrals from deviations into controlled action Intensifier (In) provides by means of performing of various influences (control strengthening, appliying disciplinary measures, bonus awards and etc.) with strengthening of transducer output value to volume enough for maintaining necessary working mode of managing object.

Block "Teaching and educational process" includes following elements: management channel (MCh), disturbance channel (DCh), comparing element (Σ).

Management channel (MCh) is channel of ativity of input action on output value (academic staff of IHL which performs teaching).

Disturbance channel (DCh) is a channel through which disturbance action $L(t)$ influences output value of TEP.

Comparing element (Σ) performes measuring of output values of channels Mch and Dch.

Measuring element, comparing element, transducer and intensifier form device which controls block "Teaching and educational process". TEP management is performed after measuring of deviation $\beta(t)$ and by means of its transformation produces controlled action $\mu(t)$. The latter, being attached to TEP, changes controlled value so that the deviation $\beta(t)$ reduces.

Measuring element which measures controlled value on output of TEP and sends to comparing (system input) forms *main system feed reaction*.

In monitoring education quality model (HEI) under the principle of management by deviation the managing action is received due to deviation transformation which may be caused by various factors. Accordingly, deviation in system reduces independently of which of реуыу factors it was determined.

As in analized model with management principle by deviation reduces the deviation which appears when changing element parameters of the system, closed system is less sensible to parameter changes of its elements in comparison with open systems, where deviation determined by change their element parameters is not compensated.

In mentioned system managing action is received due to deviation signal transformation but not of the fact that causes deviations, for instance, disturbance action (i.e. due to transformation of conclusion but not of its cause), for this reason it cannot influence backwards without delay comparing with disturbance action. Consequently, management principle by deviation does not allow full removy of deviation i.e. does not permit to achieve absolute invariant.

Advantages:

1) reduce value deviation which is controlled from essential value notwithstanding factors by which it is determined (external disturbance actions, change of element system parameters, change of assigned action);

2) less sensible to changes of element system parameters comparing with open systems Disadvantages:

1) in simple single-circuit system it is impossible to achieve absolute invariant;

2) problem of stability accurs in system.

TEP management may be performed on one of its stages undr open system and on the orther – under closed. Such management in general is considered to be combined.

Lets built concept model of combined TEP management system (fig. 8).

In combined systems management principle by deviation is realized through feedback and control principle by disturbance by compensation bond. If the most significant error is caused by disturbance action a connection under this disturbance is introduced.

In TEP HEI there accurs situation that directly affects the quality of education which is preferably to be predicted in adnvance. Such situations may include: demographic situation in Ukraine in 2011 when the number of people who entered HEI was too small; transfer of secondary schools for 12-year training program for pupils; holding the World Football Championship "Euro-2012" (educational process of year 2012 was held in a shortened period), participation of personnel in parades and etc. To compensate such situations there was advised to add additional bond $L_1(t)$ under principle of combined management by disturbance (feedback – ZZ).

For other situations leading to deterioration of quality in education (dismissal from classes due to recovery from an accident, being in duty, student's illness, vacation for family reasons, etc. (such that cannot be foreseen and as a result compensate studying process)) we shall introduce disturbande connection $L_2(t)$.

Analytical dependence accepts the form $\mu(t) = f[\beta(t), L(t), \gamma(t), x(t)]$, i.e. controlled action is a deviation function, function of disturbance actions and changes by assigned actions.

Fig. 8 shows concept model of monitoring system of TEP HEI under principle of compined management where Ch_{d1}, Ch_{d2} – disturbance channels of appropriate disturbances; TR – trancsducer (response level: dean's office, academic office, department, division), In – intensifier devices (response level: teacher, commander of training units – regimental commanders, platoon commanders, division commanders).
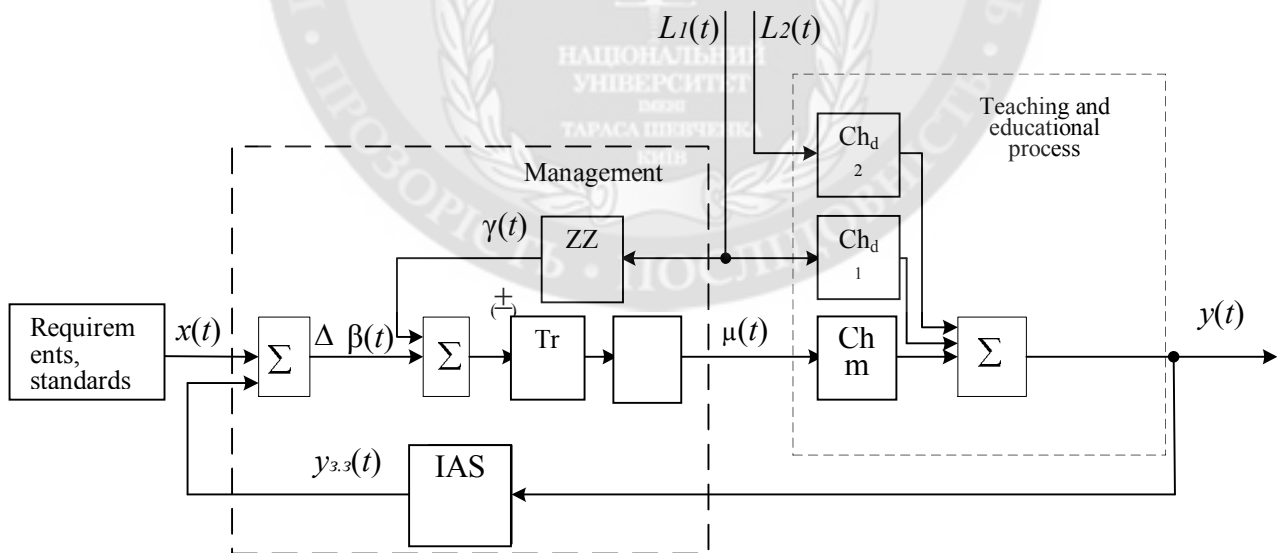

Fig. 8. Concept model of monitoring system of teaching and educational process in HEI under principle of combined management

Let us replace measuring element (ME) for block "IAS", where we put function of educational monitoring of TEP HEI. That is function concerning performing organization of collection, storing, processing and distribution of information on quality of education in HEI which

provides continuous monitoring the status of TEP and also gives the opportunity to forecast tendencies in development of education quality.

Block "IAS" conncets to the output of subject of management – TEP and measures controlled value $y(t)$ with assigned "reference" values. Measured value of this volume $y_{3.3}(t) = x(t) - y(t)$ is sent to comparing element $\sum$. Measuring element which measures controlled value on the output of the object and sends it to the comparing element (system input) makes main system feedback.

In general, there possible compensation relation in system both by disturbance and assigned action when for the formation of of managing action deviation, disturbance and assigned actions are used. Compensation relation by general disturbance (assigned action) removes error component which is caused by this disturbance (change of assigned action) and feedback reduces errors caused by secondary disturbance actions which have not any compensation relations. If compensation relations partially remove errors deermined by main disturbance (assigned actions) residual errors are reduced by feedback.

To form managing action in combined systems there used both direct information on main disturbance actions (changes of assigned action) and deviation of controlled value from assential value which is determined by all disturbances (change of assigned action) Due to this:

1) in combined system due to compensation relations a fuul compensation of errors may be achieved which are determined by main disturbance and assigned actions (it is possible to achieve invariant);

2) along with opportunity of full error compensation determined by main actions, in combined system error reduce under feedback and are determined by secondary disturbances which do not have any compensation relations and also underbalanced errors from general disturbance and assigned action;

3) violating conditions of disturbance compensation the occurred error is reduced by closed system i.e. combined system is less sensible to changes of open channels parameters than in open system;

4) due to open compensation channels in combined system the problem of stability ocuurs less frequently than closed system has.

Conclusions on this research and perspectives for further researches in this regard. Realization of such model allows: significantely reduce task dimension in perfomancing of management influence parameters on teaching and educational process; more deliberately approach to resolving of questions in quality control of навчально-виховного процесу; to response immediately and maximum effective on situation formed; forecast undesirable situations.

Further research trend presupposes involves development of methods for monitoring the quality of education of HEI.

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**КОНЦЕПТУАЛЬНА МОДЕЛЬ МОНІТОРИНГУ ЯКОСТІ ОСВІТИ ВНЗ
ЗА ПРИНЦИПОМ КОМБІНОВАНОГО УПРАВЛІННЯ**

У статті розроблені моделі моніторингу якості освіти ВНЗ, які побудовані відповідно до державних вимог та стандартів щодо якості освіти та можуть існувати в навчально-виховному процесі ВНЗ. Розроблені моделі моніторингу якості освіти ВНЗ нададуть допомогу керівнику ВНЗ в своєчасному коригуванні навчально-виховного процесу, що в свою чергу дозволить досягнути реалізацію якісної підготовки військових фахівців і як наслідок задовольнити потреби держави, щодо підвищення ефективності підготовки висококваліфікованих фахівців на рівні не нижче заданого.

Ключові слова: система управління якістю вищої освіти, процес навчання, моніторинг.

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КОНЦЕПТУАЛЬНАЯ МОДЕЛЬ МОНИТОРИНГА КАЧЕСТВА ОБРАЗОВАНИЯ ВУЗА ПО ПРИНЦИПУ КОМБИНИРОВАННОГО УПРАВЛЕНИЯ

В статье разработаны модели мониторинга качества образования ВУЗа, которые простроены в соответствии с требованиями государства и стандартов, применимых к качеству образования, которые могут существовать в учебно-воспитательном процессе ВУЗа/ Разработанные модели мониторинга качества образования ВУЗа позволят оказать помощь руководителю ВУЗа в проведении своевременной корректировки учебно-воспитательного процесса, что в свою очередь позволит достичь реализации качественной подготовки военных специалистов и как следствие удовлетворить потребность государства в повышении эффективности подготовки высококвалифицированных специалистов на уровне не ниже заданного.

Ключевые слова: система управления качеством высшего образования, процесс обучения, мониторинг.