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COMPLEX OF MODELS FOR SUPPORTING QUALITY MANAGEMENT DECISIONS OF THE EDUCATIONAL PROCESS OF HIGHER EDUCATION INSTITUTIONS

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Abstract. *A set of system models is offered to determine the structure of information support of decision support systems for quality management of educational process at higher education institution (HEI). Information models are set up by means of component and morphological structures that describe the essence of the student questioning process and the relationship between the entities. Here is an example of a computer model implementation based on input and survey materials conducted in Sumy*

National Agrarian University. The main activity of a HEI is to provide consumer-oriented educational services. Consumers of activities of higher education are referred to as external (employers, the state and society in general), and internal (students, teachers, management of HEI). Ongoing monitoring is an effective means of ensuring high quality education. It can be interpreted as a systematic collection, refinement, evaluation, and distribution. Information on the activities of the educational system at all levels for the unprecedented monitoring of its status and the progression of the development. Educational monitoring is a means of supervising the transfer of social experience to the new generation, the correspondence of the actual results of the activity of the pedagogical system and its exact purpose. We believe that determining the degree of satisfaction of internal consumers is one of the main tasks of quality management. Such an assessment is necessary to adjust actions in the educational processes of higher education institutions and to make changes to the organization's management, educational programs and learning technologies, as well as accreditation of specialties. On the basis of available (unformalized or formalized) information about the actual state of the system, managers at different levels make decisions on the quality management of the educational process in HEI. The problem can be solved by developing information support for decision support systems (DSS) on the quality management of the educational process of HEI (for managers, heads of departments, employees of educational and methodological departments and other persons responsible for taking into account the "human factor").

Keywords: *educational process; the quality of education; management; monitoring; component analysis; morphological analysis; information system.*

1. INTRODUCTION.

The main activity of a higher education institution (HEI) is to provide consumer-oriented educational services. Consumers of activities of higher education are referred to as external (employers, the state and society in general), and internal (students, teachers, management of HEI). Ongoing monitoring is an effective means of ensuring high quality education.

Statement of the problem. There are various types of requirements for educational and teaching staff in educational institutions. As a rule, they are used in determining the possibility of occupying a particular position by a particular teacher, while undergoing a competitive selection procedure for the replacement of vacant positions. There is a great deal of interest in learning about the HEI experience that has been developed and used by some models of teacher evaluation. In the national science, questions regarding the evaluation of scientific and pedagogical activity of teachers of HEI are considered Vasilieva Y.Y. [2], Zakharevich V. G. [3], Tretyakova N. V. [1] and other. This is a superfluous formalization of methods, based on the

assumption that the overall assessment of the teacher's activity is determined only by the quantitative characteristics of its components; lack of a clear understanding of the direction of interpretation of the results obtained during the evaluation of the results and the possibilities of their practical use; the complexity of developing assessment methods, etc.

Analysis of recent studies and publications. Tretyakova N. V. notes that the criteria for evaluating the quality of the lecturer's performance are not determined. For this reason, educational establishments have different types of requirements for the academic staff. As a rule, they are applied to determine the possibility for a particular lecturer to occupy a position by undergoing a procedure of the competitive selection for vacant positions [1].

Vasilieva Y.Y. believes that science and practice are in urgent need of general methods of evaluating the quality of the lecturer's performance, which would reveal the general task, the logic of the evaluation stages and the necessary conditions for its implementation. [2]

Zakharevich V. G. defines that the development and introduction of the lecturer's evaluation system at each university should ultimately contribute to improving the quality of educational services provided and improving management of education quality methods. [3]

It should be noted that not all of them can be considered perfect. Most of the techniques have typical disadvantages that do not allow to transform the process of evaluation of the teacher's activity into a tool for developing his professionalism.

The article's purpose. The purpose of our study is to develop a methodology of system analysis that can be the basis for information support of the DSS on quality management of the educational process of HEI, namely: to substantiate the approach to the description of the quality management systems of the educational process of HEI; describe the structure and composition of a set of models of information support of DSS on issues of quality management of the educational process of HEI.

2.THE THEORETICAL BACKGROUNDS

The purpose of the study is to develop the approaches to the quality management of the educational process using the evaluation of a lecturer's performance as an element of quality assessment in higher education. One of the methods for evaluating the lecturers' performance can be the questionnaire of students about the courses at certain intervals or at the end of the semester. During the session, students were questioned about their views on the quality of courses at the university faculties. 75 courses have been analyzed (Fig.1).

In total, the research sample comprised 152 respondents, the selection of whom was intentional. We applied a critical approach to the composition of the interviewed groups during the survey. When evaluating the quality of lecturers' performances, it is best to start interviewing the students in their second year. First-year students, especially in the first semester, are not able to compare the performances of different lecturers. Thus, the objectivity and reliability of the measurements can be affected. In such a situation, it is worth conducting a questionnaire for the first-year students before and after the first session. The session, in this case, may be the reason to a shift in the evaluation of the lecturer's performance. The choice of factors was inspired by long-term research conducted in 2017-2019, which focused on the quality of teaching disciplines at the university. Factors were selected considering the primary objective of our research, in ensuring the quality of the educational process. Collection of data was performed using a questionnaire which was drafted in the Microsoft Office 2016.

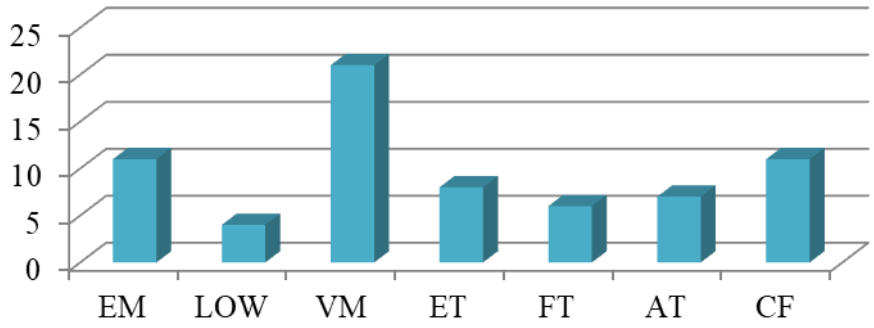


Fig. 1. Descriptive Statistics: number of courses according to faculties, 2018 (source: own calculation) *

*EM - Economics and Management Faculty, LOW- Law Faculty, VM- Veterinary Medicine Faculty, ET- Engineering and Technology Faculty, FT- Food Technologies Faculty, AT- Agro-technologies and Land Use Faculty, Construction Faculty.

The results of the study indicate an important issue of the educational process: a lecturer's performance is formed via students' evaluation. Using questionnaire of students as a method for evaluating the performance of the members of higher educational institutions provides an opportunity update managerial forms and methods of the internal system of quality assessment of higher education and promotes the formation of specialists capable of implementing changes in education through the improvement of intellectual and cognitive, motivation and value, and practical sphere of a personality; improvement of professional competence and managerial culture, which includes: familiarization with methodological approaches to the quality management of education and the prospects of the education system update.

In turn, a university member must develop qualitatively new features of social consciousness and practice, a new type of culture, thinking and market economy, understanding of quality and quality management; knowledge of an essence of the concept of comprehensive quality management, administrative and operational aspects of quality management. Lecturers should move from the theory-oriented to practical training in the agrarian sector. Therefore, a modern lecturer faces the following issues:

- students' involvement in the educational process;
- use of the teamwork and work in groups in the educational process;
- implementation of E-learning technologies, which requires a redesign (normative, methodological, psychological) of the education system;
- students' ability to use phones and other gadgets to work in classes;
- a student's involvement in scientific and creative work starting in his first year of studies, which would result in his portfolio.

Consider the results of the survey of students of the Sumy National Agrarian University from different specialties. Thus, to the question "How many % of the course have you attended during the semester?", the answers were as follows: 8% of the interviewed students attended up to 25% of the course; 9,5% of students - 25-50% of the course; 20% of the interviewed students - 50-75% of the course; 62.5% of the interviewed students - 75-100% of the course.

3. RESEARCH METHODS

Development of information support for decision support systems for quality management of the educational process can be solved by using the methodology of system ergonomic analysis developed in the functional-structural theory of ergotechnical systems.

The concept of building formal models of the human-machine system includes many special component and morphological structures.

Information about system components (component structures) and the relationships between objects (morphological structures) is presented as a set of knowledge bases and databases. An interconnected set of these structures is called a generalized information model of the human-machine system.

This model is suitable for all types of systems: production, information, operational, as well as information processing and management systems.

The specificity of the class of information systems for quality management of the provision of educational services requires the construction of new models focused on this subject area (on the basis of known theoretical and methodological results (Adamenko A. N., Asherov A. T., Berdnikov I. L., Gubinsky A.I. & Evgrafov V.G.) [4].

4. THE RESULTS AND DISCUSSION.

The general approach to determining the information needs of PTD (persons who take decisions) for quality management of the educational process is shown in Fig. 2.

All the necessary components of the PTD information model for quality management of the educational process can be given by the formula (1).

Description of symbols and interrelations of models are presented in Fig. 2.

$$IMOPR=<MMS,MPA,Ozs,SOA> \quad (1)$$

The analysis of the list of information about the processes of questioning of students, necessary for decision-making on quality management of educational process, allows us to conclude that this information can be set using two classes of structures: component and morphological (Adamenko A. N., Asherov A. T., Berdnikov I. L., Gubinsky A.I. & Evgrafov V.G. [4], Lavrov E.A., Pasko N.B., Barchenko N., Borozenec I. [5]).

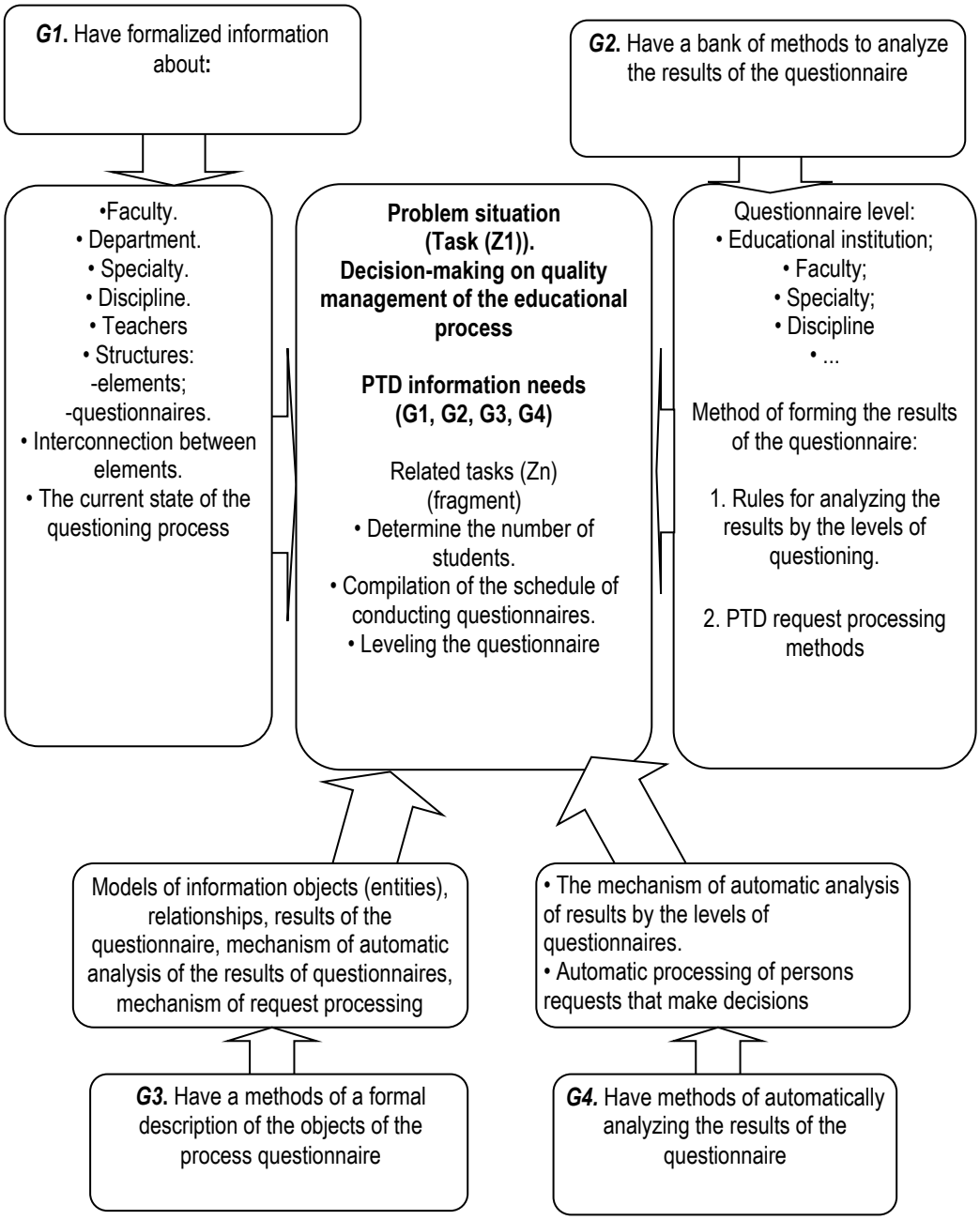


Fig. 2. Approach to the definition of information needs of PTD (persons who take decisions) for quality management of educational process

Component structures are introduced to identify the essentials needed to describe the processes of questioning, morphological structures - to specify the relationships of different nature between the entities isolated in the component structures. Then the complex of system models MMS of the information model for the PTD will be represented by the scheme shown in Fig. 3. and the structural formula (2):

MMS=< KF, KS, KKaf, KD, KT, KAn, MPAn,MProekt> (2)

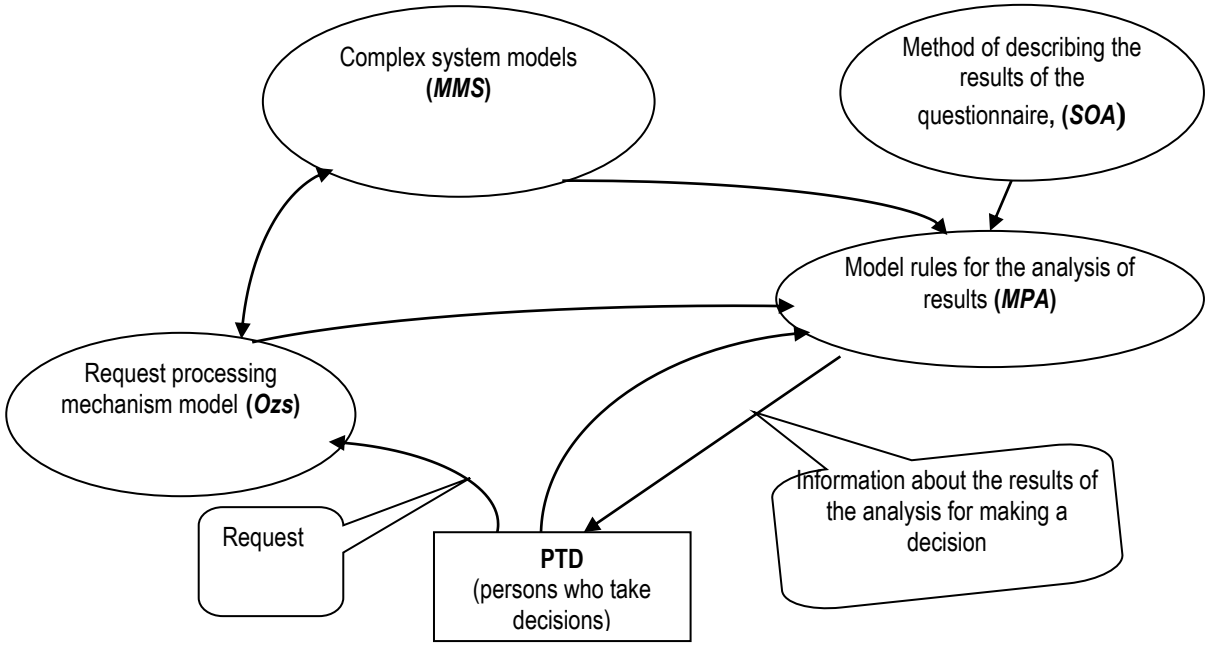


Fig. 3. Models required for decision-making on quality management of the educational process

Description of accepted symbols is shown in Fig. 4

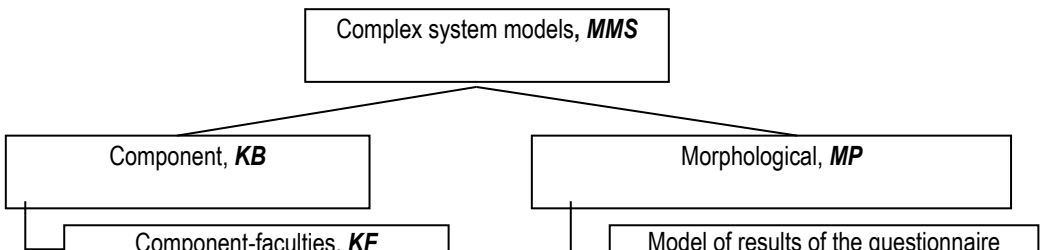


Fig. 4. Structure of the complex of system models for quality management of the educational process

Component-faculties KF. The model represents information about the organizational structure of an educational institution:

$$KF = < \{KodF_l, NameF_l\} \Big| l = 1,2,...L_0 >, \quad (3)$$

where $KodF_l$ –code of the l-th faculty of the educational institution;

$NameF_l$ – name of the faculty with the designation $KodF_l$;

L_0 – number of faculties of the educational institution.

Component-specialty, KS. The model represents information about the specialty available in the educational institution and its affiliation with the faculties:

$$KS = < \{\{ShyfrS_{nl}, NameS_{nl}, KodF_l\} \Big| n = 1,2,...N_{0l}\} \Big| l = 1,2,...L_0 >, \quad (4)$$

where $Shyfr_{nl}$ – the code of the n-th specialty at the faculty with the designation $KodF_l$

$NameS_{nl}$–the name of the n-th specialty at the faculty with the designation KodFl;

N_{0l} –number of specialties at the faculty with the designation $KodF_l$.

Component-department, KKaf. The model represents the information available about the department at the educational institution and its affiliation with the faculties:

$$KKaf =< \{\{KodKaf_{kl}, NameKaf_{kl}, KodF_l\} | k = 1,2,...K_{0l}\} | l = 1,2,...L_0 >, \quad (5)$$

where $KodKaf_{kl}$ – the code of the k-th department at the faculty with the designation $KodF_l$;

$NameS_{nl}$– the name of the k-th department at the faculty with the designation KodFl;

K_{0l} –number of department s at the faculty with the designation $KodF_l$.

Component-teachers, KT. The model represents the information available about the teachers at the faculty

$$KT =< \{\{\{KodT_{ikl}, FIOT_{ikl}, PosT_{ikl}, KodKaf_{kl}, KodF_l\} | i = 1,2,..., I_{0kl}\} | k = 1,2,...K_{0l}\} | l = 1,2,...L_0 >,$$

(6)

where $KodT_{ikl}$ – code of the i-th teacher of the k-th department of the l-th faculty;

$FIOT_{ikl}$ – surname, name, patronymic of the i-th teacher of the k-th department of l-th faculty;

$PosT_{ikl}$ – position of the i-th lecturer of the k-th department of l-th faculty;

I_{0kl} – the number of teachers of the k-th department of the l-th faculty.

Component-discipline, KD. This model provides a set of disciplines that are taught in all courses of all specialties in all faculties of the educational institution.

$$KT =< \{\{\{\{\{KodD_{nzl}, NameD_{nzl}, ShyfrS_{nl}, z, KodT_{ikl}, KodKaf_{kl}, KodF_l\} \quad (7)$$
$$| z \in \{1,2,...5\}\} | n = 1,2,..., N_{0l}\} | i \in \{1,2,..., I_{0kl}\}\} | k = 1,2,...K_{0l}\} | l = 1,2,...L_0 >,$$

where $KodD_{nzl}$ – code of the discipline, which is taught at the z-th course of the specialty $ShyfrS_{nl}$ of the Faculty $KodF_l$ teacher $KodT_{ikl}$ department $KodKaf_{kl}$;

$NameD_{nzl}$ – the name of the discipline, which is taught at the z-th course of the specialty $Shyfr_{nl}$ of the Faculty $KodF_l$ teacher $KodT_{ikl}$ department $KodKaf_{kl}$;

z – a course on which discipline is taught.

Component - questionnaire, KAn. The model describes a set of questionnaires that can be used to conduct questionnaires at all faculties of an educational institution. This takes into account all specialties, all courses and all academic disciplines.

$$KAn =< \{KodAn_h, TextAn_h, KodF, ShyfrS, Kurs, KodD, KodT, \{Quest_{eh}\{Answ_{meh}\}|m = 1,2,..., M_{0eh}\}|e = 1,2,...E_{0h}\}|h = 1,2,...H_0 >, \quad (8)$$

where $KodAn_h$ – the code of the h- questionnaire;

$TextAn_h$ – title (summary) of the h- questionnaire;

KodF – code of the faculty;

ShyfrS – code of the specialty;

Kurs – course of study;

KodD – code of the discipline;

KodT – code of the teacher;

Questeh – question of the h- questionnaires with the number e;

$Answ_{meh}$ –m-th answer is the e-th question of the h-th questionnaire;

M_{0eh} –number of options for answers to the e-questions of the h-questionnaire;

E_{oh} –number of questions of the h- questionnaire; H0–number of different questionnaires used in the questionnaire.

Morphological model of the results of the questioning process, MPAn. The model represents the set of student responses received as a result of the questionnaire.

$$MPAn =< \{KodAn, DateAn, KodF, ShyfrS, Kurs, KodD, KodT, \{Quest_i, Answ_{ij}\}|j \in \{1,2,..., J_{0i}\},|i = 1,2,...I_{KodAn}\} >, \quad (9)$$

where Questi – i-th questions of the current questionnaire;

$Answ_{ij}$ – j-th answer of the i-th question of the current questionnaire;

I_{KodAn} – the number of questions in the current questionnaire;

J_{0i} – the number of answers to the i-th questions of the current questionnaire.

Design model, MProekt. The model represents the result of solving the data analysis of the conducted questionnaire and contains:

1) the level of questioning (educational institution, faculty, department, etc.);

2) the name of the questionnaire (summary);

3) the list of questions of the questionnaire;

4) the names of the answers regarding the quality of teaching disciplines;

5) the value of answers to each question form, grouped by the levels of the questionnaire.

$$M\,\mathrm{Pr}oekt =< \{TextAn,[VNZ],\{[NameF_l],[NameS_{nl}],[NameKaf_{kl}],[FIOT_{ikl}],[NameD_{zikl}],$$
$$\{Quest_e,\{[AnswF_{el}],[AnswS_{enl}],[AnswKaf_{ekl}],[AnswT_{eikl}],[Answ_{ezikl}]\}\big|e=1,2,...,E_0\}\} \quad (10)$$
$$\big|z\in\{1,2,...5\}\big|n\in\{1,2,...,N_{0l}\}\big|i\in\{1,2,...,I_{0kl}\}\big|k\in\{1,2,...K_{0l}\}\big|l=1,2,...L_0>$$

where TextAn– name (content of the questionnaire); VNZ– name of the educational institution; $Quest_e$– e-questions of the questionnaire; $AnswF_{el}$– the value of the answering to the e- questions at the level of the l-th faculty; $AnswS_{enl}$– the value of answering e- questions at n-th specialty of l-th faculty; $AnswK_{afekl}$– the value of answering e-questions at the level of the k-th department of the l-th faculty; $AnswT_{eikl}$– the value of answering e-questions at the level of the i-th teacher of the k-th department of the l-th faculty; E_0– the number of questions in the questionnaire.

The «[]» symbols in the model (10) mean that the brackets contain optional elements.

Thus, the content of the task of analyzing the results of the questionnaire can be presented as a task of information formation to support decision-making on quality management of the educational process (Fig. 5).

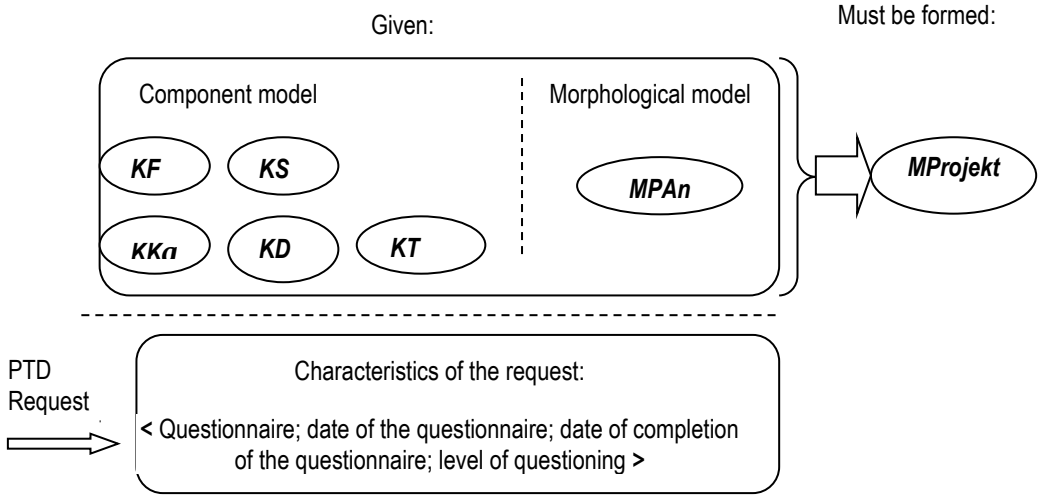


Fig. 5. Illustration to a meaningful statement of the problem of information formation to support decision-making on quality management of the educational process

Model of the query processing mechanism, Ozs. To ensure the effective use of information, we introduce the model of the mechanism of request processing - Ozs. The model is designed to display a set of possible PTD requests that arise during the

analysis of the results of the questionnaire, and the answering to them. As a result of PTD request, a sample of questionnaire data is generated for analysis. In the request, for example, the PTD indicates the questionnaire period, the level of questioning. In addition, the model provides in a formalized way the methods of forming responses to the operator-manager.

The structural formula has the form:

$$Ozs = <\{Zi;\ INTi\} |\ i=1,2,\ldots,Kz>, \quad (11)$$

where Zi – i-type request; INTi – a set of interface elements with program modules for the implementation of i-th type requests, Kz - the number of requests.

The structure of any i-th request in general can be represented as follows:

$$Z_i = \{Ztip_i; \Pr_i; Ztext_i; \{x_{ih}\} | h = 1,2,\ldots,k_i; \{Otv_{il}\} | l = 1,2,\ldots,m_i\}, \quad (12)$$

where $Ztyp_i$ – i-type request (code); $Ztext_i$ – content (text) of the request; Pr_i – the rule of the request in a logical representation (predicates, conjugated operations, disjunction, and negation); x_{ih} – attribute (the answer to the questionnaire), the value of which must be displayed; k_i – the number of attributes displayed by the i-th type request; Otv_{il} – 1st structural element of the answer to the request of the i-th type; mi - the number of structural elements of the answer.

The set of interface elements with program modules for implementing the requests of the i-th type INTi, specified in formula (11), depends on the software environment in which the decision support system is implemented by PTD.

For example, it might be MS Excel, MS Access, MS SQL Server, etc. To implement the i-th type request, the set of elements of the INTi interface has the form:

$$INT_i = <\{\{Wind_{is}, SetWind_{is}, \{TipE_{isn}, NameE_{isn}, SetE_{isn}\} | n = 1,2,\ldots,k_{is}\} | s = 1,2,\ldots,i \quad (13)$$

where $Wind_{is}$ - s-th window for i-type request; $SetWind_{is}$ - s-window assignment for i-type request; $TipE_{isn}$, $NameE_{isn}$, $NameE_{isn}$ - the type of the nth element of the s-th window, the name of the n-th element of the s-th window, the appointment of the nth element of the s-th window for the request of the i-th type,

respectively; k_{is} - the number of elements of the s-th window for the i-th type request; mi - number of windows to fulfill the i-type request.

The models given by formulas (12) and (13) are common to all types of request. On their basis, models are created for specific request.

Models of rules of analysis of results, MPA. The analysis process consists in the fact that at each step of the analysis, from the whole set of answers to the questionnaires, a sample of answers on the query PTD is formed (formula (11) is a model of the query processing mechanism, Ozs). Selection criteria may specify the specific meaning of the faculty name, specialty, course, discipline, type of questionnaire, teacher's name, etc. The set of answers received (student-filled questionnaires) are subject to the rules of analysis of the results in order to obtain the results of each question or question.

Therefore, the MPA model can be represented as the set of rules of frequency formation (%) of answers to all possible questionnaires for all variants of answers at the specified level of questioning. These rules are defined by formulas whose operands are the notation (codes) of questionnaires, questions, answers, combined by logical and arithmetic operations.

$$MPA = < \{KodAn_h, \{Quest_{eh}, \{Answ_{meh}, a_{meh}\} | m = 1,2,...M_{0eh} | e = 1,2,...E_{0h}\} | h = 1,2,...H_0 >, \quad (14)$$

where $KodAn_h$ – the code of the h-th questionnaire; $Quest_{eh}$ – question h-th questionnaire with the number e; $Answ_{meh}$ – m-th answer of the e-th question of the h-th questionnaire; M0eh – the number of options for answering the e-question of the h-th questionnaire; a_{meh} –rule of formation of frequency (in%) of the m-th variant of the answer to questions $Quest_{eh}$ within the conducted questionnaire (sampling of filled questionnaires); E_{oh} – number of questions of the h-type questionnaire; H_0 – the number of different types of questionnaires used in the questioning process.

In general, a_{meh} can be represented by a formula:

$$a_{meh} = \frac{(\sum_{i=1}^{NAn} a_{meh}^i)}{NAn} \times 100, \quad (15)$$

where NAn – the number of sample questionnaires taken for analysis; a_{imeh} – the presence or absence of the answer to option m to the question $Quest_{eh}$ the questionnaire with number i is determined by the formula:

$$a^{i}_{meh} = \begin{cases} 1, & if\ (Answ_{meh} = AnswAn^{i}_{eh}) \\ 0, & \text{in all other cases} \end{cases} \qquad (16)$$

where $AnswAni_{eh}$ answer to the question $Quest_{eh}$, specified in the sample questionnaire with number i.

Example of realization. A series of computer experiments conducted on the input and survey materials held at SNAU to investigate the effectiveness of the proposed models. The questionnaire was attended by students of the first year of specialty 073 "Management" of the Faculty of Economics and Management. MS Excel 2016 spreadsheet processor is used for automation.

The automation environment is chosen based on the fact that spreadsheets are an ideal tool to perform calculations of any complexity without the expense of programming, ensuring the storage of large arrays of information such as relational databases.

All the data needed to automate the process of questioning and analyzing the results are submitted in the form of tables (database) MS Excel. The list of table attributes and their arrangement correspond to structural formulas (3) - (14).

Figure 6 and Figure 7 show the fragments of MS Excel 2016 worksheets with a list of questions and answers of the student’s questionnaire, respectively.

The frequency (%) of the answers to all questions in all possible variants within the limits of the conducted questionnaire was determined by formulas (15) and (16). MS Excel's built-in functions and array processing formulas were used. The result of the analysis is shown at Fig. 6-8.

	A	B	C	D
1		Questionnaire 01		
2	Question code	The text of the question	Possible answers	
3	1	How many % of the course have you attended during the semester?	1 - less than 25 %; 2- 25-50%; 3 - 50-75%; 4 - 75-100%.	
4	2	Assess the quality of the learning support materials used during the course (lectures, tests, workbooks for practical / laboratory classes)	1 – satisfied; 2 – partially satisfied; 3 – dissatisfied.	
5	3	Assess the relevance of the lecture material	1- not relevant; 2 - partly relevant; 3 - relevant.	
6	4	Does the lecturer use modern interactive teaching aids for better learning (computer, multimedia projector, etc.)?	YES - uses; NO – does not use.	
7	5	Does the teacher use applied methods for mastering the theoretical material (team tasks, business games, case methods, etc.)?	YES- uses; NO – does not use.	
8	6	Assess the level of satisfaction with the quality of the Moodle platform?	1 – satisfied; 2 – partially satisfied; 3 – dissatisfied.	
9	7	Assess the level of accessibility and comprehensibility of teaching materials	1 – everything understand, satisfied; 2 - partially understand, partially satisfied; 3 - not understand, dissatisfied.	
10	8	Assess the level of a teacher's culture in communicating with students	1 - high; 2 - medium; 3 - low.	
11	9	Do you understand the scale of assessment of knowledge (scoring) by the teacher for each assignment?	YES – understand; NO – not understand.	
12	10	Have you mastered the material for the self-study within the course?	YES – succeeded; NO – failed.	
13	11	Try to assess just and independently your own level of knowledge acquisition within the course	1 – satisfied; 2 – partially satisfied; 3 – dissatisfied.	
14	12	Do you consider the course important in terms of your specialty?	YES- important; NO - not important.	

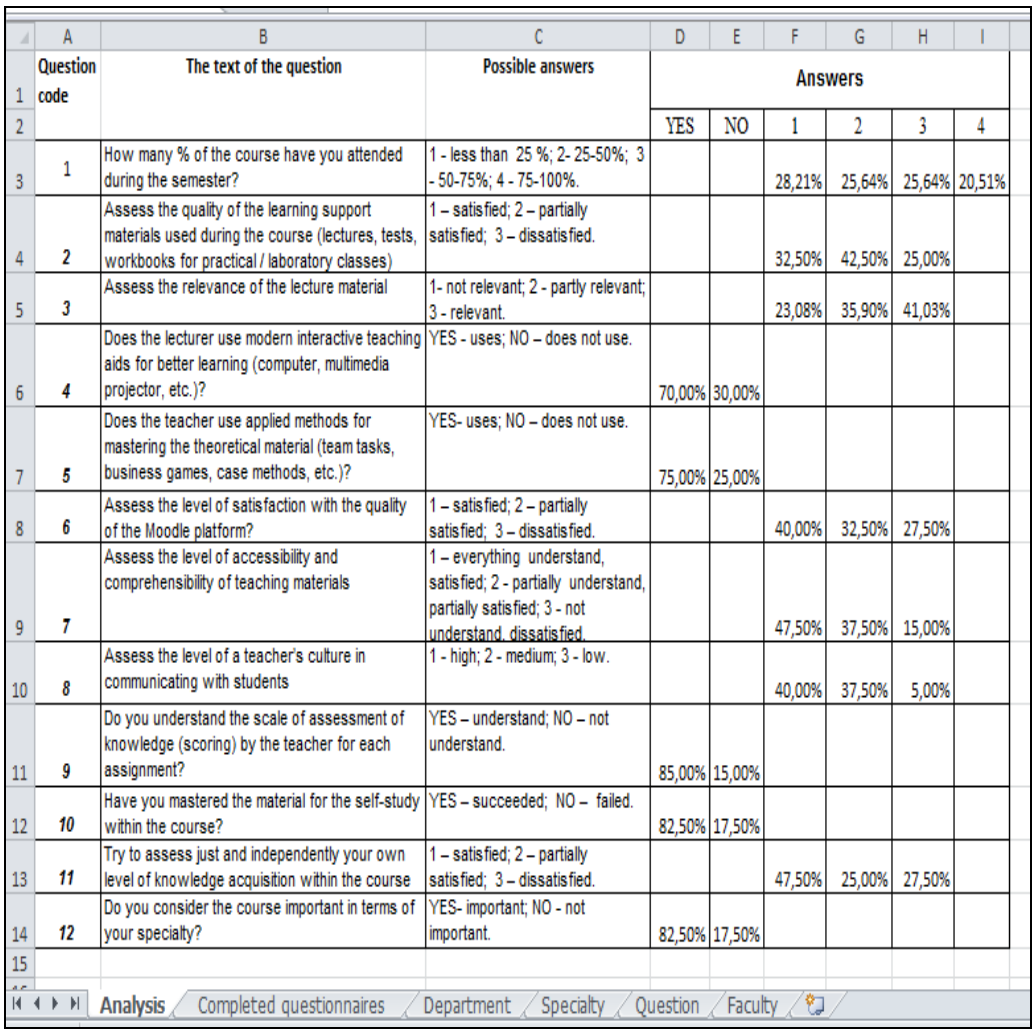
Analysis | Completed questionnaires | Department | Specialty | Question

Fig. 6. List of questions of the questionnaire

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Questionnaires	Qc1	Qc2	Qc3	Qc4	Qc5	Qc6	Qc7	Qc8	Qc9	Qc10	Qc11	Qc12	Faculty code	Specialty code	Code of the department
2	1	1	2	3	Yes	Yes	1	1	1	Yes	Yes	1	Yes	101	73	15
3	2	1	2	3	Yes	Yes	2	3	2	Yes	Yes	1	Yes	101	73	15
4	3	2	2	2	No	No	2	2	2	No	Yes	1	Yes	101	73	15
5	4		3	2	No	No	3	2	2	Yes	Yes	2	Yes	101	73	15
6	5	1	1	1	Yes	Yes	1	1		Yes	No	3	No	101	73	15
7	6	4	1	2	Yes	Yes	3	2	1	Yes	Yes	2	Yes	101	73	15
8	7	1	2	1	Yes	Yes	1	1	1	Yes	Yes	3	Yes	101	73	15
9	8	2	2	2	No	Yes	2	2		No	Yes	2	Yes	101	73	15
10	9	1	1	3	Yes	Yes	1	1		No	Yes	1	Yes	101	73	15
11	10	3	3	1	No	No	3	1	3	Yes	No	3	No	101	73	15
12	11	2	2	2	Yes	Yes	2	2	1	Yes	No	3	No	101	73	15
13	12	1	1	1	Yes	Yes	1	1	2	Yes	Yes	2	Yes	101	73	15
14	13	4	2	2	No	No	2	2	2	Yes	Yes	3	Yes	101	73	15
15	14	4	2	2	Yes	Yes	2	2	2	Yes	Yes	1	Yes	101	73	15
16	15	3	3	3	Yes	Yes	1	1	2	Yes	Yes	2	Yes	101	73	15
17	16	2	2	2	Yes	Yes	2	2	1	Yes	Yes	3	Yes	101	73	15
18	17	1	1	1	Yes	No	1	1	1	Yes	Yes	3	Yes	101	73	15
19	18	3	3	3	No	Yes	3	3	1	Yes	Yes	2	Yes	101	73	15
20	19	4	1	3	Yes	Yes	1	1	1	Yes	Yes	3	No	101	73	15
21	20	4	1	1	No	No	1	1		No	Yes	2	Yes	101	73	15
22	21	1	1	3	Yes	Yes	1	3		Yes	Yes	3	Yes	101	73	15

Analysis | Completed questionnaires | Department | Specialty | Question | Faculty

Fig. 7. Questionnaire answers (fragments)



	A	B	C	D	E	F	G	H	I
1	Question code	The text of the question	Possible answers	Answers					
2				YES	NO	1	2	3	4
3	1	How many % of the course have you attended during the semester?	1 - less than 25 %; 2- 25-50%; 3 - 50-75%; 4 - 75-100%.			28,21%	25,64%	25,64%	20,51%
4	2	Assess the quality of the learning support materials used during the course (lectures, tests, workbooks for practical / laboratory classes)	1 – satisfied; 2 – partially satisfied; 3 – dissatisfied.			32,50%	42,50%	25,00%	
5	3	Assess the relevance of the lecture material	1- not relevant; 2 - partly relevant; 3 - relevant.			23,08%	35,90%	41,03%	
6	4	Does the lecturer use modern interactive teaching aids for better learning (computer, multimedia projector, etc.)?	YES - uses; NO – does not use.	70,00%	30,00%				
7	5	Does the teacher use applied methods for mastering the theoretical material (team tasks, business games, case methods, etc.)?	YES- uses; NO – does not use.	75,00%	25,00%				
8	6	Assess the level of satisfaction with the quality of the Moodle platform?	1 – satisfied; 2 – partially satisfied; 3 – dissatisfied.			40,00%	32,50%	27,50%	
9	7	Assess the level of accessibility and comprehensibility of teaching materials	1 – everything understand, satisfied; 2 - partially understand, partially satisfied; 3 - not understand, dissatisfied.			47,50%	37,50%	15,00%	
10	8	Assess the level of a teacher's culture in communicating with students	1 - high; 2 - medium; 3 - low.			40,00%	37,50%	5,00%	
11	9	Do you understand the scale of assessment of knowledge (scoring) by the teacher for each assignment?	YES – understand; NO – not understand.	85,00%	15,00%				
12	10	Have you mastered the material for the self-study within the course?	YES – succeeded; NO – failed.	82,50%	17,50%				
13	11	Try to assess just and independently your own level of knowledge acquisition within the course	1 – satisfied; 2 – partially satisfied; 3 – dissatisfied.			47,50%	25,00%	27,50%	
14	12	Do you consider the course important in terms of your specialty?	YES- important; NO - not important.	82,50%	17,50%				
15									

Fig. 8. The results of the analysis of the conducted questionnaire

5. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

The offered complex of information models allows to define the structure of information support of the quality management system of educational and educational process of HEI. A set of system models is offered to determine the structure of information support of decision support systems for quality management of educational process at higher education institution(HEI).

Information models are set up by means of component and morphological structures that describe the essence of the student questioning process and the relationship between the entities. Here is an example of a computer model implementation based on input and survey materials conducted in Sumy National Agrarian University.

Such an assessment is necessary to adjust actions in the educational processes of higher education institutions and to make changes to the organization's management, educational programs and learning technologies, as well as accreditation of specialties. The quality of education or the output of a specialist required by employers depends on the quality of work of the teacher. Accordingly, the issues of quality control and assessment of the teacher's work are one of the difficult and important tasks in managing the quality of education. It should be noted that the criteria for assessing the quality of the teacher's work is not normatively defined.

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КОМЛЕКС МОДЕЛЕЙ ДЛЯ ПІДТРИМКИ ПРИЙНЯТТЯ РІШЕНЬ З УПРАВЛІННЯ ЯКІСТЮ НАВЧАЛЬНО-ВИХОВНОГО ПРОЦЕСУ ЗАКЛАДІВ ВИЩОЇ ОСВІТИ

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Анотація. *Основною діяльністю закладу вищої освіти (ЗВО) є надання освітніх послуг, яка має орієнтуватися на споживача. До споживачів діяльності вищого навчального закладу відносять як зовнішніх (роботодавці, держава і суспільство в цілому), так і внутрішніх (студенти, викладачі, керівництво ЗВО). Дієвим засобом забезпечення високої якості освіти є її постійний моніторинг. Освітній моніторинг є засобом нагляду за передачею соціального досвіду новому поколінню, відповідності фактичних результатів діяльності педагогічної системи її остаточній меті. Вважаємо, що визначення ступеня задоволеності внутрішніх споживачів є однією з головних завдань менеджменту якості. Така оцінка необхідна для коригування дій в освітніх процесах ЗВО та внесення змін до управління організацією, освітні програми і технології навчання, а також акредитація спеціальностей. Якість освіти або отримання на виході необхідного роботодавцям фахівця в першу чергу залежить від якості роботи викладача.*

Відповідно, питання контролю та оцінки якості роботи викладача є однією із складних та важливих завдань в управлінні якістю освіти. Слід зазначити, що критерії оцінки якості роботи викладача ЗВО нормативно не визначені. Виходячи з чого, в освітніх установах існують різного роду переліки вимог до науково-педагогічних працівників. Як правило, їх використовують при визначенні можливості займати ту чи іншу посаду конкретним викладачем, при проходженні процедури конкурсних відборів на заміщення вакантних посад. На сьогоднішній день існує великий інтерес до вивчення досвіду ЗВО, які розробили і використовують ті чи інші моделі оцінки роботи викладачів.

На підставі наявної (в неформалізованому або формалізованому вигляді) інформації про фактичний стан системи, керівники різних рівнів приймають рішення з управління якістю навчально-виховного процесу в ЗВО. При цьому особливо гостро стоять питання забезпечення вхідними даними та формалізованого опису процесів функціонування системи. Проблема може бути вирішена шляхом розробки інформаційного забезпечення систем підтримки прийняття рішень (СППР) з питань управління якістю навчально-виховного процесу ЗВО (для керівників, завідувачів кафедр, працівників навчально-методичних відділів та інших осіб, що відповідають за урахування "людського фактору").

***Ключові слова**: навчальний процес; якість освіти; менеджмент; моніторинг; компонентний аналіз; морфологічний аналіз; інформаційна система.*