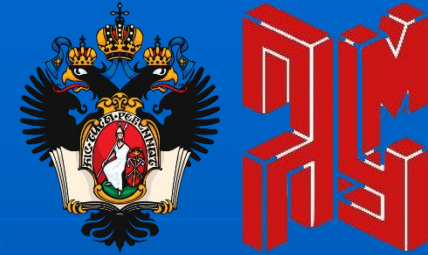


“The Saint-Petersburg state university”  
the faculty “Applied mathematics – control processes”  
the chair “Information systems”



The theme of dissertation:

*“The environment of automated training with the properties of adaptation based on the cognitive models”*

on the competition of scientific degree of the candidate of technical sciences  
on the spec. 05.13.01 – “The system analysis, control and information processing”

The chairman of “The dissertation council”:

the head of the chair “Modeling of electromechanical and computer systems”,  
“The honorary professor of “SPbSU””, d.ph.-m.s., prof. *Egorov Nikolay Vasilyevich*.

The scientific supervisor: the prof. of the chair “Information systems” of “SPbSU”,  
the member of “The American mathematical society”,  
d.ph.-m.s., prof. *Kvitko Alexander Nikolaevich*.

The applicant: the author of the unique cognitive modeling technology  
for the system, financial and complex analysis *Vetrov Anatoly Nikolaevich*.

The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
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the chair “Information systems”

The plan of the meeting of “The dissertation council”:

- I. The opening speech of the members of “The dissertation council”.
- II. The scientific report with multimedia-presentation of the reporter (applicant).
- III. The answers the questions of the foreign and national members of “The dissertation council”.
- IV. The performances of the members of “The dissertation council”, the representative of the opposing (leading) organization, the official opponents and the scientific supervisor.
- V. The vote of the members of “The dissertation council”.
- VI. The concluding remarks of the chairman and the members of “The dissertation council”.  
on the dissertation

*“The environment of automated training with the properties of adaptation based on the cognitive models”*

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## Part I. The opening speech of the members of “The dissertation council”

The chairman of “The dissertation council”:

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“The honorary professor of "SPbSU"”, d.ph.-m.s., prof. *Egorov Nikolay Vasilyevich*.

The scientific secretary of “The dissertation council” :

the prof. of the chair “Modeling of electromechanical and computer systems”,  
d.ph.-m.s., prof. *Kurbatova Galina Ibragimovna*.

The secretary of “The dissertation council” :

the associate prof. of the chair “Modeling of electromechanical and computer systems”,  
c.ph.-m.s., associate prof. *Varayun Marina Ivanovna*.

The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
the faculty “Applied mathematics – control processes”  
the chair “Information systems”

Part II. The scientific report  
with multimedia-presentation  
of the reporter (applicant)  
on the dissertation

*“The environment of automated training with the properties  
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## **The existing contradictions and the priority aspects of informatization**

- the technologies, being the basis of the existing means of training and training-methodical complexes practically do not take into account the features of information processing by the trainee as the subject of training;
- the improvement of organization and technology of the process of the automated training causes the need of the analysis of efficiency of functioning of the information-educational environment with taking into account of the individual features of the subjects of training (physiological, psychological, linguistic and etc.);
- the requirements to modern information-educational environments initiate monitoring, the realization of accumulation and expeditious data processing, characterizing individual dynamics of change of indicators of quality of formation of knowledge of trainees.

## **The relevance of the theme of dissertation research**

is explaining by the evolution of priorities from outside of the state and international bodies regulating the policy of development of the system of education and informatization of educational sphere, the extension of requirements to the synthesis of information environments of educational establishments, the imperfection of scientific-methodical and technological device for support the analysis and assessment of efficiency of information exchange between the subjects and means of training, the need of creation of the universal scientific approach (method and technology) to the assessment of quality of training, and also continuous development and innovations in the field of the information technologies.

**The purpose of research is**

the increase in the efficiency of functioning of the information-educational environment of the automated (remote) training system due to realization of the individually-oriented formation of knowledge of the trainee with the use of the adaptive generation of educational influences based on the parametrical cognitive models block.

**The object of research**

the information-educational environment of the automated (remote) training system of educational establishment.

**The subject of research**

the automated (remote) training system with the properties of adaptation based on the parametrical cognitive models block.

**The methods of research**

- theoretical – the theory of systems, the system analysis and modeling, the theory of control, structuring and representation of knowledge, engineering psychology and pedagogics;
- experimental – the applied methods of theory of information, the physiology of sensory systems (analyzers), cognitive psychology and applied linguistics.

The achievement of the purpose of research realizes **the complex of research tasks**

- the analysis of theoretical bases of construction of the automated IEE of the adaptive training with the model of subject of training at the base of the theory of automatic control, organizational models and technologies of interaction of subjects with means of training;
- the development of the structure of IEE of the automated (remote) training system with the properties of adaptation based on the parametrical cognitive models block;
- the creation of the cognitive modeling technology for the system analysis and increase of efficiency of functioning of the automated information-educational environment;
- the synthesis of the parametrical cognitive models block as inf. basis of the system analysis: the formation of the CM of subject of training and the CM of means of training in the basis of the IEE of ART;
- the realization of the complex of programs for the automation of research tasks, including: the adaptive electronic textbook, the basic and applied diagnostic modules.

**The main scientific results**, submitted on defence:

- the structure of information-educational environment and principles (algorithms) of functioning of components of the automated (remote) training system with the properties of adaptation based on the parametrical CM block [**slides 1.1–1.8.3**];
- the cognitive modeling technology, including the technique of its use, the recommended innovative bases (models) and the algorithm of formation of the structure of cognitive model, the techniques of research of the parameters of cognitive models and the algorithm of processing of a posteriori data of testing [**slides 2.1.1–2.7.2**];
- the structures of the cognitive models of subject of training and the means of training [**slides 3.1–3.8**];
- the complex of programs, including the adaptive electronic textbook (the individually-oriented generation of educational influences by means of the adaptive representation of information fragments processor), the basic diagnostic module (the estimation of the level of residual knowledge of a trainee) and the applied diagnostic module (the diagnostics of parameters of the cognitive model of subject of training) [**slides 4.1.1–4.20.1**];
- the statistical justification of practical use of the received results (by means of preliminary processing of a posteriori data, the secondary processing of selections of a posteriori data: some results of the regression analysis, the discriminant analysis, multidimensional scaling and the factor analysis) (\*) [**slides 5.1-5.6.2**].



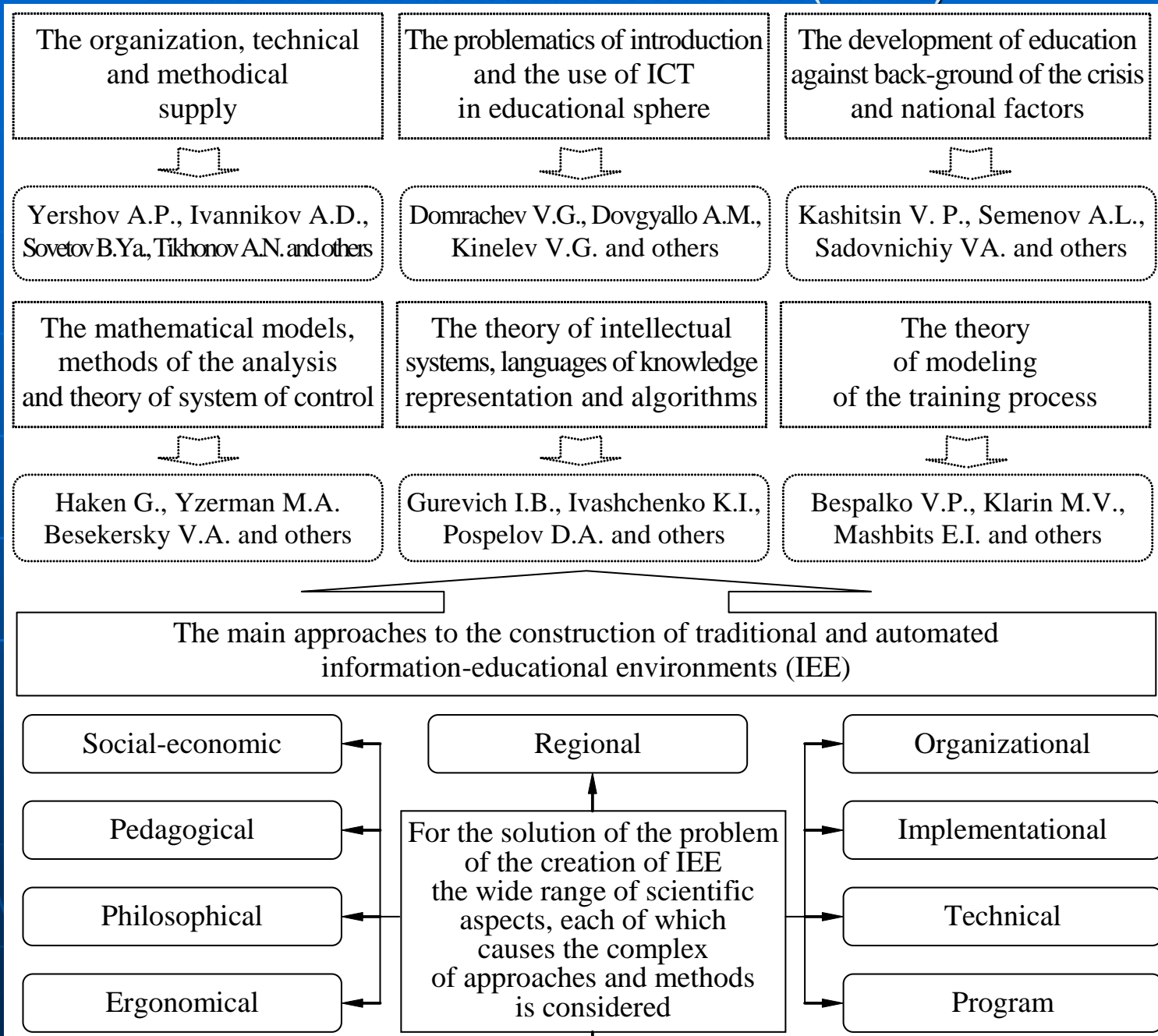
**The reliability of the scientific results of dissertation research is confirmed by:**

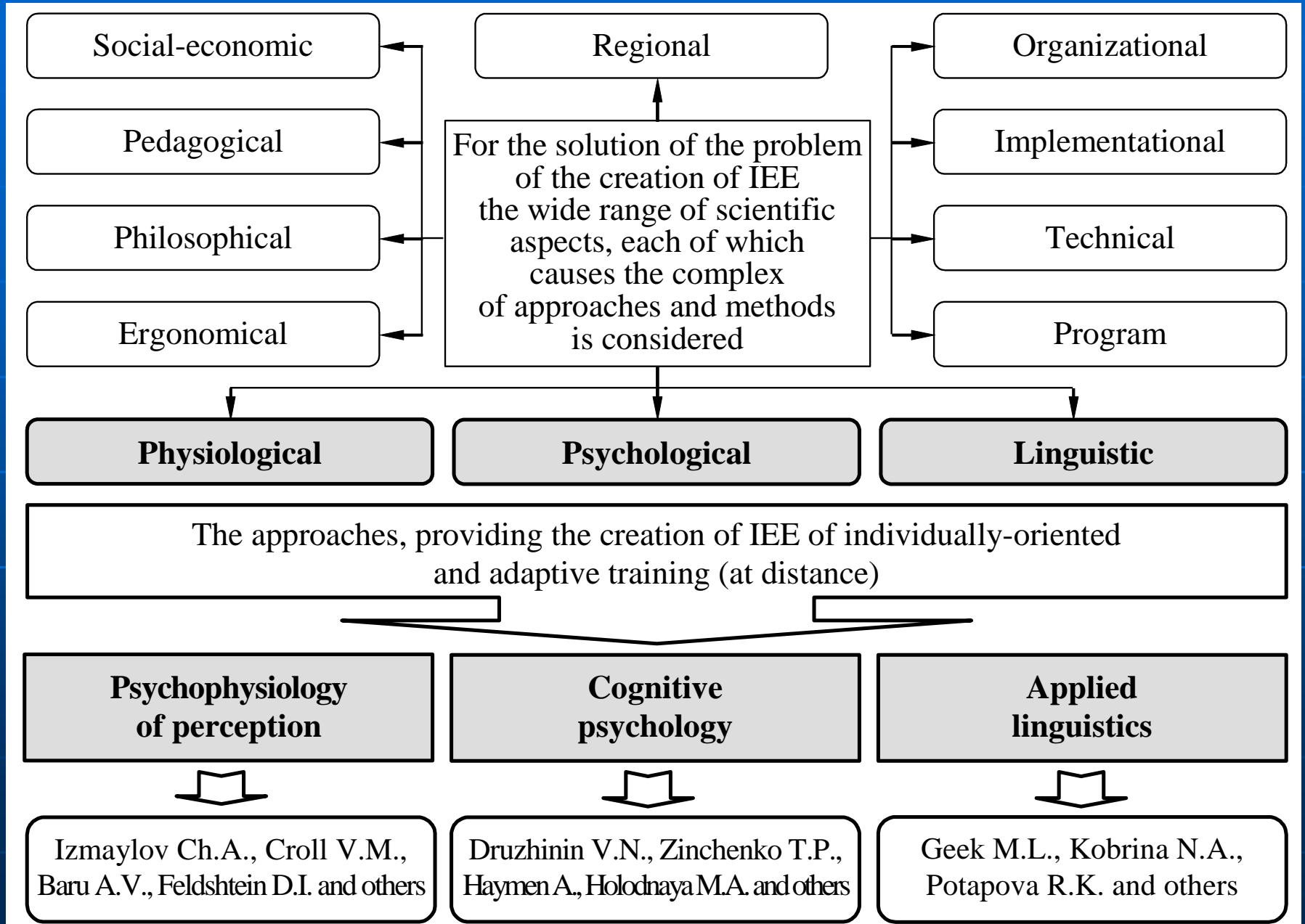
- the system approach to the description of the selected difficult object of research;
- the correct use of fundamental provisions of the theory of information, physiology of sensory systems, cognitive psychology, applied linguistics and ergonomics;
- the approbation of elements of the dissertation on seminars and conferences “THEAS” and “RAS”;
- the introduction of results in learning process of “SPbSETU "LETI"” and “IBI”, the reasonable application of experimental methods and the strict logic of carrying out of experiment;
- the results of statistical processing of a posteriori data, training of 10 diploma students.

**The basic results of diss. were publ. in 52 on 2007 y. (106 on 2012 y.) [265 on 2018 y.] scientific works:**

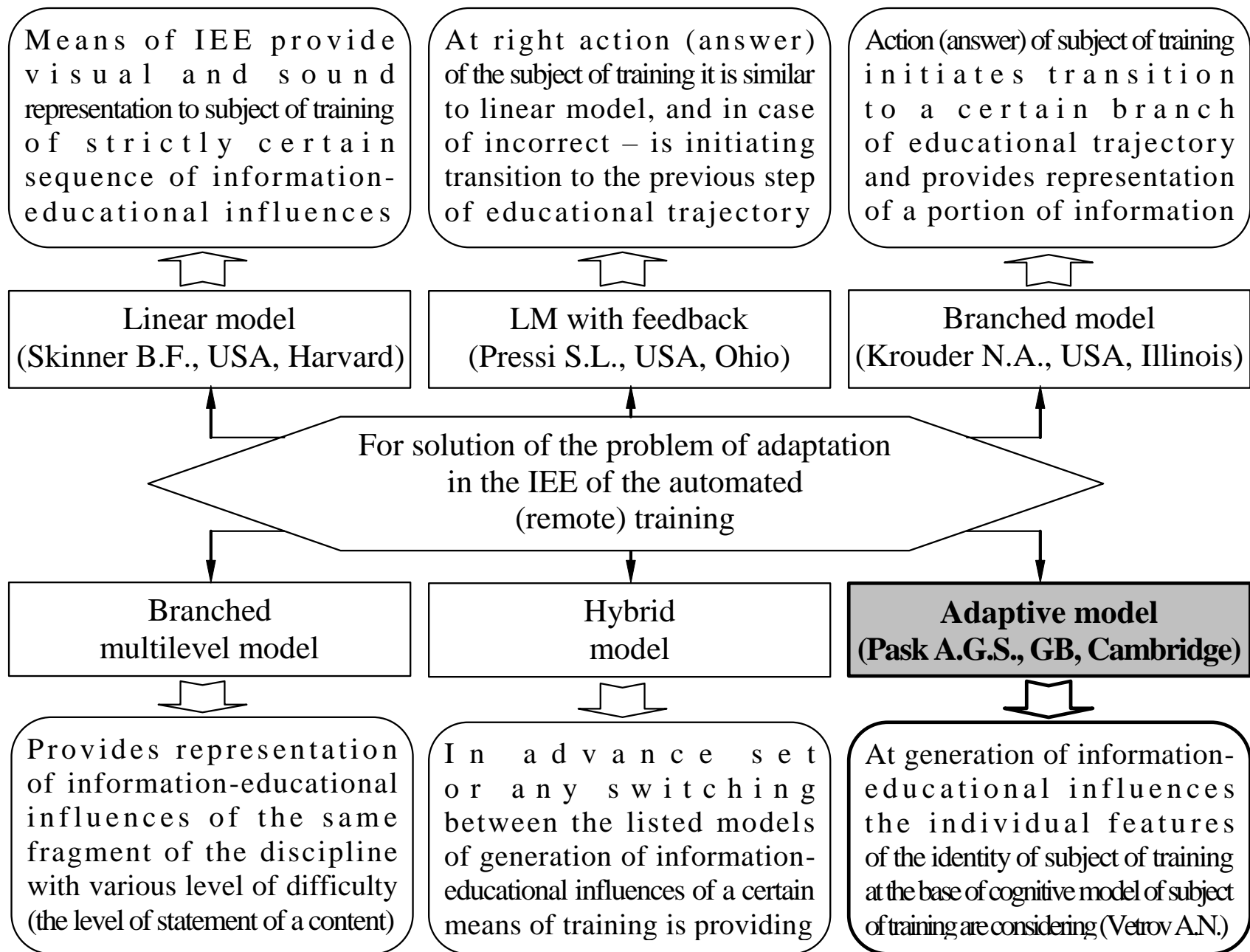
- 01 textbook and 03 methodical instructions to lab. works on the discipline “Computer science”;
- 01 textbook (10 volumes) on the discipline “Finance, monetary circulation and credit”;
- 02 units in 01 coll. scientific monography of “THEAS” (with formal coauthors-teachers);
- 04 (10) learning manuals and scientific monographies (with coauthors-diploma-students);
- 12 (29) [49] learning manuals and scientific monographies (without coauthors);
- 01 (02) report(s) on the individual initiative SRW (2003-2005 y. and 2006-2008 y.);
- 01 appendix to the report on the individual initiative SRW (2003-2005 y.);
- 05 (09) [14] scientific articles in scientific journals, recommended by “HSAC of RF”, from them 00 (05) scientific articles were deposited in “"VINITI" of "RAS"”;
- 22 (48) [182] scientific reports in materials of 11 (24) [39] int. scientific conferences;
- 04 copyright certificates about deposition and registration of works – objects of intellectual property in “RAS” (RF, Moscow city).  
*In 2005-2007 y. (2012 y.) [2018 y.] the norm for the candidate (doctor) of techn. sciences is executed (it was required 02 (10) scientific articles in scientific journals from the list of “HAC of RF”).*

# The scientific aspects of informatization of the information-educational environment and the theoretical-methodical base of research (1 from 2)





# The models of organization of interaction of the subjects and means of training for a solution of the problem of adaptation in the information-educational environment



Classical technologies of the organization of ART are not oriented on individualization of training and do not meet modern requirements to IEE of a new generation

Class-lesson technology

Design-group technology

Technology of the correspondence training

Individual orientation of information interaction between the subjects and means of training in IEE is reaching due to the use of a set of technologies

Technology of the individual training

Technology of the individualized training

**Technology of the adaptive training**

Realizes the topological scheme of information interaction “subject – means of training – ( t e a c h e r ) ” at studying of educational trajectory in IEE

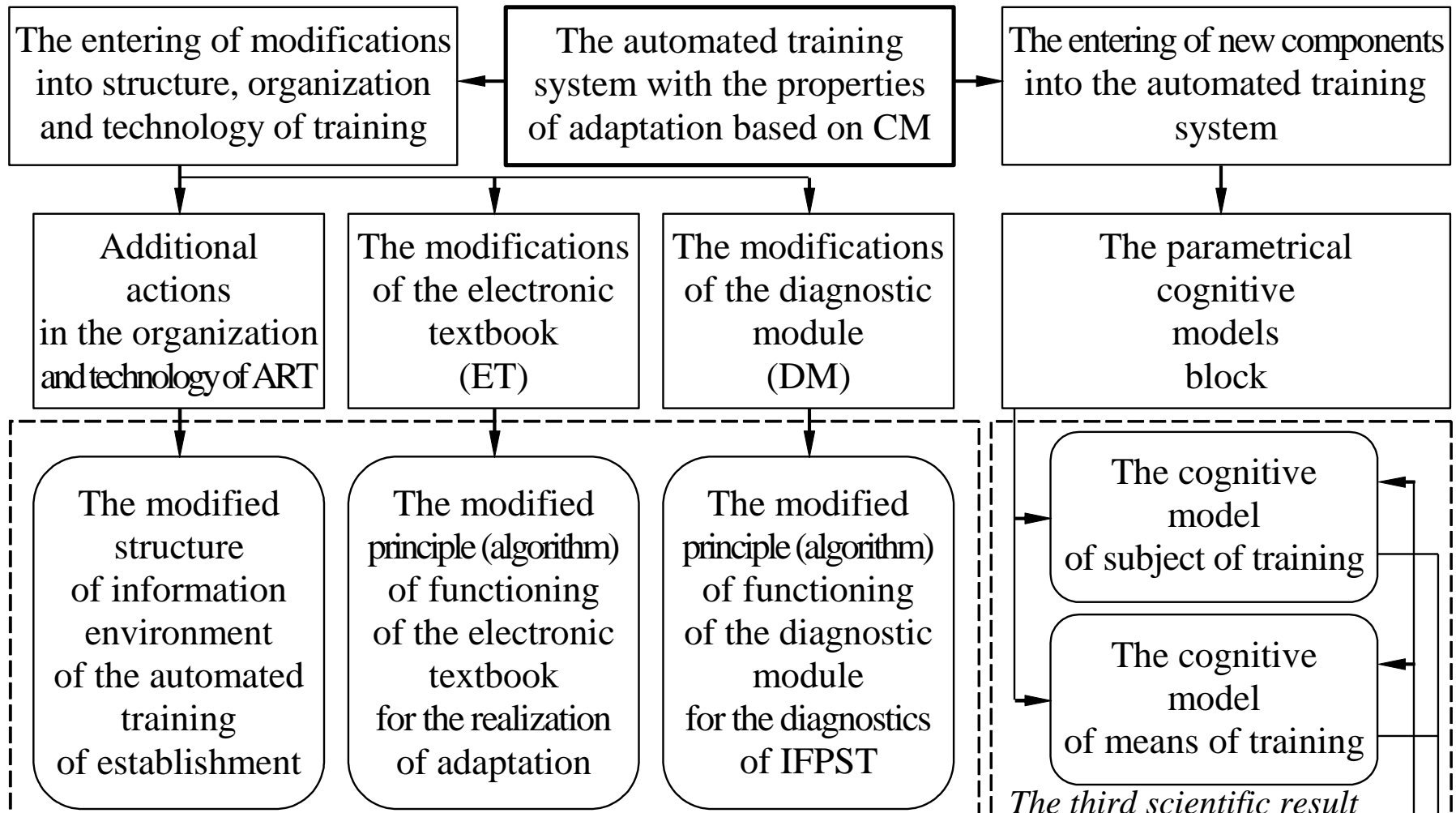
Allows to take into account individual features of the identity of subjects of training during the educational process, realized in the traditional or IEE of ART

Allows to realize the contour of adaptation in IEE of ART based on parametrical cognitive models block of subject and means of training, offered in this work

The complex approach to the synthesis of the information-educational environment of the automated training

with the properties of adaptation based on the parametrical cognitive models block (1 from 2)

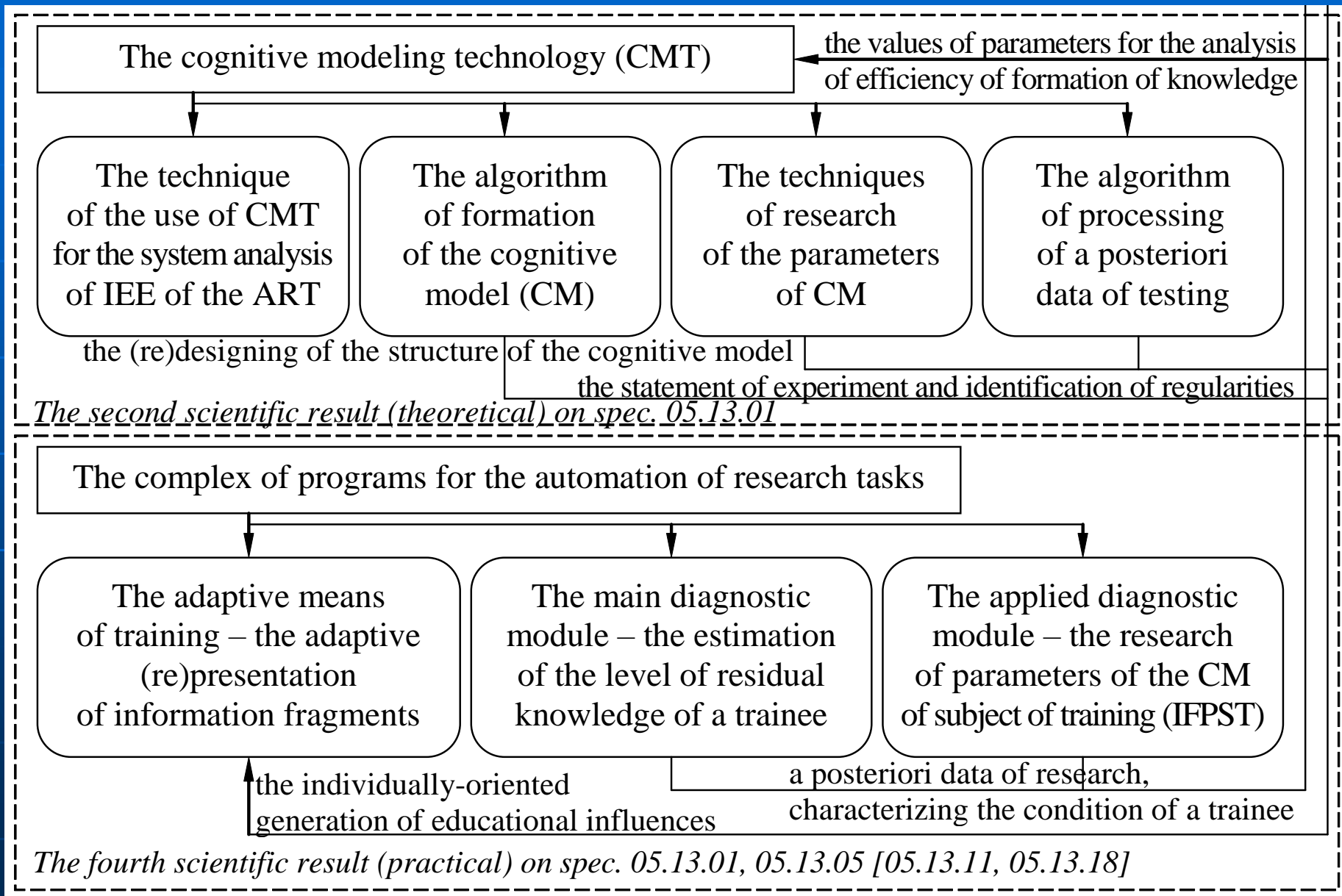
The solution of a complex task of the synthesis of the information-educational environment (IEE) of the automated training with the properties of adaptation based on the cognitive models block



*The first scientific result (theoretical) on spec. 05.13.01*

*The third scientific result (theor.) on spec. 05,13.01 and 19.00.02*

The complex approach to the synthesis of the information-educational environment  
of the automated training  
with the properties of adaptation based on the parametrical cognitive models block (2 from 2)



The main requirements presented  
to the structure of the cognitive modeling technology and the cognitive models

The synthesis of the automated training system with the properties of adaptation based on the parametrical cognitive models block demands the elaboration of complex approach

The modification of structure and principles (algorithms) of functioning of the components of automated training system for the realization of adaptation based on the cognitive models block

The cognitive modeling technology (CMT)

The technique of use of CMT and the algorithm of formation of the cognitive model

The cognitive models of subject of training and means of training

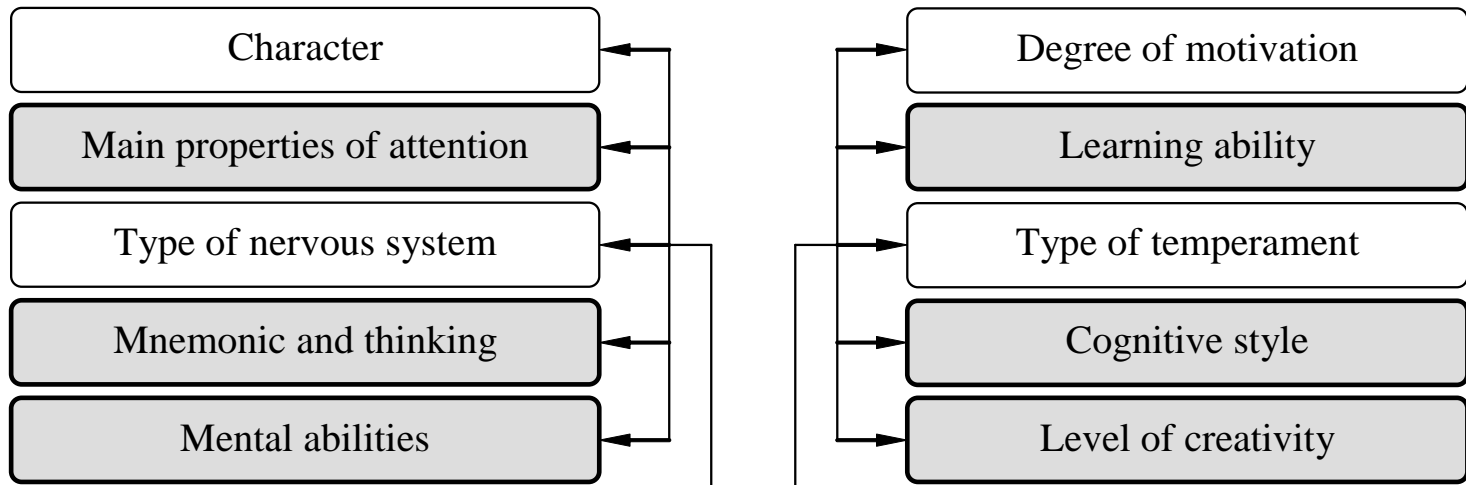
Is universal in relation to the object of research, represents the iterative cycle, including a set of stages and allowing not only to receive the primary representations, but also to carry out the structural analysis

Are developed for the formalization of the sequence of the use of the cognitive modeling technology with the purpose of construction the structure of cognitive model for the tasks of the system analysis of information-educational environment

Concentrates in the own basis a set of the parameters, characterizing the IFPST (the CM of subject of training) and the technical capabilities of means of training, on the basis of which the generation of information-educational influences (the CM of means of training) is realized



The main requirements presented to the structure of the cognitive models of subject of training and means of training



Realization of technology of the adaptive training initiates accounting of specific features

At developing of the structure of the cognitive model it is necessary to take into account a set of specific requirements

Relevance

IEE must consider only those individual features of the subject, which are essential for achievement of the planned purposes of the training process with taking into account IFPST

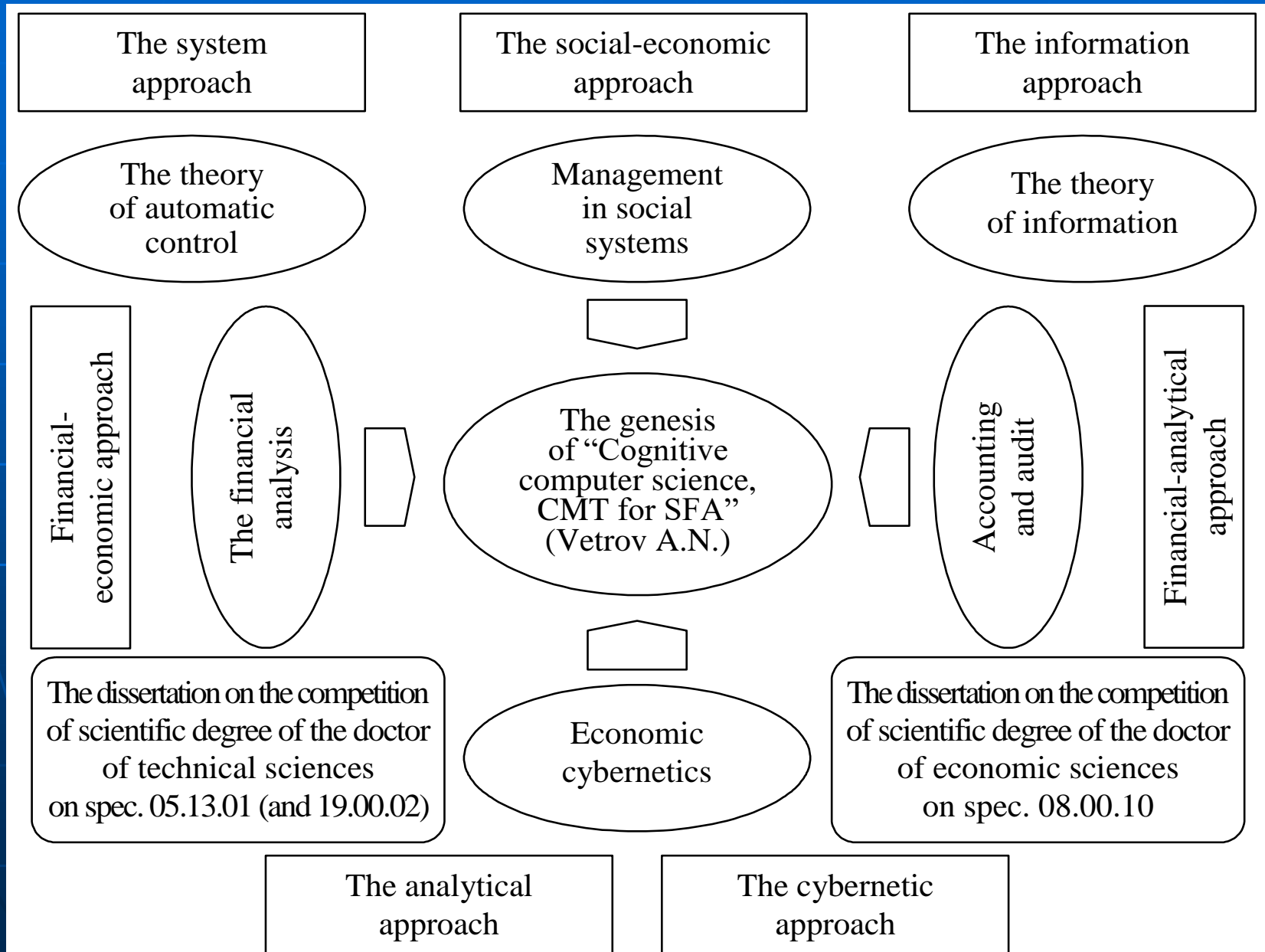
Adequacy

IEE must provide the compliance of model of subject to its original, is extremely important division of steady and situational individual features of subjects and means

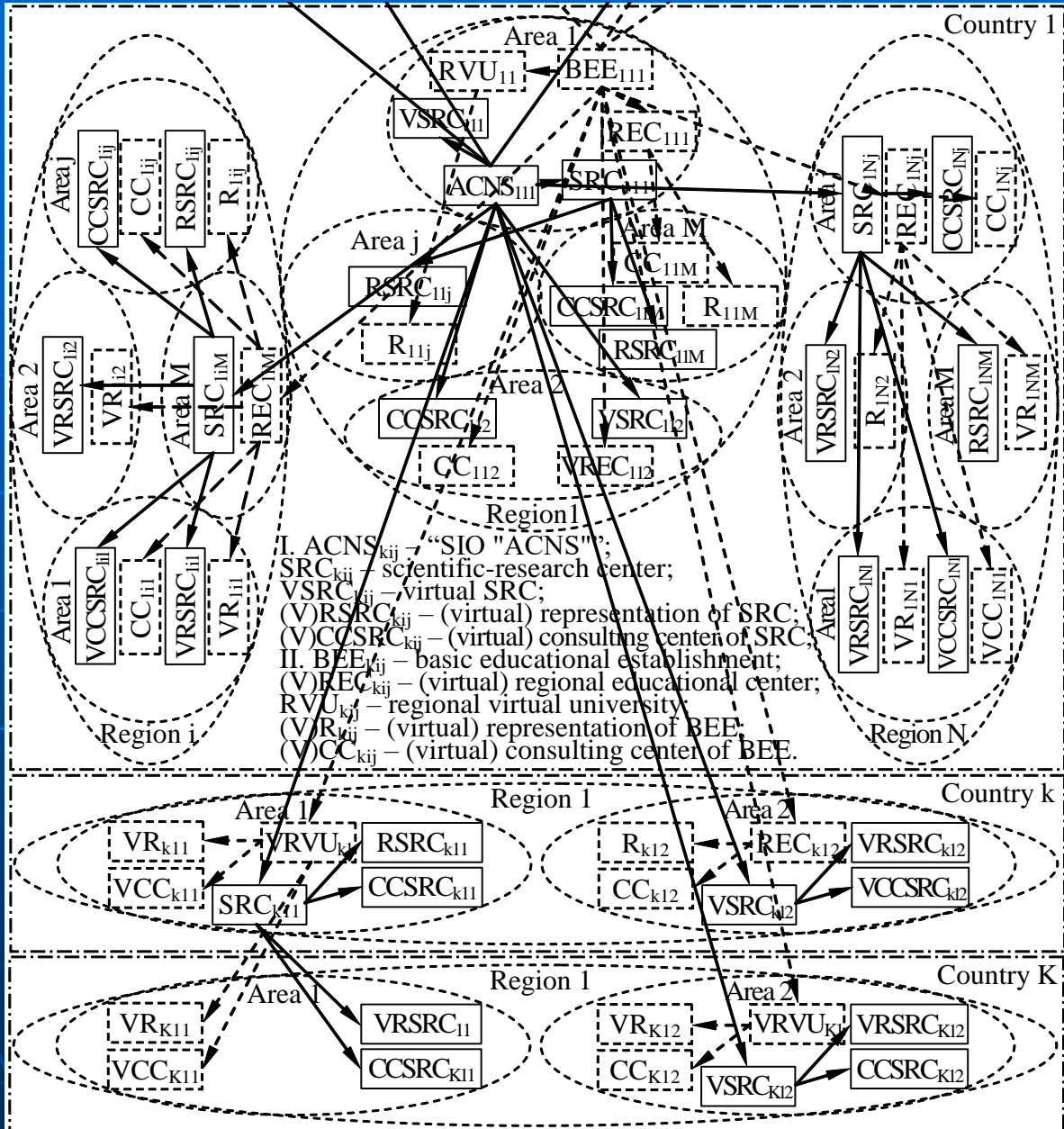
Solvency

IEE must support the quasidynamic updating of model of the subject of training due to systematic updating and accumulation of data about his condition

The genesis of “Cognitive computer science, the cognitive modeling technology for the system and financial analysis” as new (academic) scientific direction (according to the decision of “The Presidium of “The Russian academy of natural science””, the protocol №699 from the 08<sup>th</sup> of June 2018 y.)

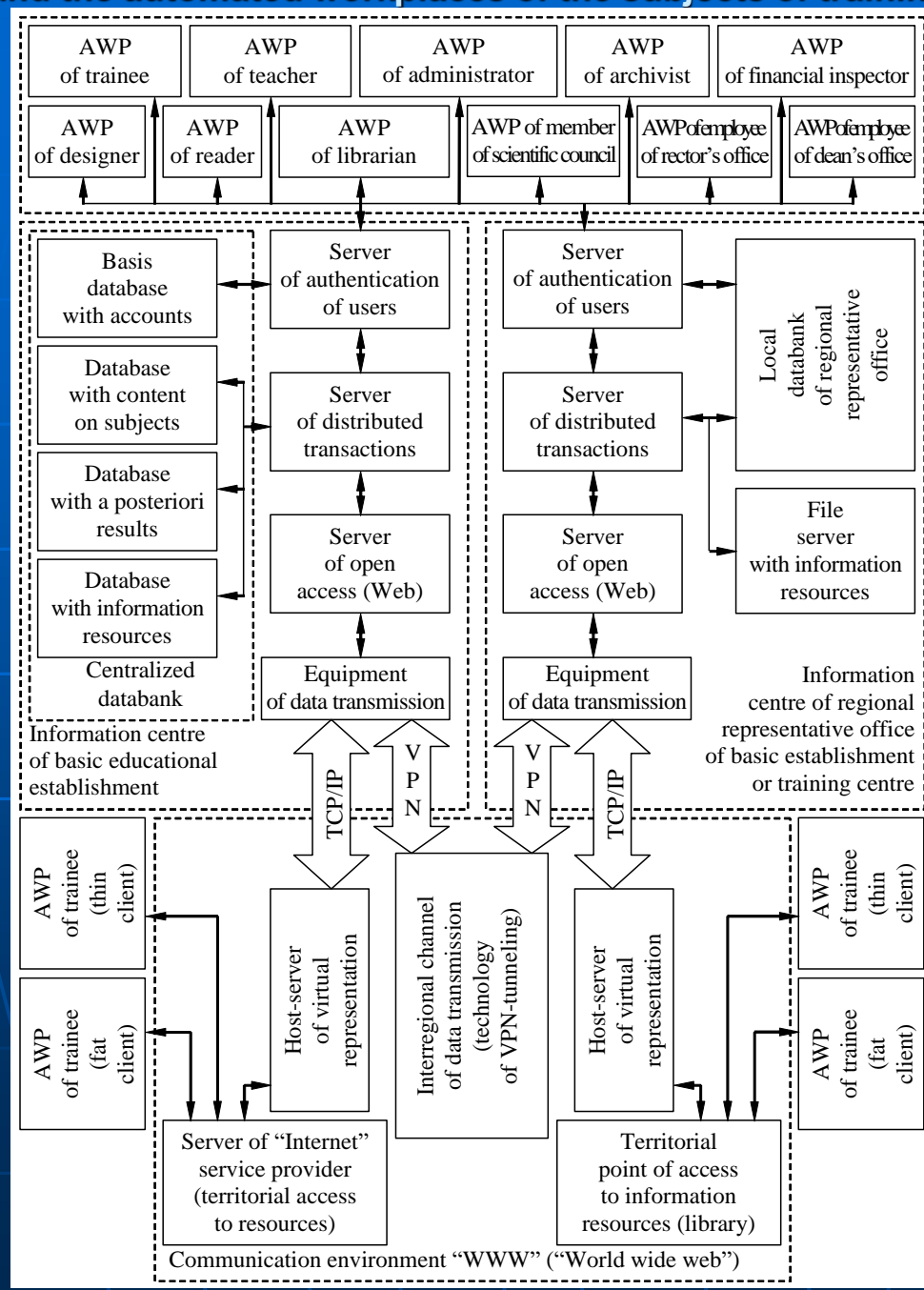


# The structure of the territorially distributed information-educational environment: as the example of the geographically distributed (countries), regions and areas

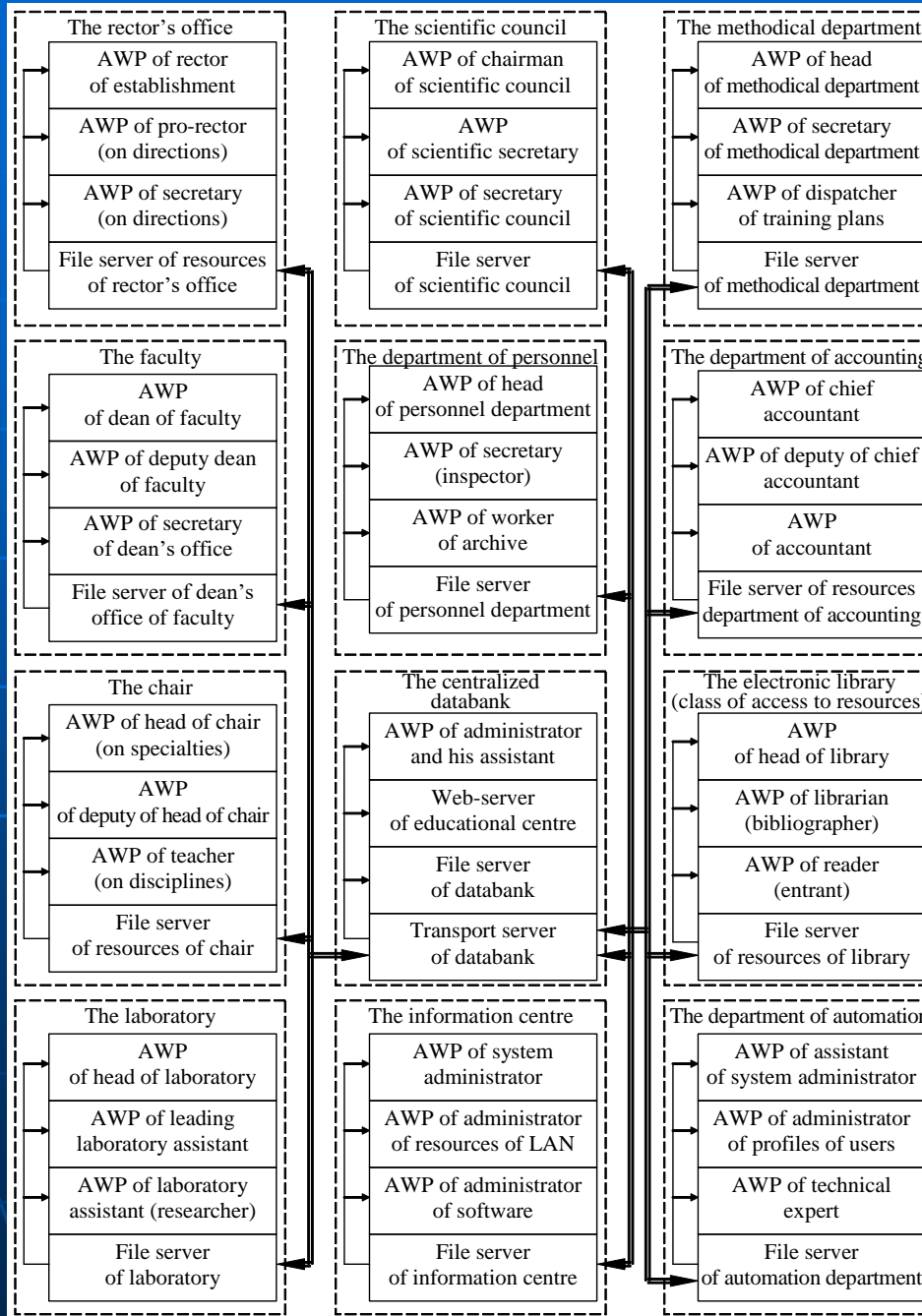


k – index of country; i – index of region; j – index of area;  
K – quantity of countries; I – quantity of regions; J – quantity of areas.

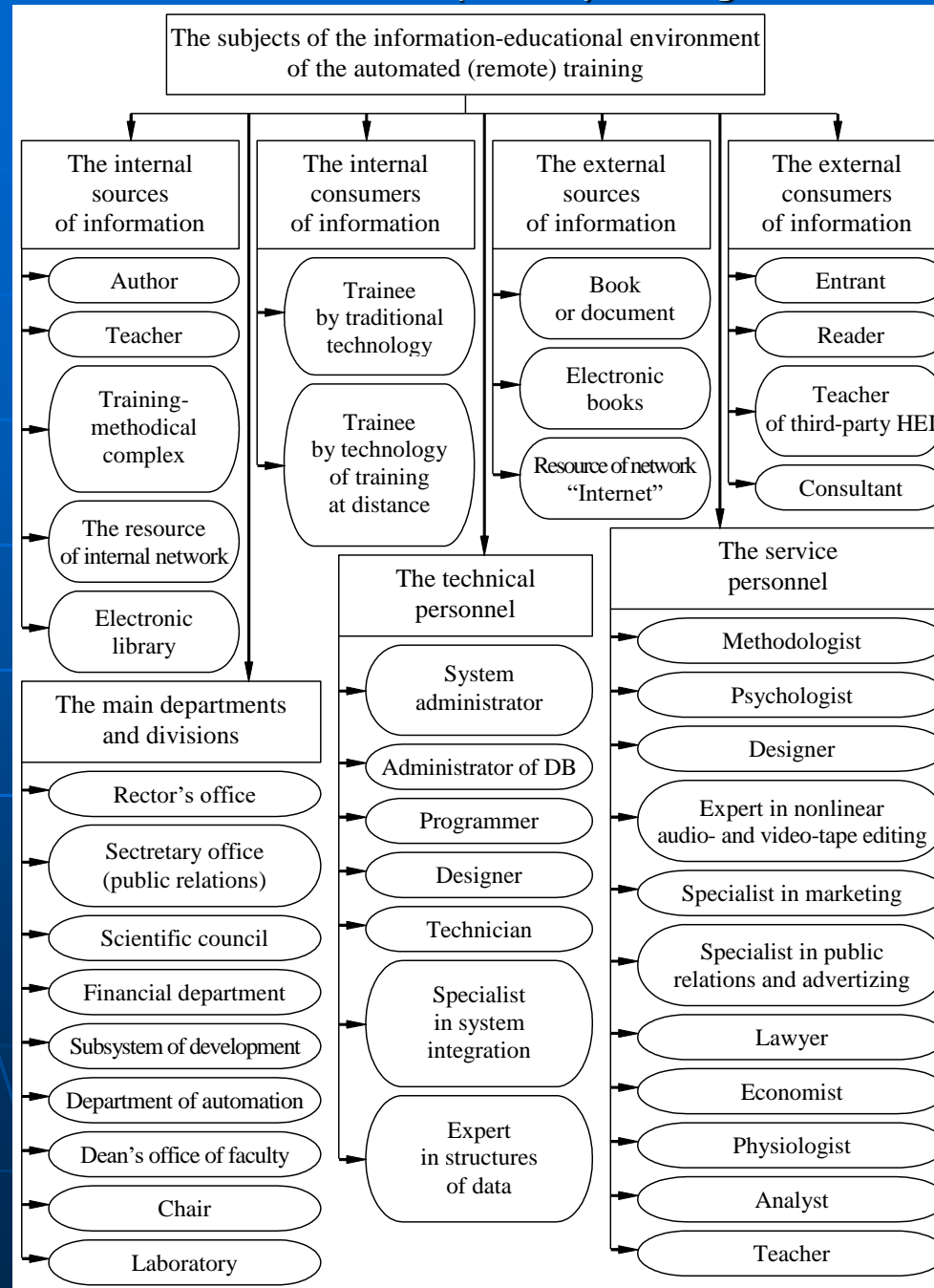
# The standard scheme of interaction of the information centre of educational establishment and the automated workplaces of the subjects of training

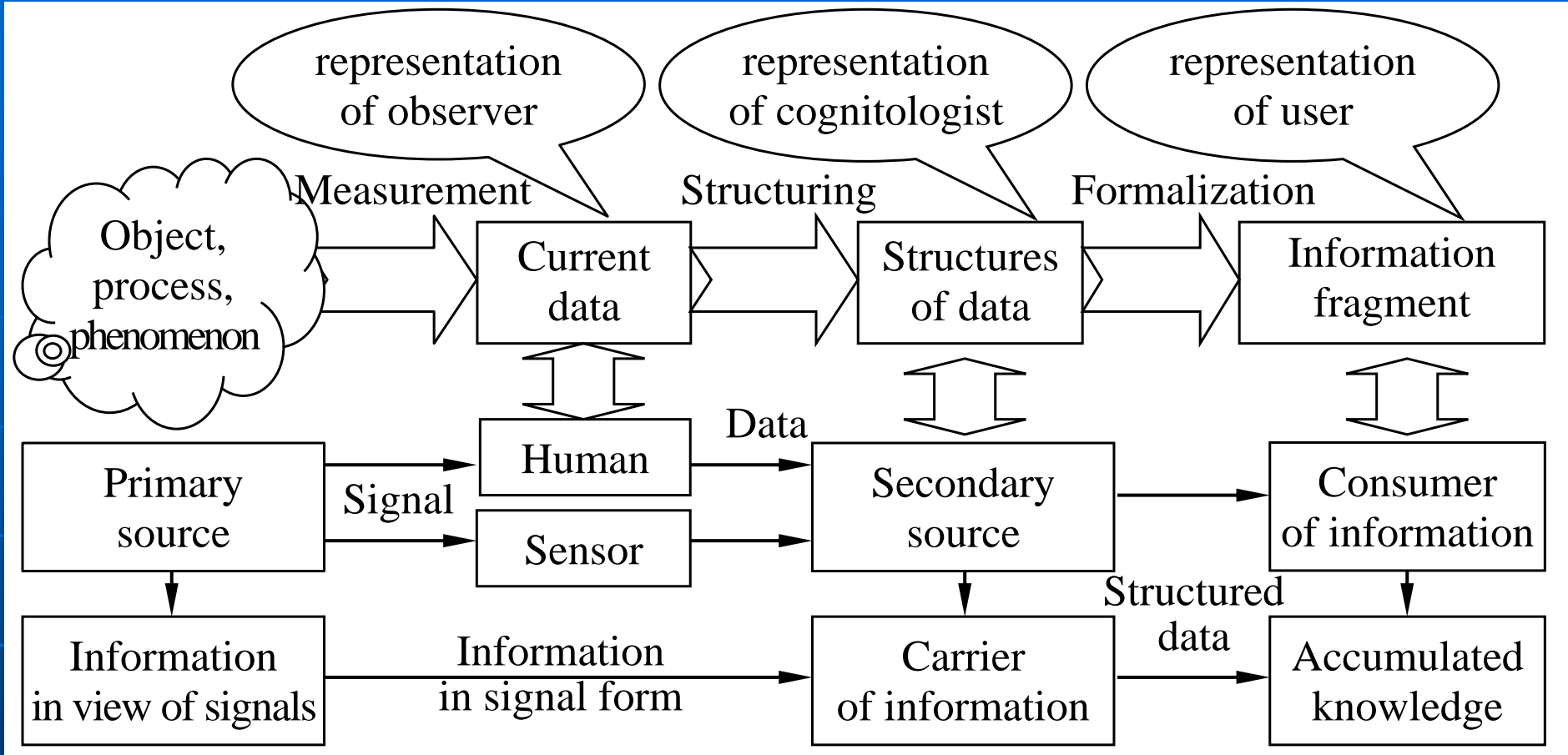


# The standard scheme of interaction of the automated workplaces of the subjects of the information environment of educational establishment



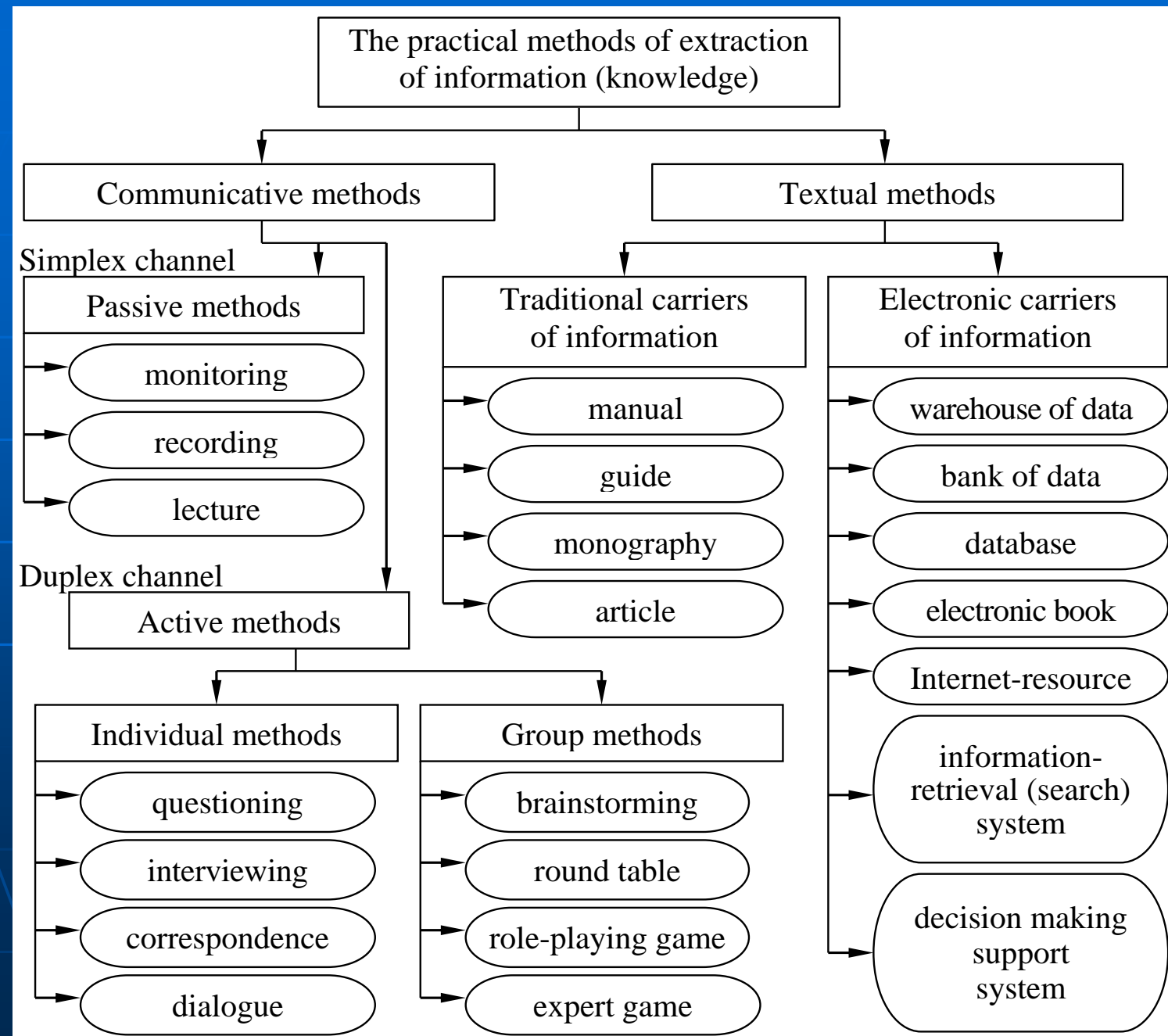
# The classification of the subjects of the information-educational environment of the automated (remote) training





# The classification of the practical methods of extraction and transmission of information (as the aggregate of knowledge) on the subjects of studying

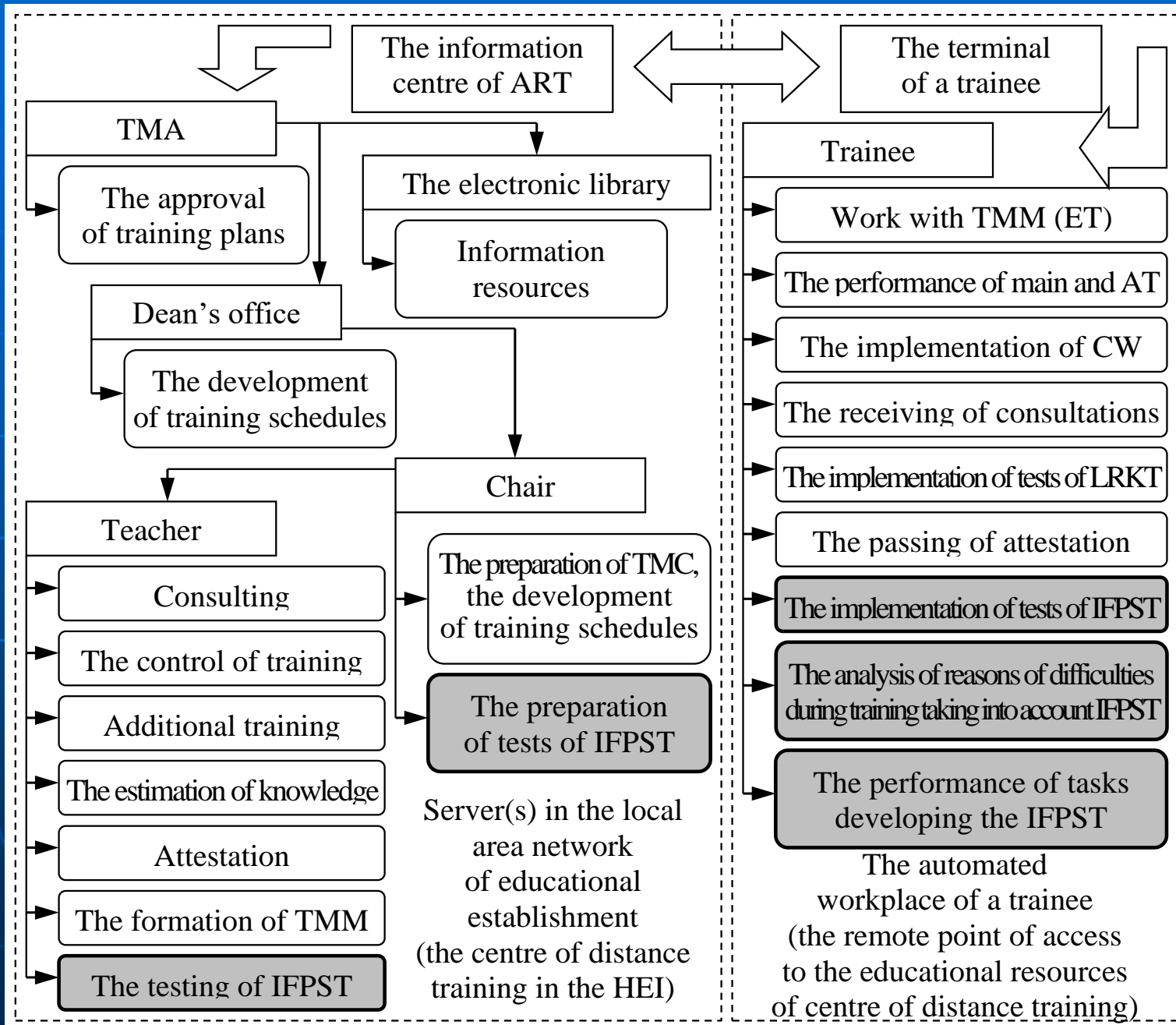
1.2.5



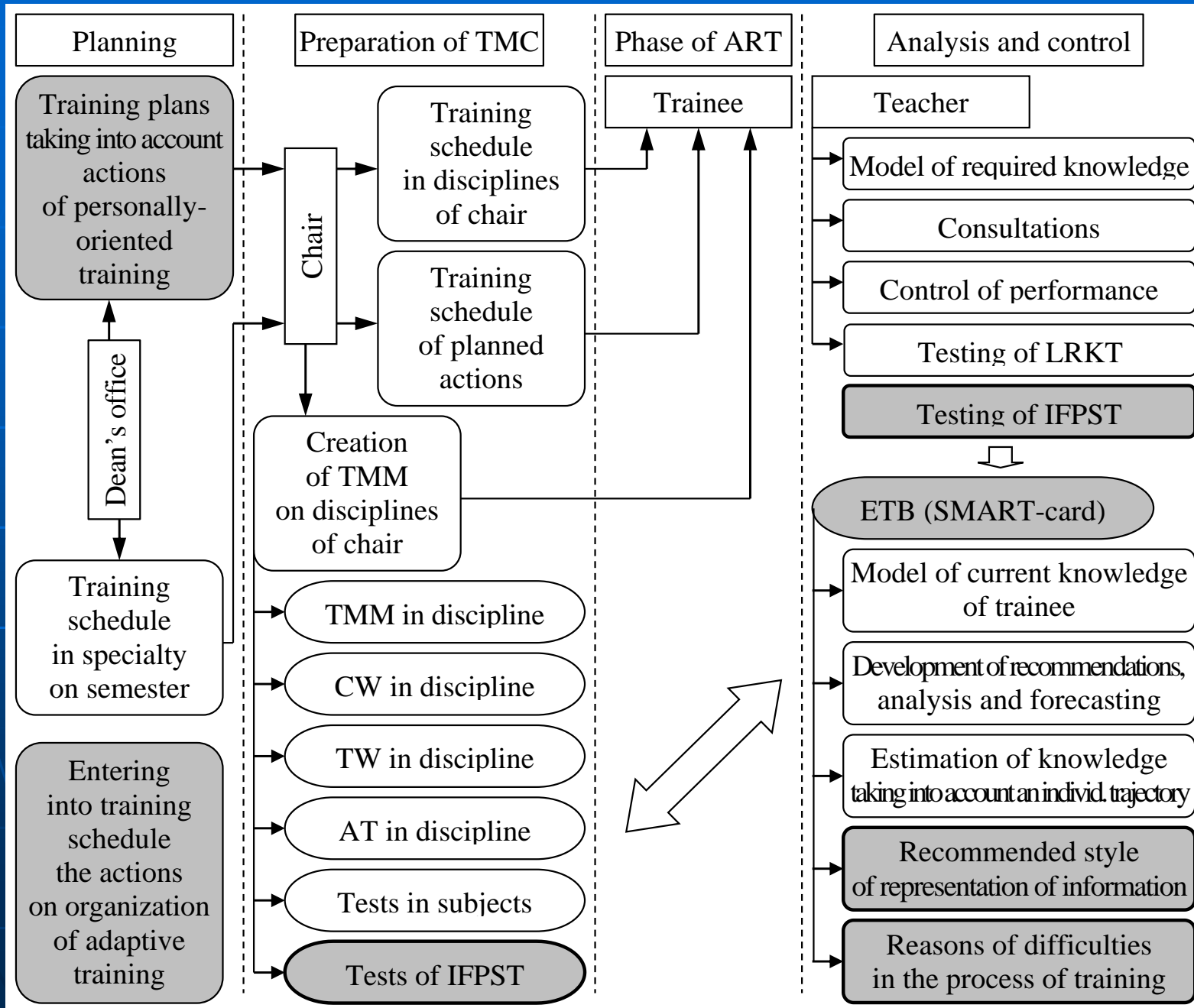


Modifications in the organization of the information environment of educational establishment for the support of accounting of the individual features of personality of the subjects of training

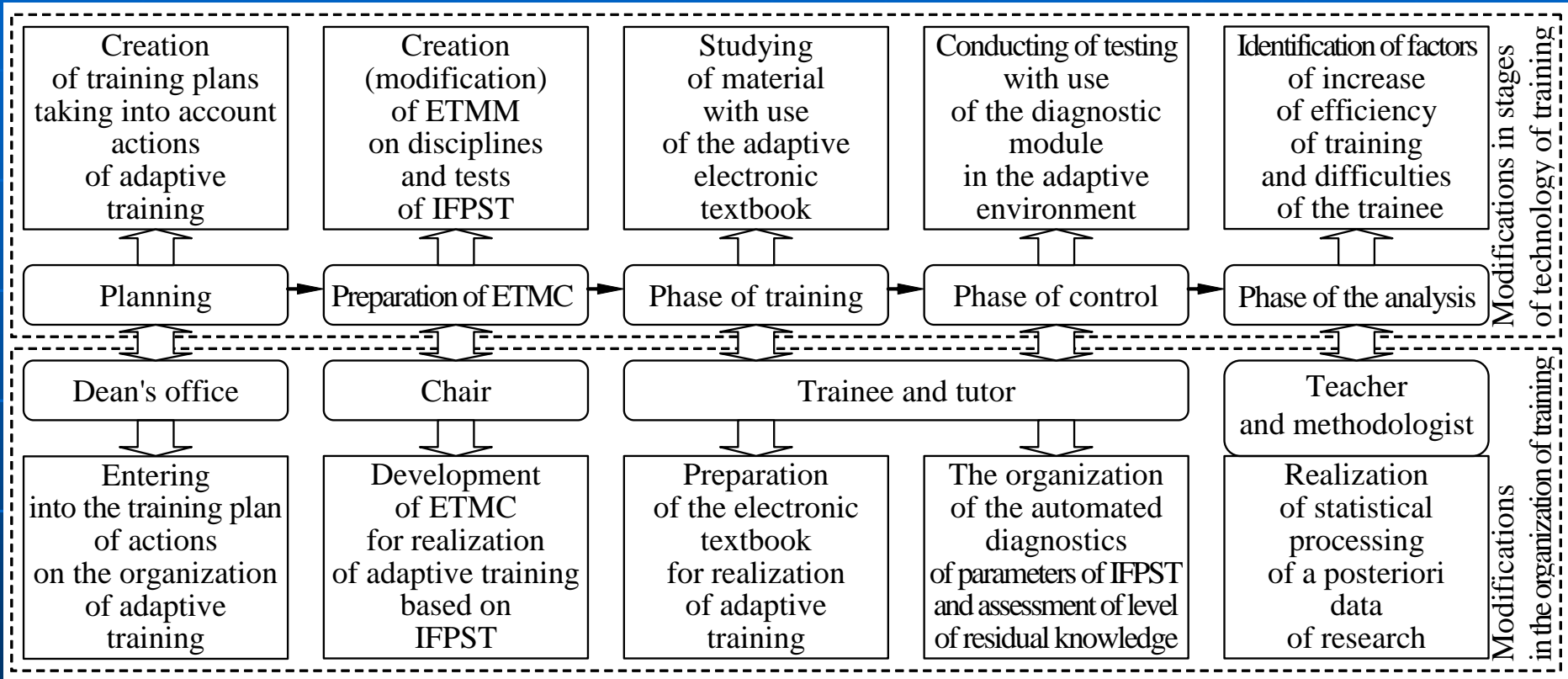
1.3.1



# Modifications in the technological process of formation of knowledge at the realization of the automated personally-oriented training

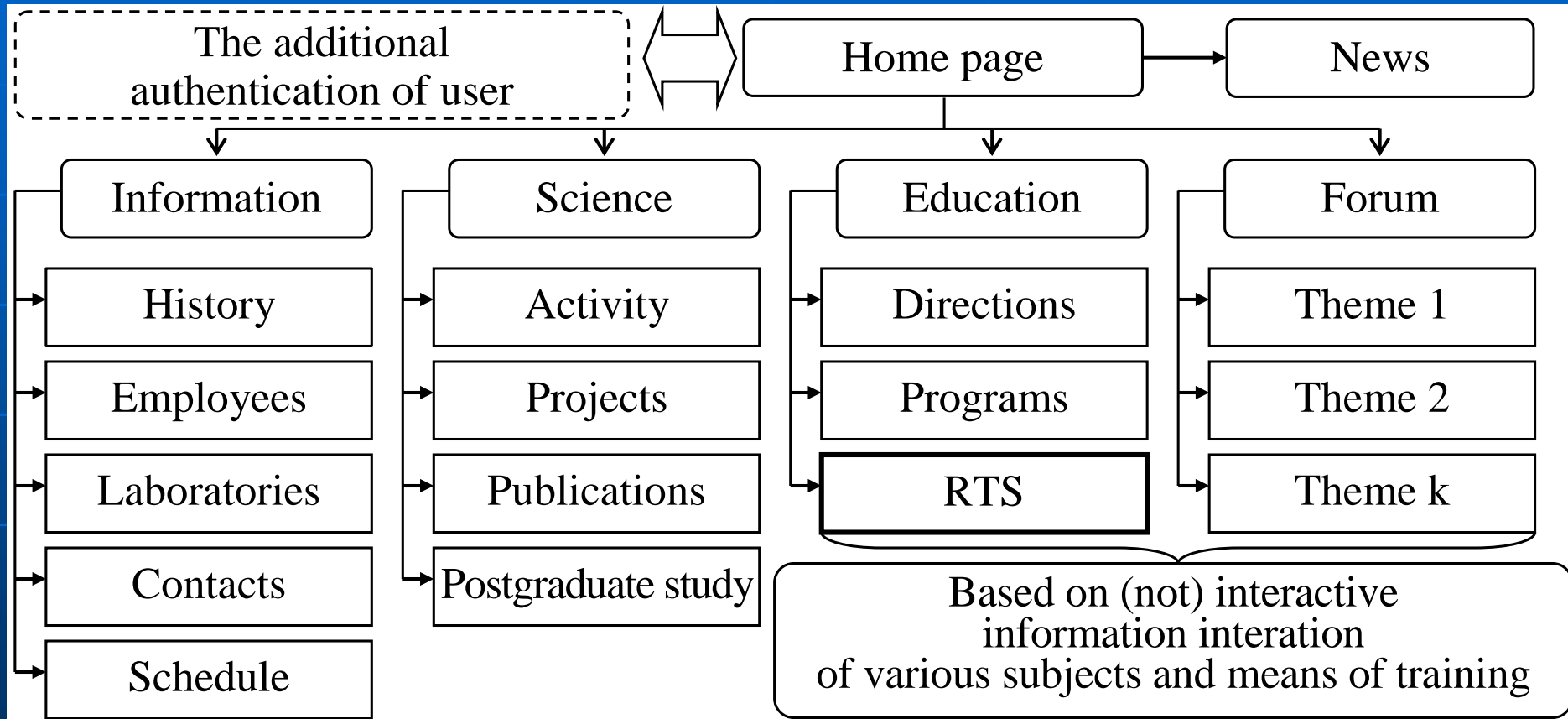


# The comparison of modifications in the organization and technology of automated training for the realization of the contour of adaptation based on the parametrical cognitive models

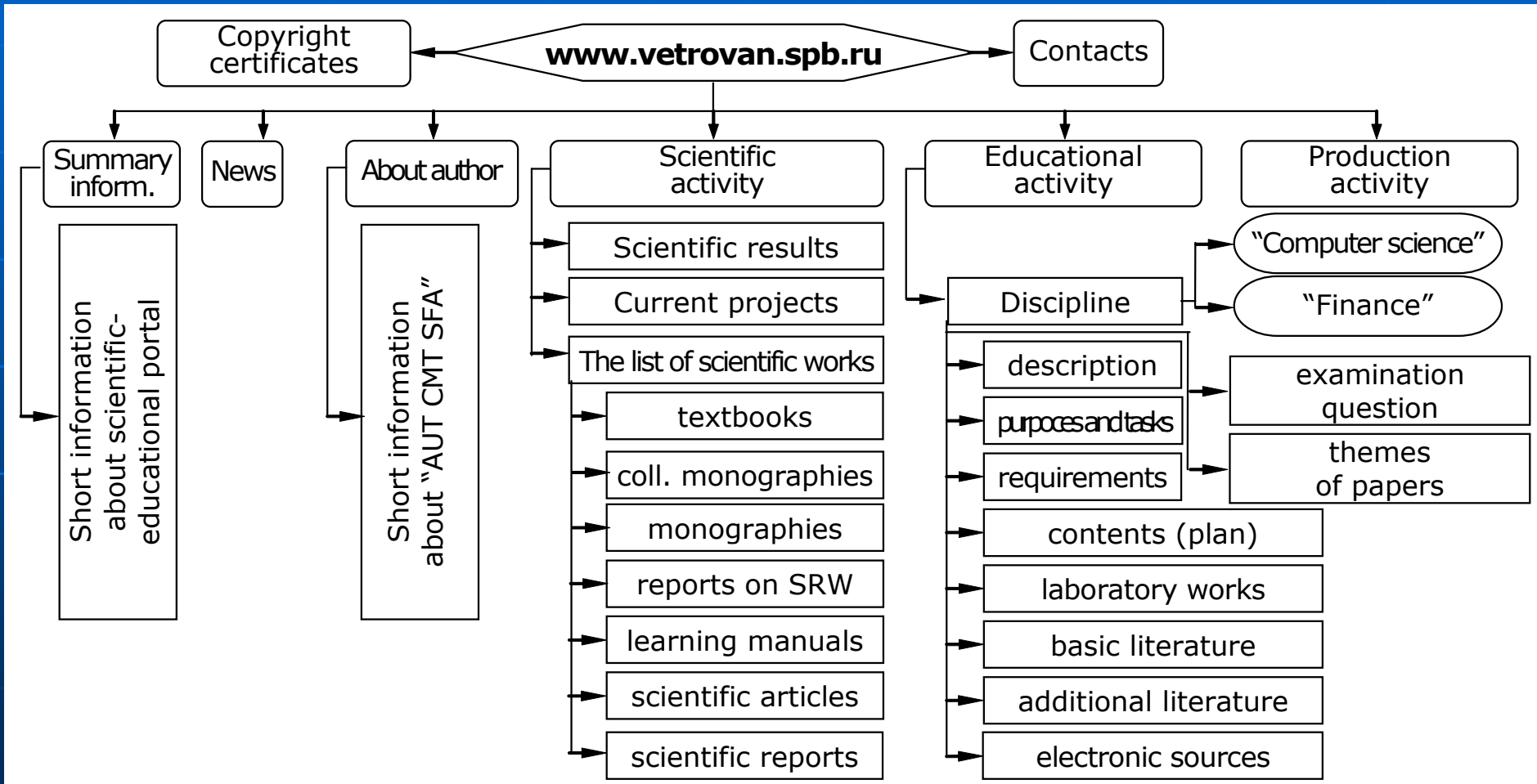


# The structure of the information-educational portal of educational (scientific) centre

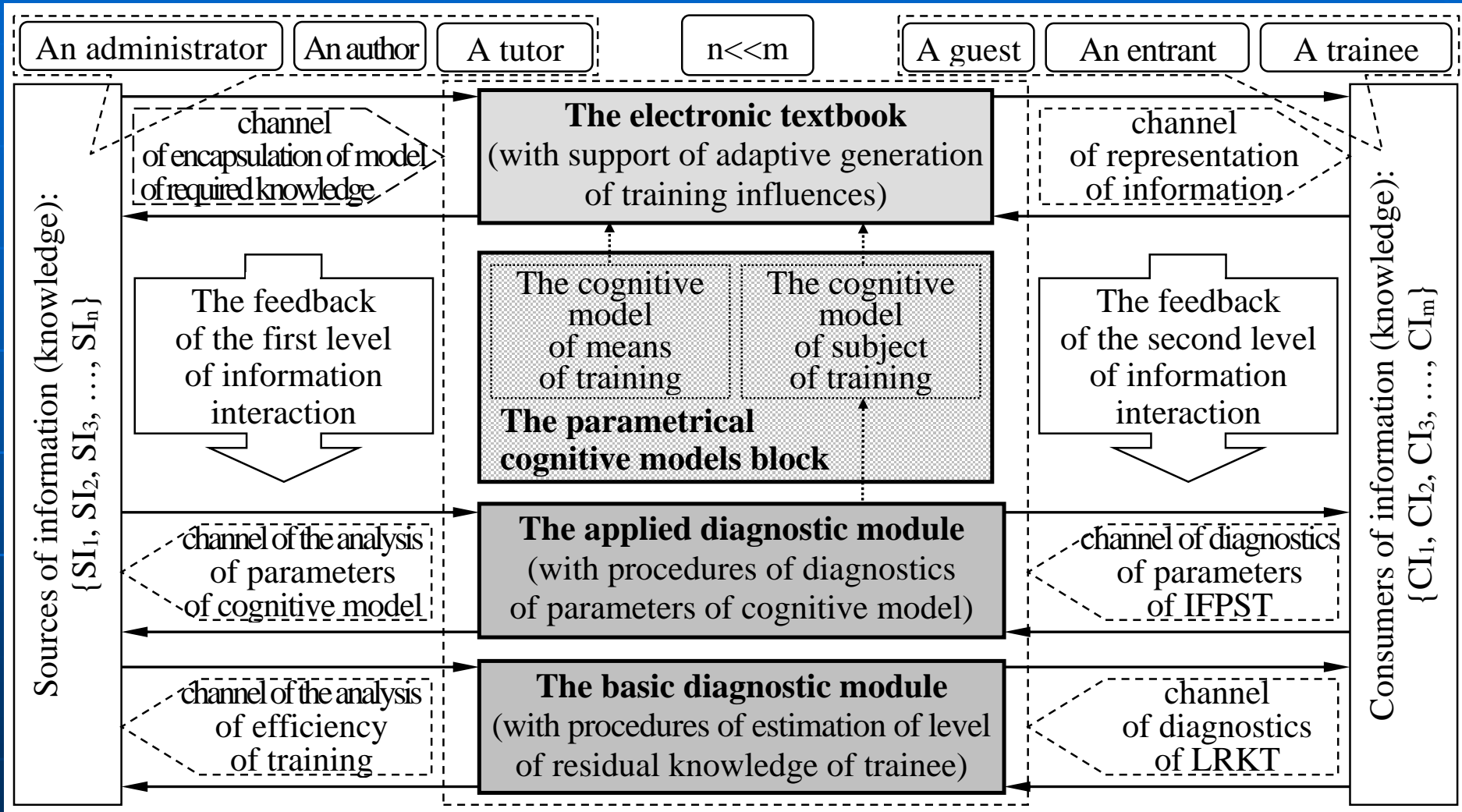
1.4.1



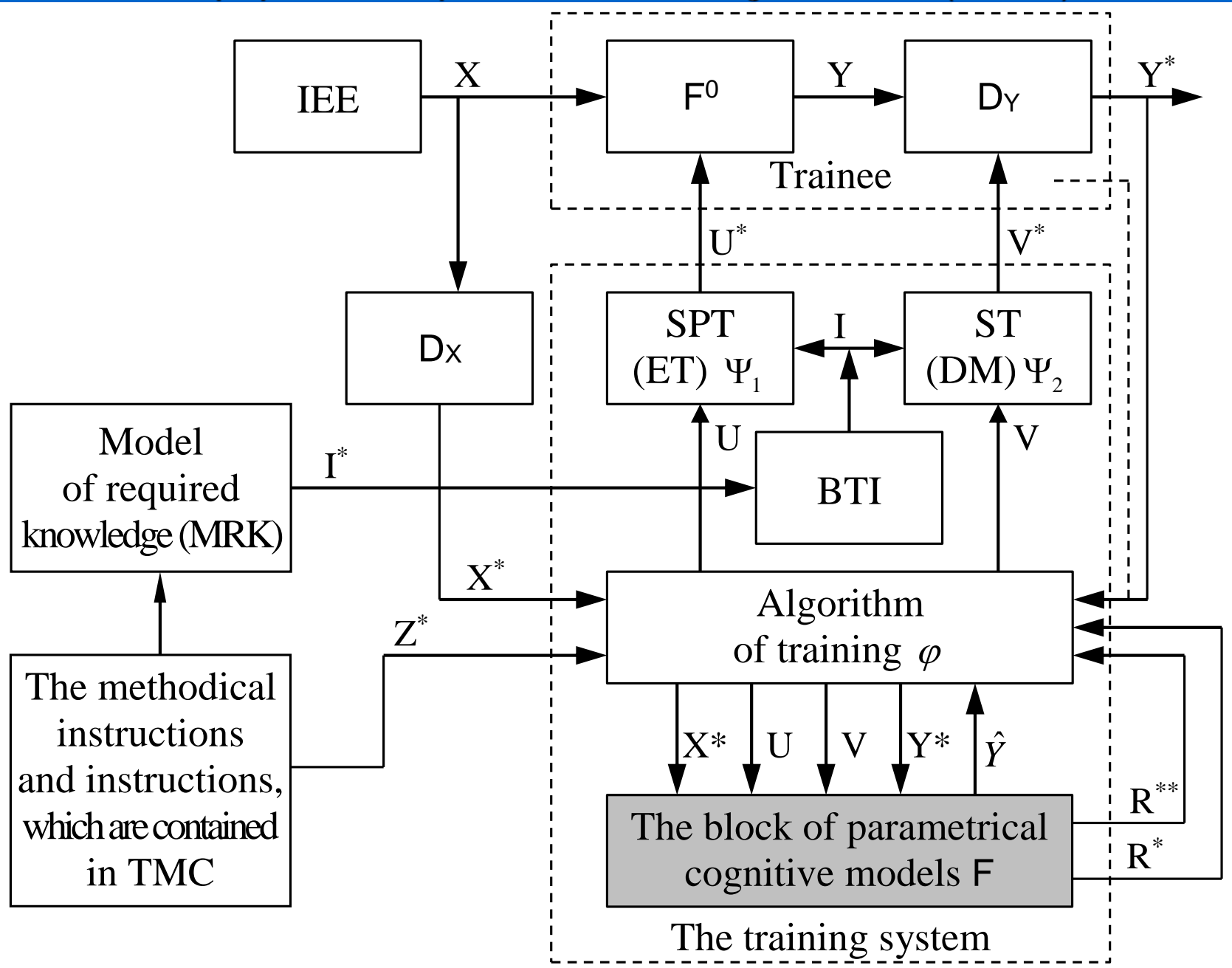
The structure of the information-educational portal of teacher (scientist):  
 on the example of the scientific-educational portal  
 of “AUT CMT SFA” Vetrov A.N.  
 (in the international foreign English language  
 and the national Russian language)



# The structure of the automated training system with the properties of adaptation based on the parametrical cognitive models block



The formal description of the structure of the automated training system with the properties of adaptation based on the cognitive models (1 from 3)



1. The condition of trainee and its estimation:
 
$$\begin{cases} Y = F^0(X, U^*) \\ \hat{Y}_n = F(X_n^*, U_{n-1}, V_n, Y_n^*) \end{cases}$$
2. The algorithm of training  $\varphi$  forms addresses and parameters of TI and control questions:
 
$$\begin{cases} U_{in} = \varphi(X_n^*, \hat{Y}_{n-1}, Z_n^*, C_{n-1}); n \in [1, k] - \text{number of step, } i \in [1, N] - \text{number of information fragment;} \\ V_{in} = \varphi(X_n^*, \hat{Y}_{n-1}, Z_n^*, R_{n-1}) \end{cases}$$

$C = [C^*, C^{**}]$ ,  $C^*$ - potential possibilities of means of training  
(the CM of means of training),  $C^{**}$ - IFPST (the CM of subject of training)
3. The databank of training information:
 
$$I^* \rightarrow I = \langle I_{1n}, I_{2n}, \dots, I_{in}, I_{Nn} \rangle \quad I_{in} = \{I_{in}^U, I_{in}^V\}$$

$$\begin{cases} I_{in}^U = \{I_{1n}^U, \dots, I_{Nn}^U\} \\ I_{in}^V = \{I_{1n}^V, \dots, I_{Nn}^V\} \end{cases}$$
4. The shaper of a portion of training (SPT) and the shaper of tests (ST):
 
$$\begin{cases} U_{in}^* = \Psi_1(U_{in}, I_{in}^U) & U_{in}^*(t_{n-1}) \Rightarrow Y_i^*(t_n) \\ V_{in}^* = \Psi_2(V_{in}, I_{in}^V) & (i \in [1, N], n \in [1, k]) \end{cases}$$

provides the adaptive generation of TI  $U^*$   
and control questions  $V^*$  with the use of addresses in DB  
and parameters of display  $U_i$  and  $V_i$  on the basis I
5. The resultativity of performance of test tasks:
 
$$Y^* = D_Y(Y, V^*)$$

calculation with the operator  $D_Y$  (sensor) on the basis  
of the condition of trainee  $Y$  and a set of questions  $V^*$
6. The task and the purpose of training is represented in the view:
 
$$Z^* = \begin{cases} Q(Y^*) \rightarrow \delta, & \delta - \text{the required LRKT} \\ T(Y^*) \rightarrow \min, \end{cases} \quad \begin{aligned} Y_0 &\rightarrow Y^{**} - CAP(\text{cond.}_{abs.}_{proficiency}) \\ Q_n &\approx \delta (\delta \approx Q^*) \end{aligned}$$
7. The condition of the trainee on the n-th step:
 
$$Y_n \Leftrightarrow P_n \quad P_n = \{p_1^n, p_2^n, \dots, p_i^n, p_N^n\} \quad p_i^n|_{t_n} \in [0, 1]$$

probability of ignorance of the i-th element  
TI at the n-th moment of time  $t_n$   $p^{**} = 0$



8. The condition (the probability of ignorance of contents) of j-th trainee changes by means of a set of TI:

$$P_n^j = F_n^j(P_{n-1}^j, U_n^j, C_{n-1}^j) \quad P_{n-1}^j \Big|_{C_{n-1}} \xrightarrow{U_n} P_n^j$$

9. As the condition of the trainee directly is not observed  $Y_n \Leftrightarrow P_n$ , therefore testing is necessary. At the same time reaction (answer) of the trainee:

$$\begin{cases} R_n = F^0(P_n, U_n, V_n) \\ R_n = (r_{u_1}^n, r_{u_2}^n, \dots, r_{u_i}^n, \dots, r_{u_{M_n}}^n) \end{cases} \quad r_{u_i}^n = \begin{cases} 0 & U_n - \text{educational influence of the set level of difficulty} \\ 1 & \text{(on the basis of the level of required knowledge)} \end{cases}$$

10. The task and algorithm of adaptation of the parameters of cognitive models in the process of training:

$$C_n = \chi(C_{n-1}, R_n) \quad Y_n \Leftrightarrow P_n = \chi(P_{n-1}, U_n, R_n)$$

11. The algorithm of training allows to define the optimum portion of TI at each step:

$$Q(P_{n+1}) = Q(F(P_n, U_{n+1}, C_n)) \rightarrow \min_{U_i, R_j} \Rightarrow U_{n+1}^*$$

12. The probability of ignorance of the elements of TI:  $\alpha_i^{n+1} = \begin{cases} \alpha_i^n (i \notin U_n) \\ \gamma' \alpha_i^n (i \in U_n; r_i^n = 0) \\ \gamma'' \alpha_i^n (i \in U_n; r_i^n = 1; n = 1, 2, \dots) \end{cases}$

$$p_i^n = p_i(t_i^n) = 1 - e^{-\alpha_i^n t_i^n} \quad (i \in \{1, \dots, N\}, n \in \{1, \dots, \infty\})$$

13. The criterion of quality of training:

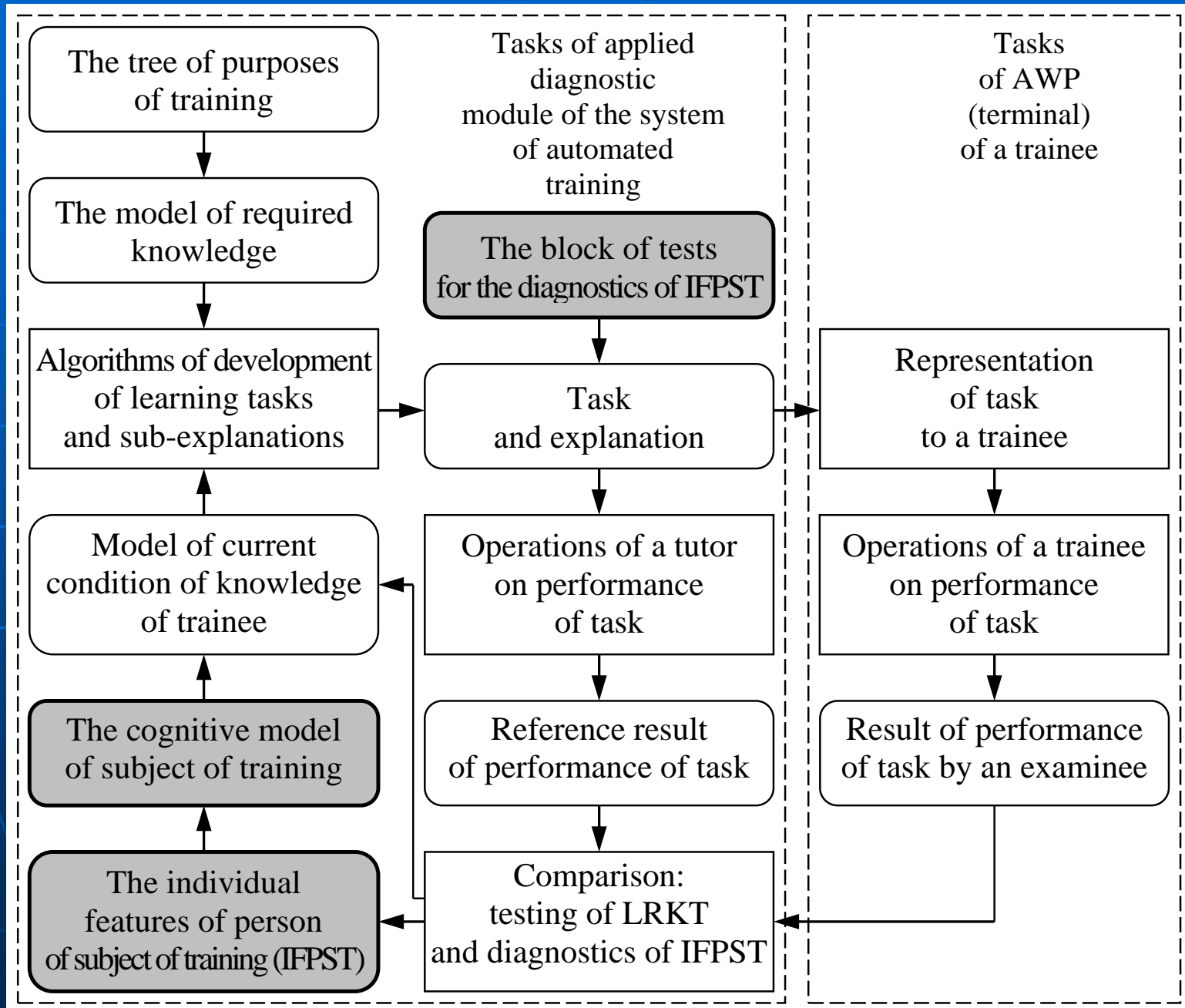
$$Q_n = \sum_{i=1}^N p_i(t_i^n) q_i \quad Q_n = \sum_{i=1}^N p_i(t_i^n) q_i \rightarrow \min_{U_n \in \Phi(L_n)} \Rightarrow U_n^*$$

$$t_i^{n+1} = \begin{cases} \Delta t_i^n (i \in U_n) \\ t_i^{n+1} + \Delta t_i^n (i \notin U_n); n = 0, 1, \dots \end{cases}$$

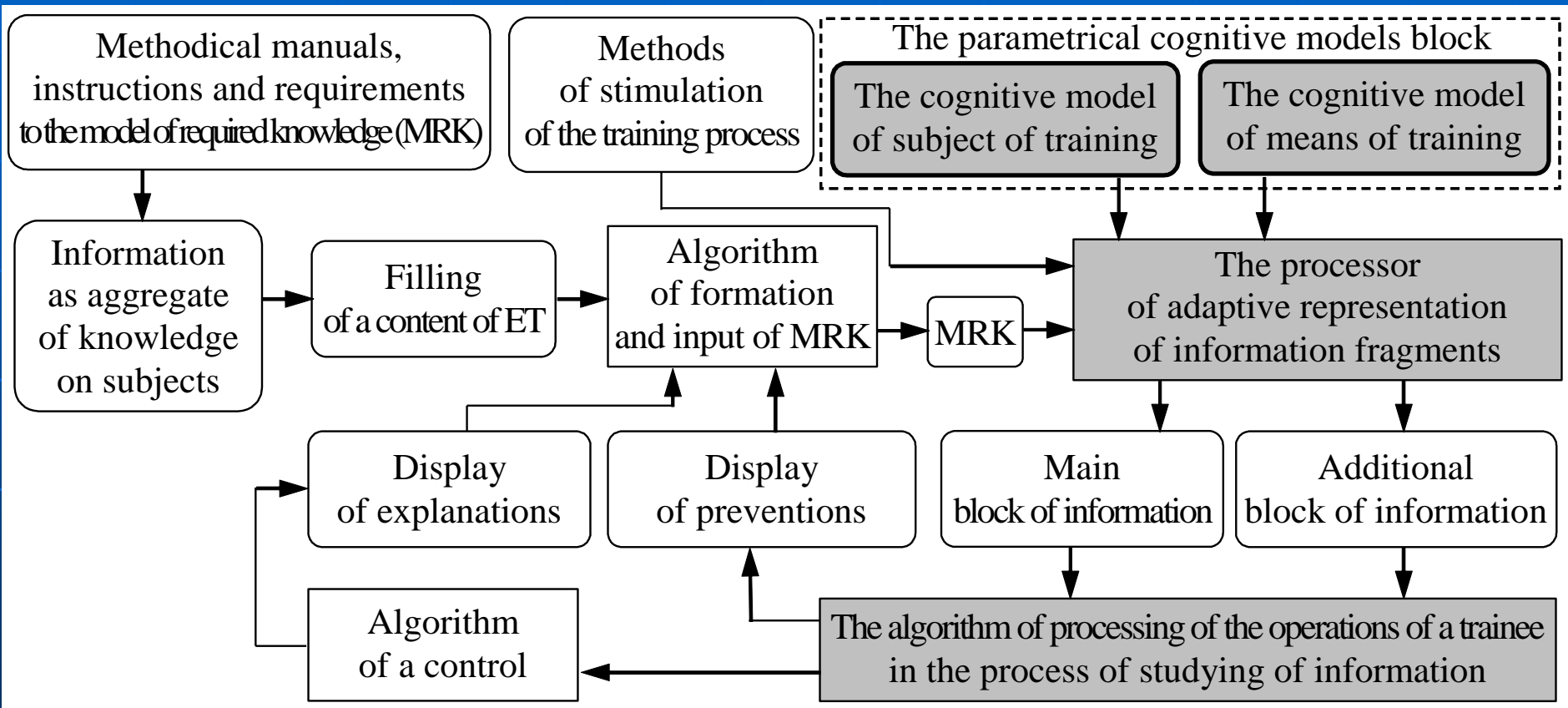
14. The algorithm of selection of information fragments

$$\begin{cases} u_1 = \max_{i \in [1, N]} p_i(t_i^n) q_i \\ u_i = \max_{i \in [1, N] (i \neq u_1)} p_i(t_i^n) q_i \\ u_{M_n} = \max_{i \in [1, N] (i = u_j, j = [1, M_n])} p_i(t_i^n) q_i \end{cases}$$

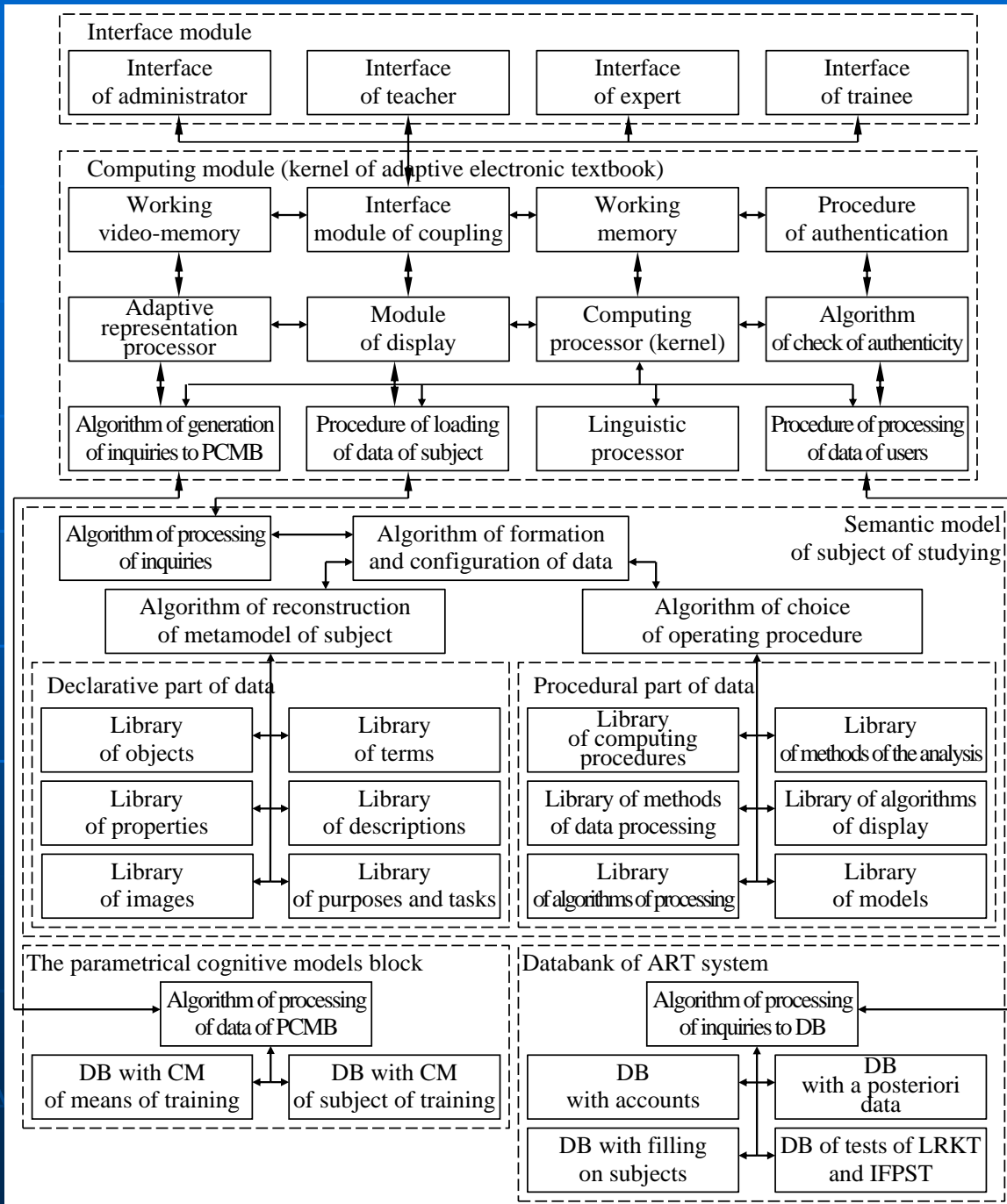
The scheme, reflecting the principle (algorithm) of functioning of the basic and applied diagnostic modules



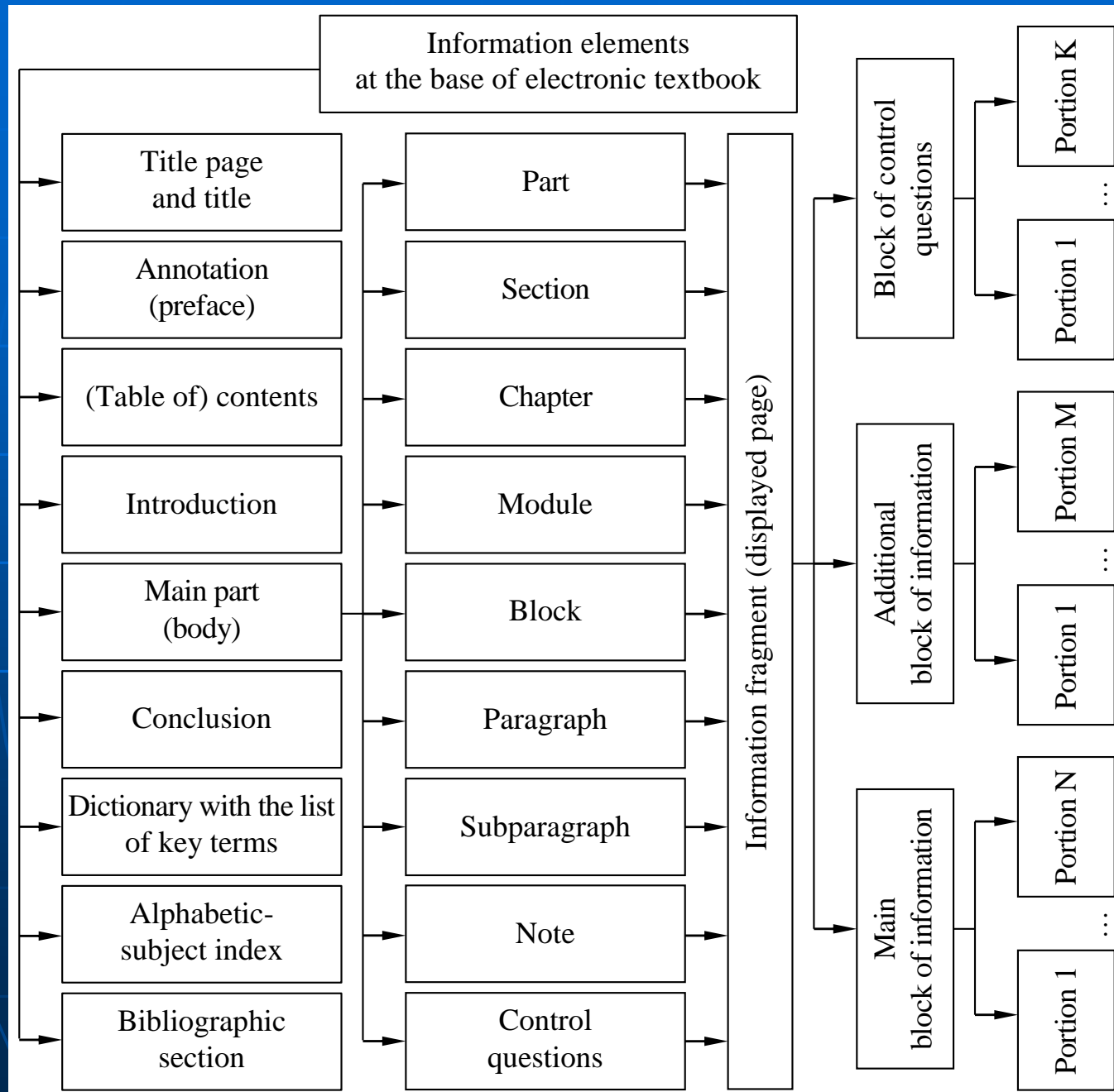
The scheme, reflecting the principle (algorithm) of functioning of the electronic textbook with adaptation based on the parametrical cognitive models block



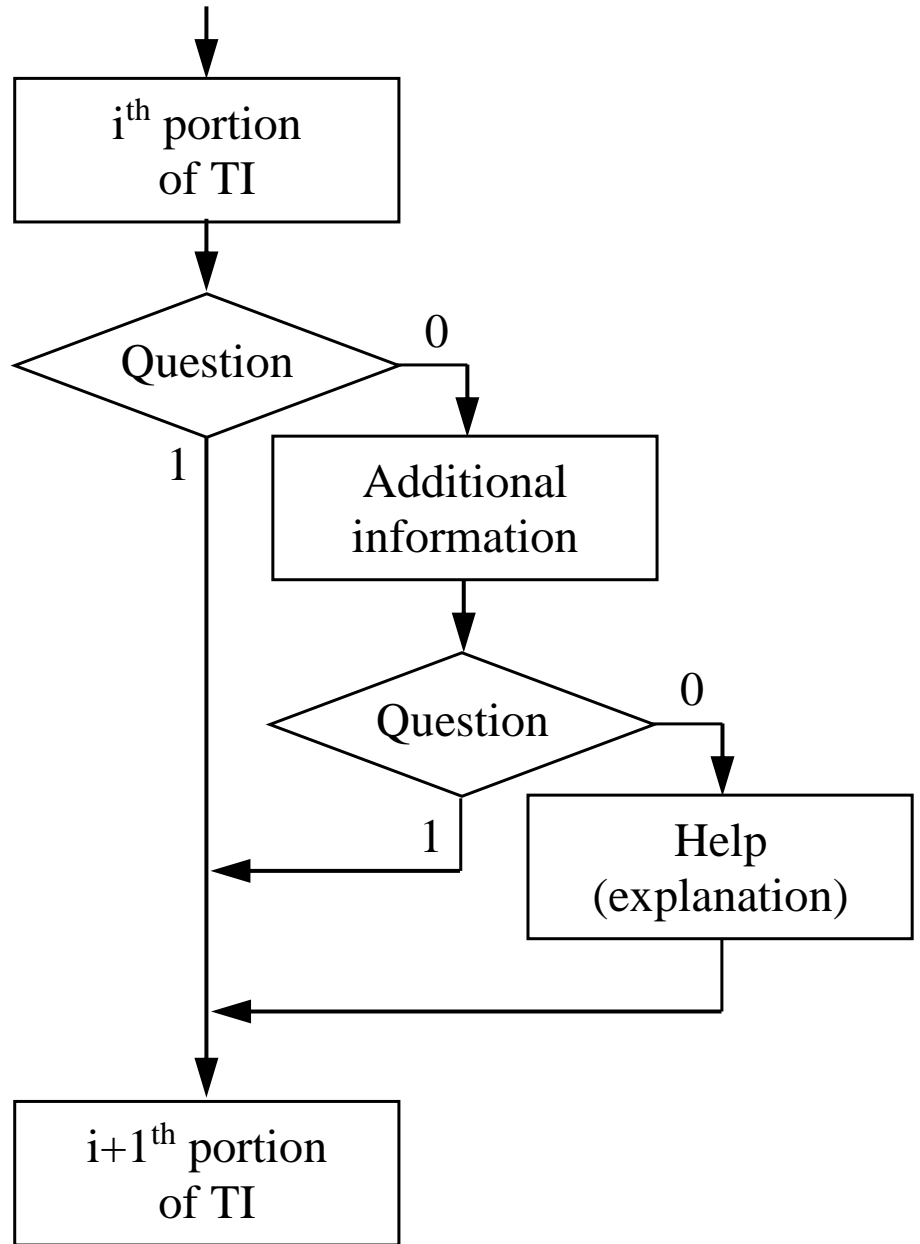
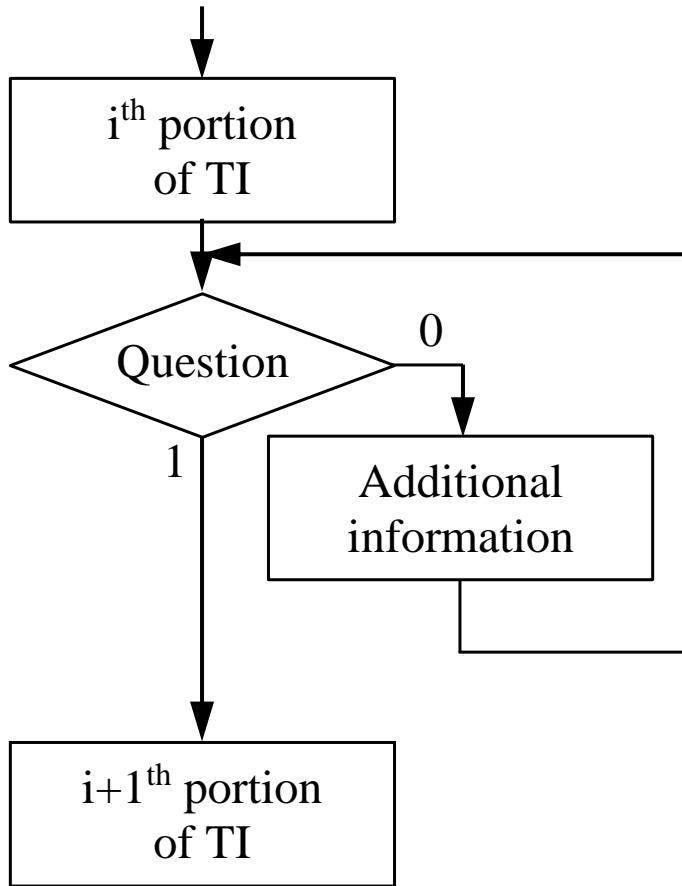
# The features of architecture of the adaptive electronic textbook



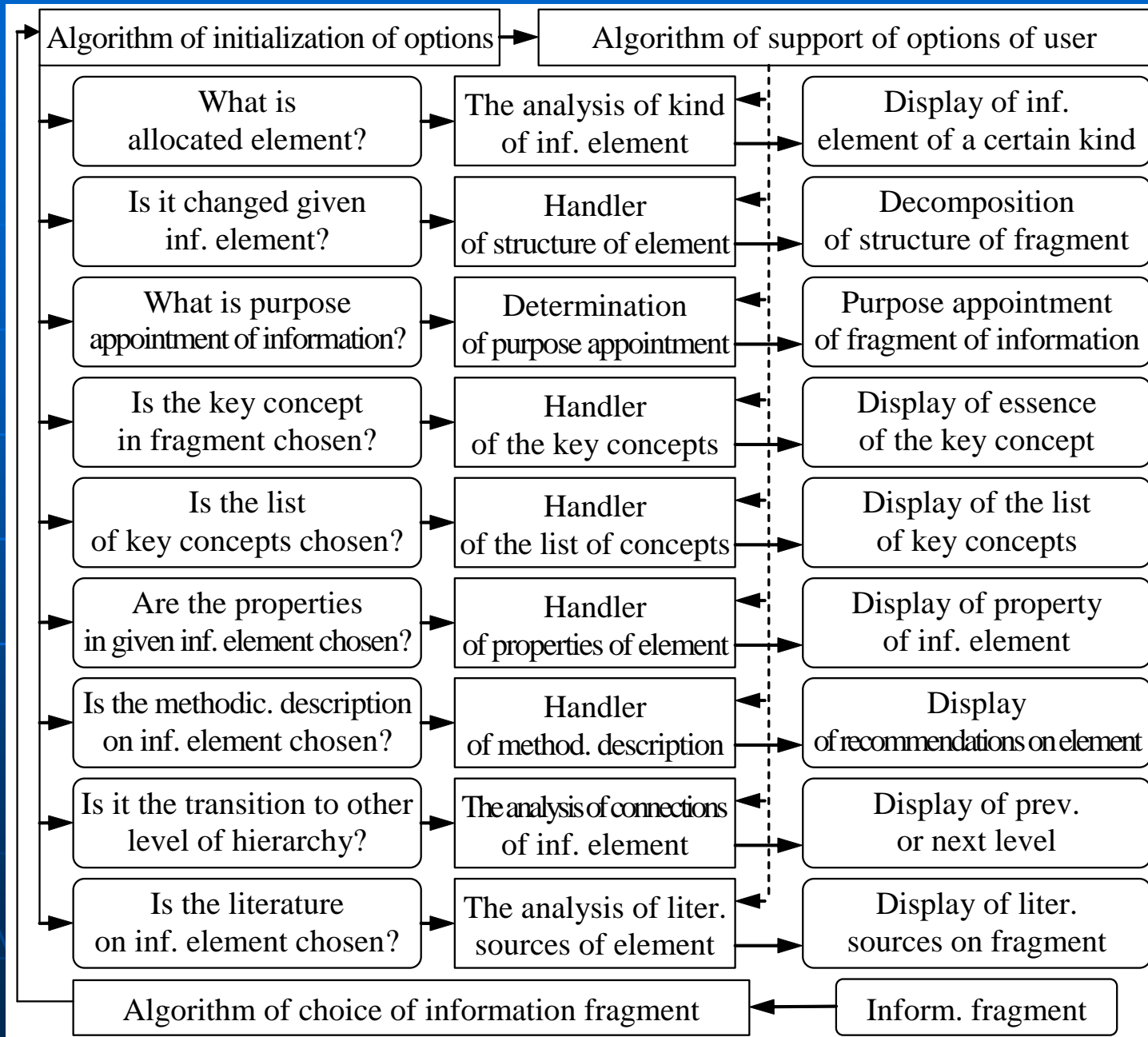
# The information structure of the subject of studying, displayed at the level of representation of data by means of the electronic textbook

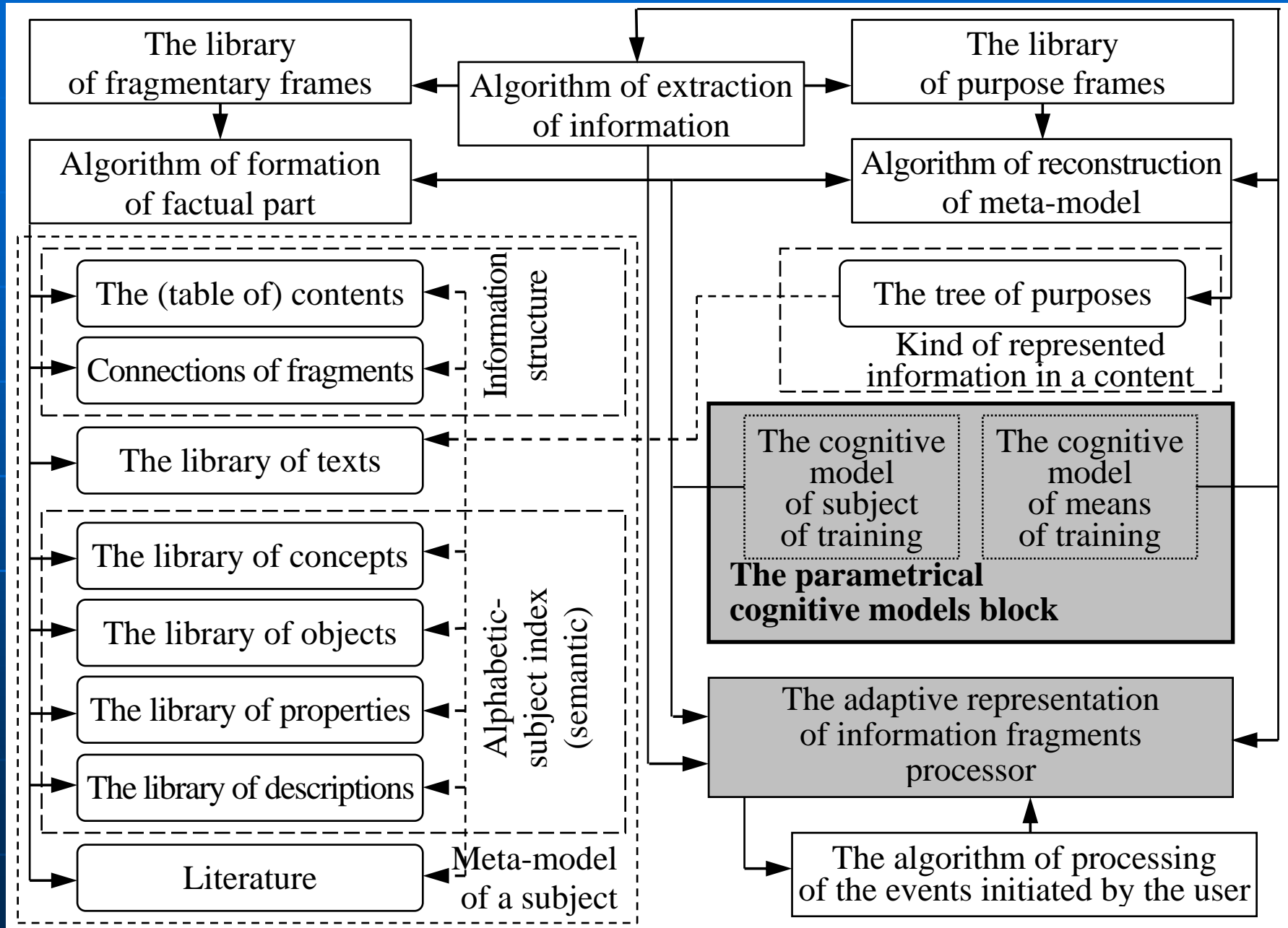


The schemes of realization of branching (1 – correct answer, 0 – wrong answer):  
at the left – linear model and at the right – branched model



# The algorithm of processing of events initiated by the user in the adaptive means of training (electronic textbook)

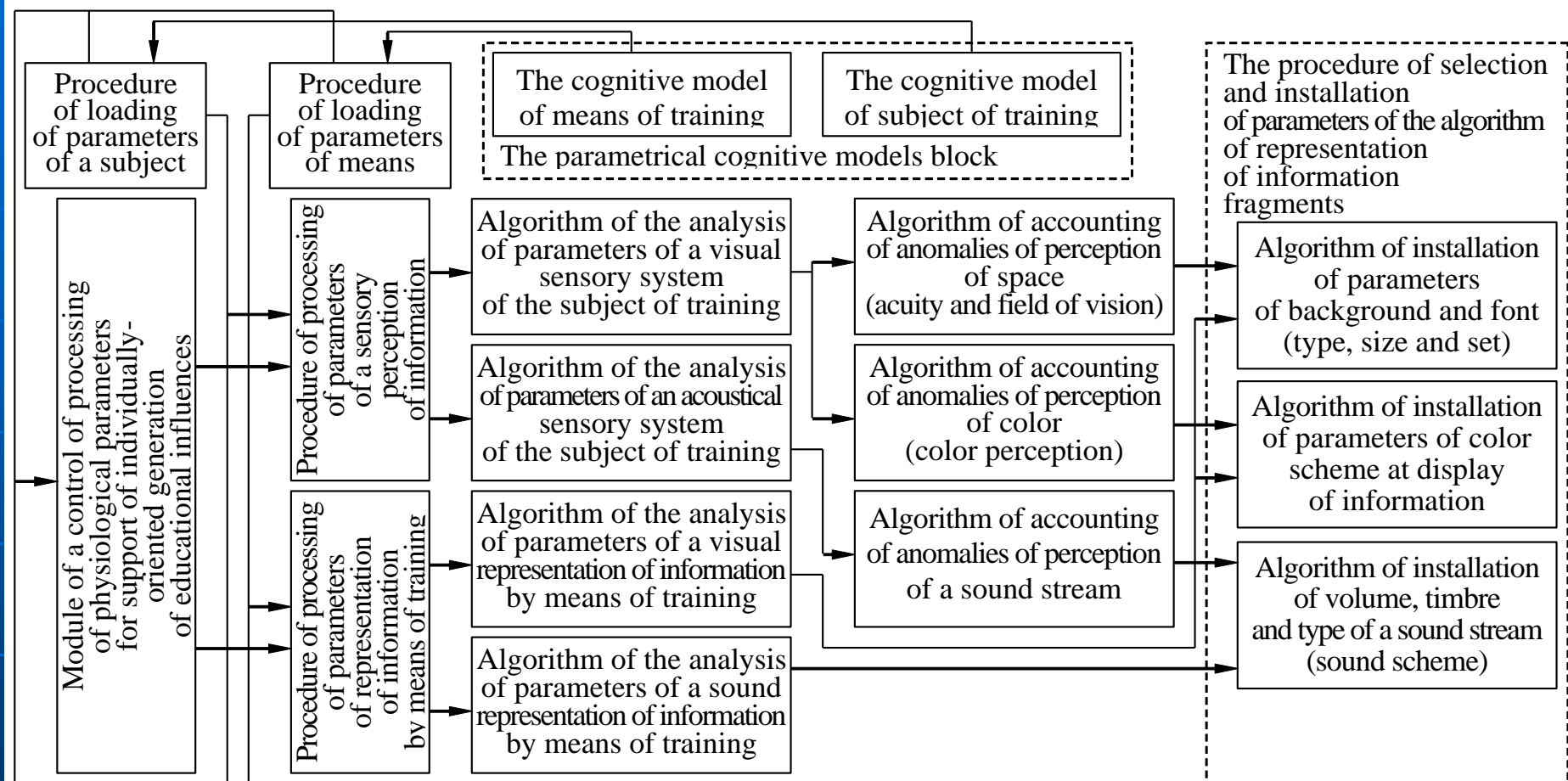




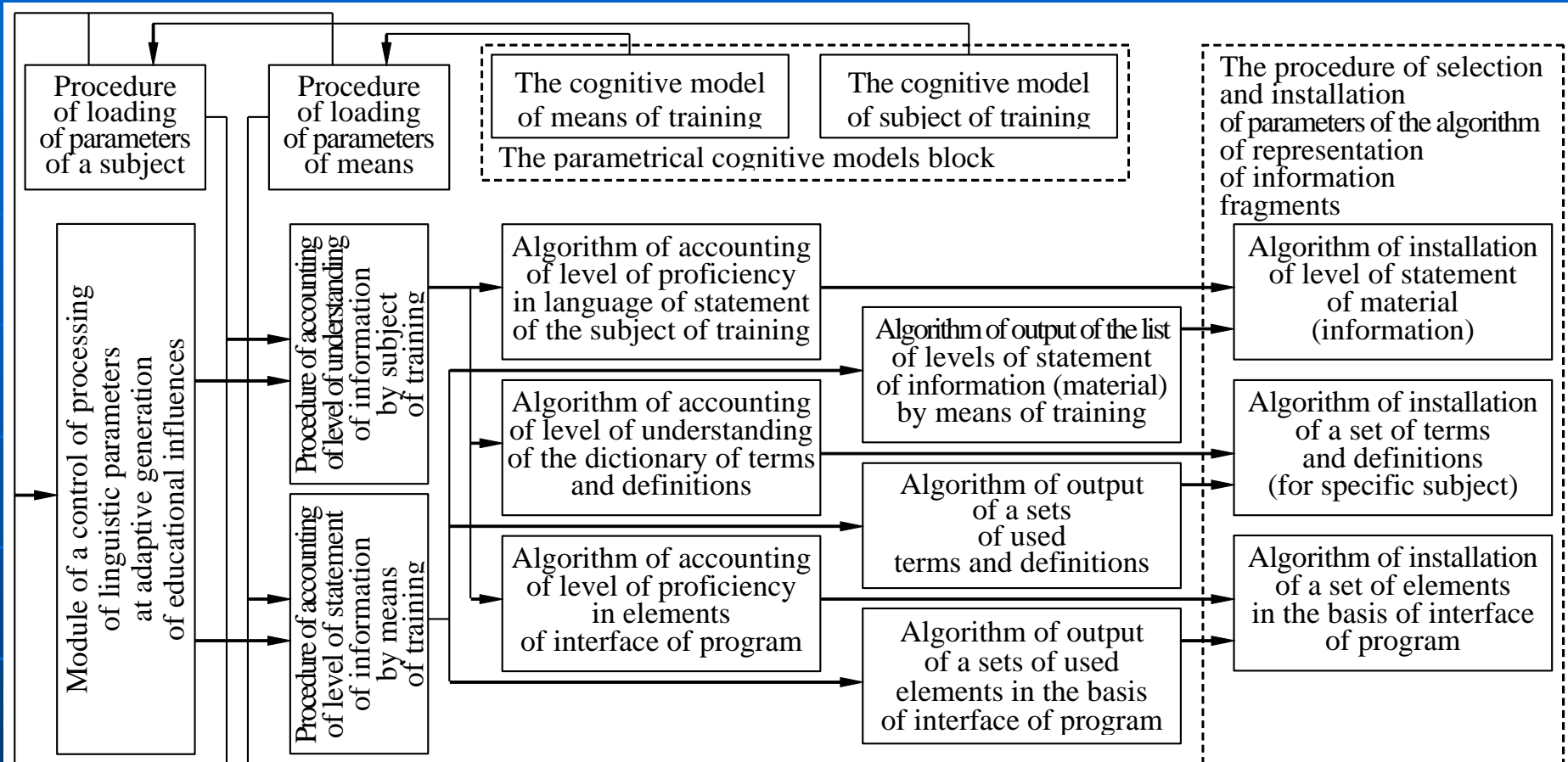


# The structurally-functional scheme of the adaptive representation of information fragments processor (1 from 3)

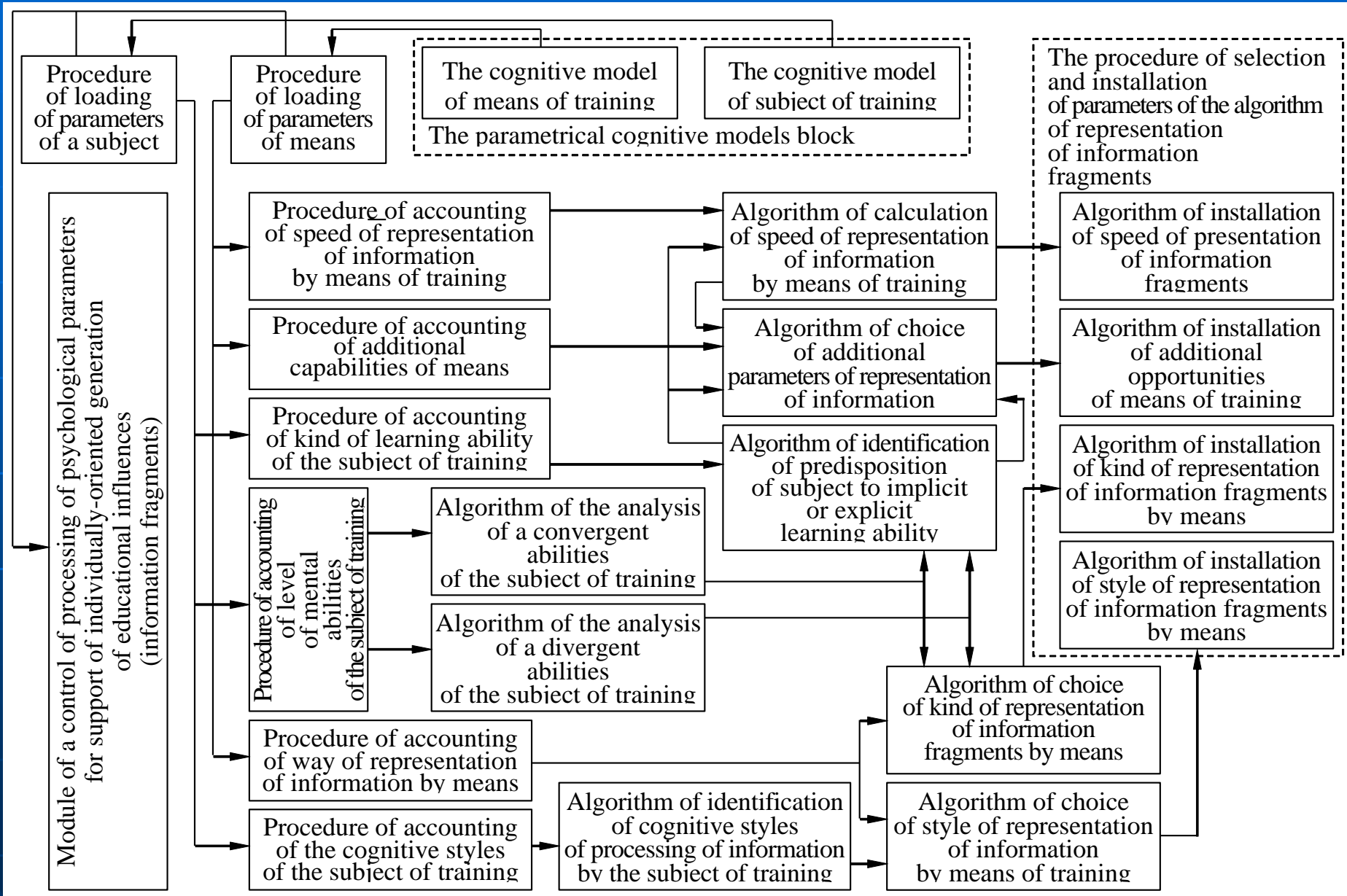
1.8.1

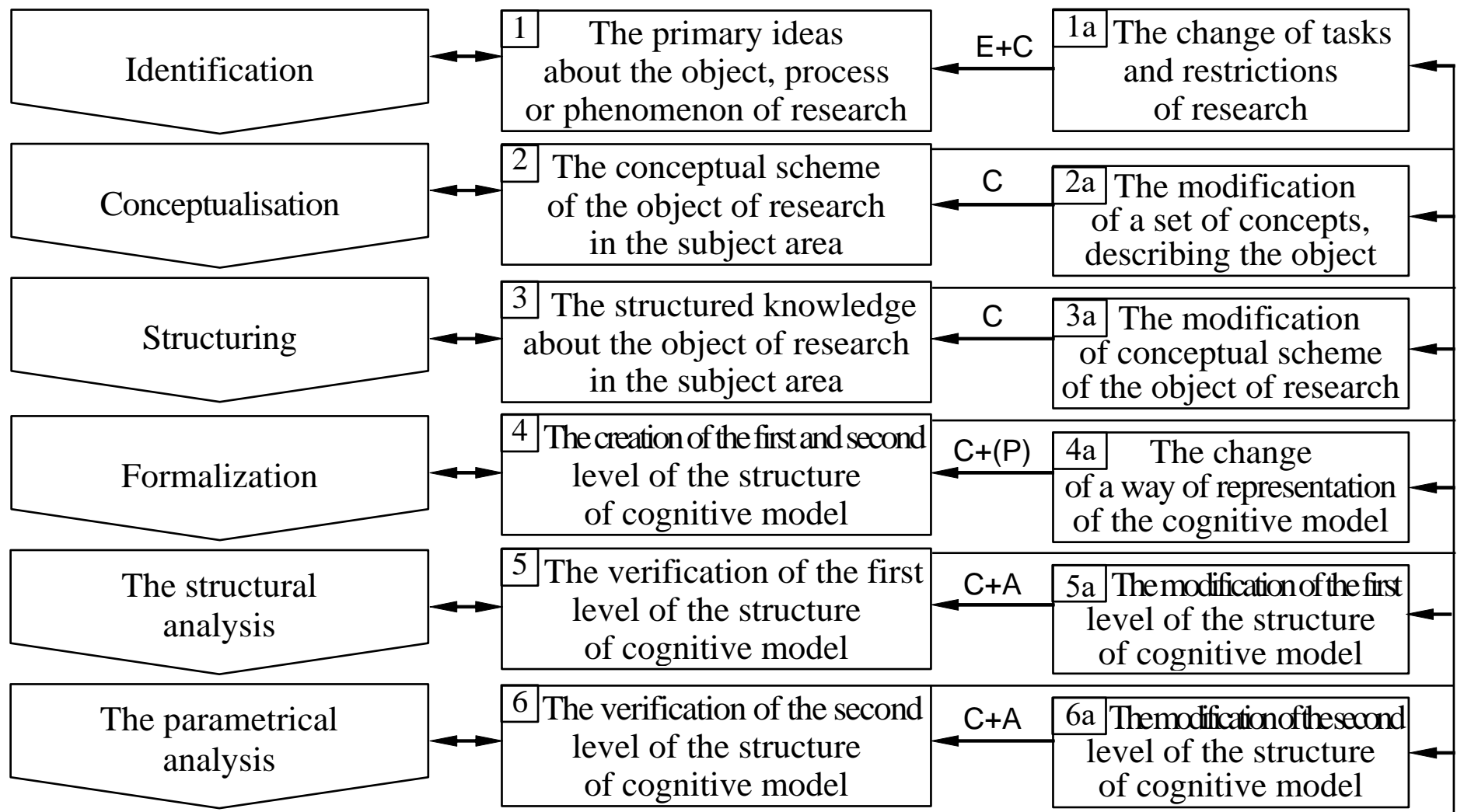


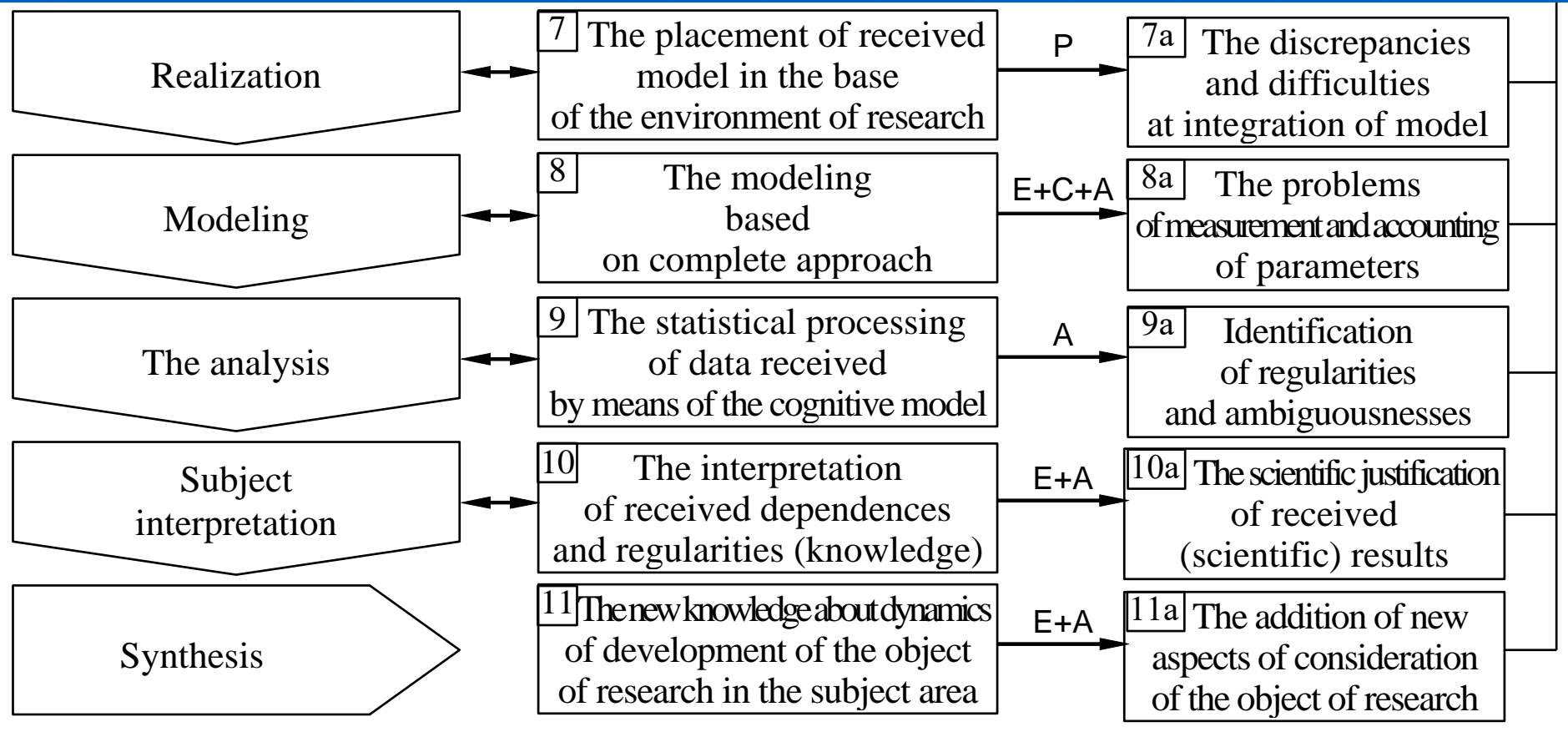
# The structurally-functional scheme of the adaptive representation of information fragments processor (2 from 3)



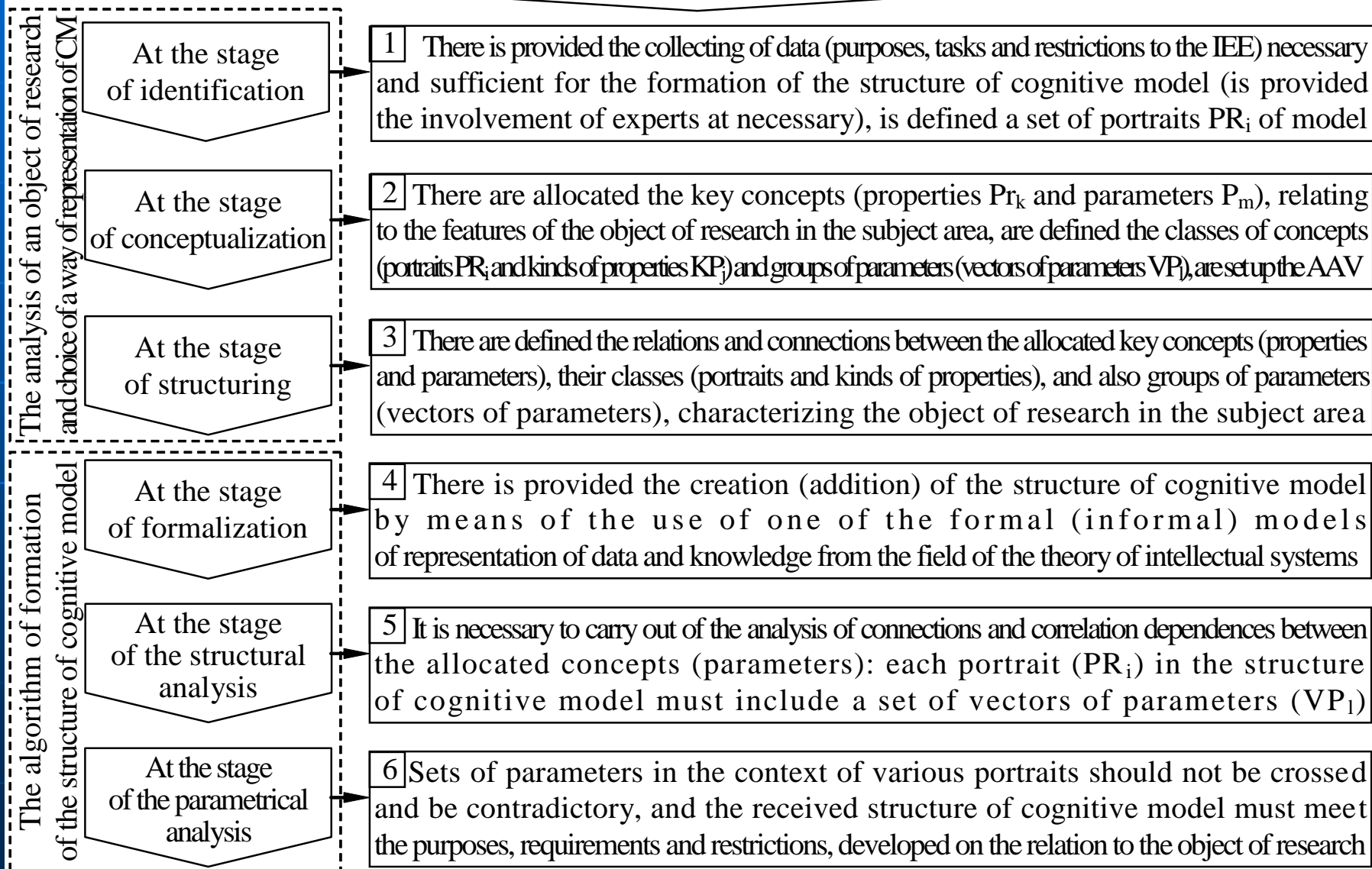
# The structurally-functional scheme of the adaptive representation of information fragments processor (3 from 3)

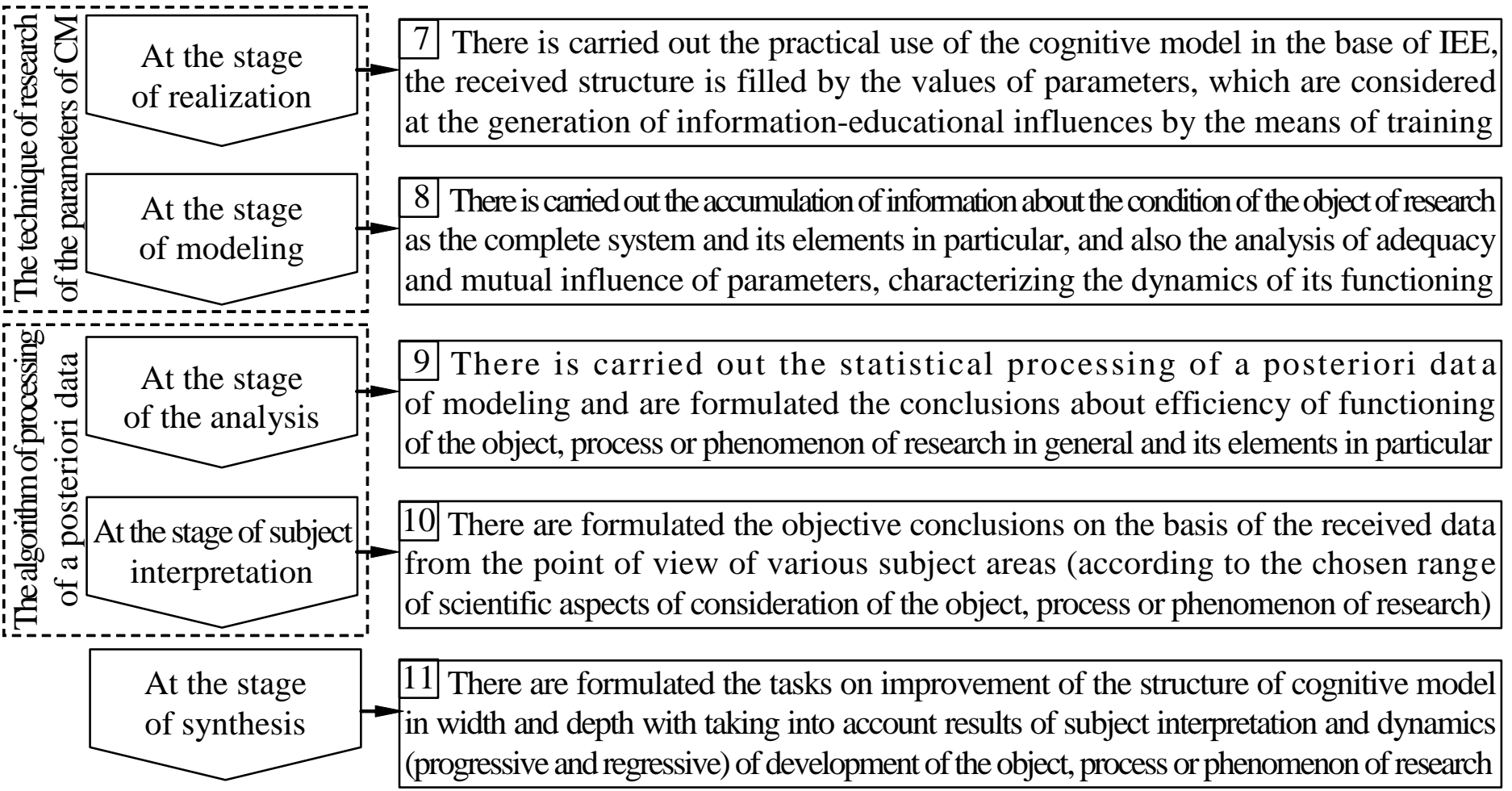




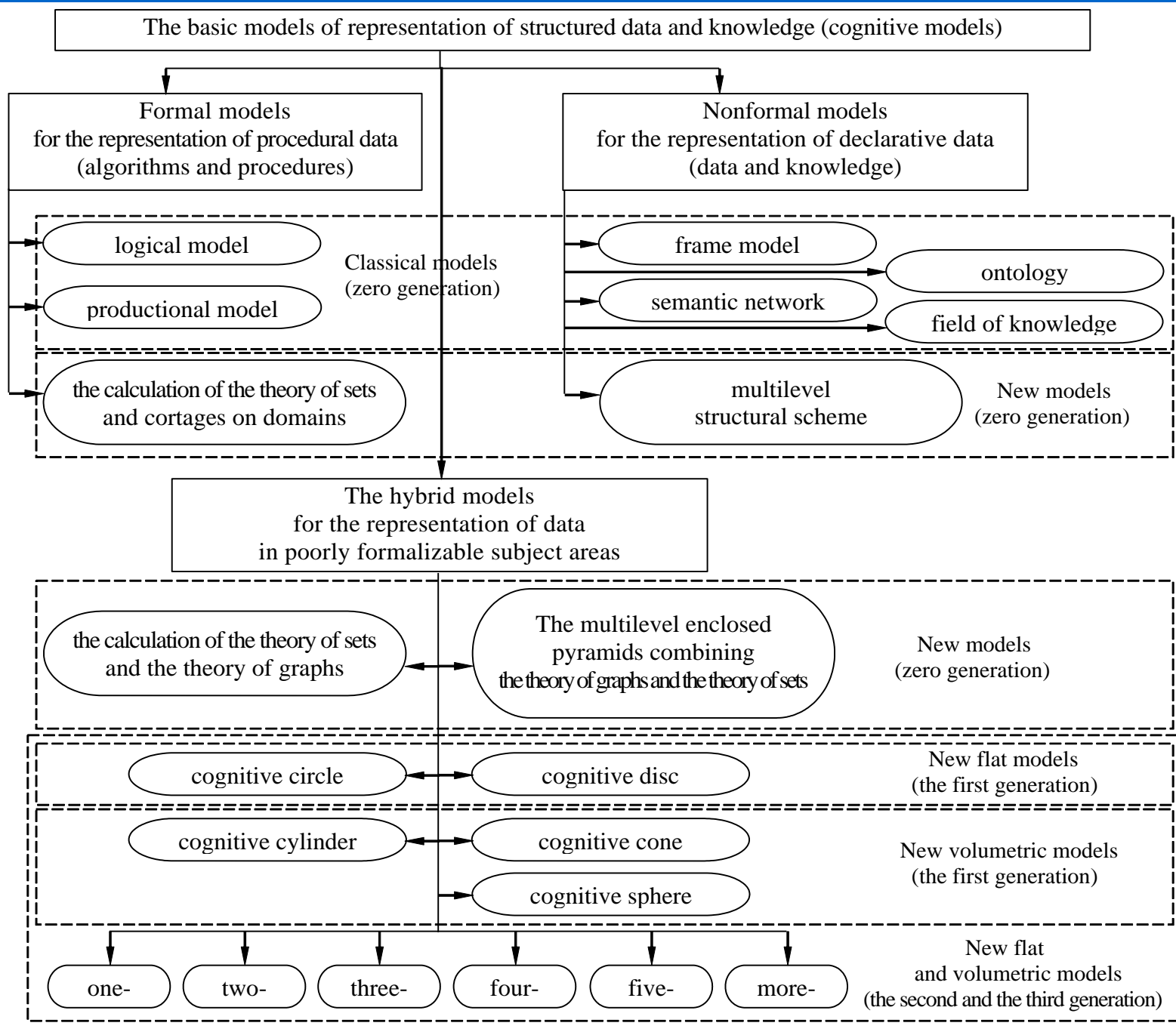


For the use of the cognitive modeling technology in relation to the object of research in the subject area it is necessary to satisfy a set of conditions at each stage



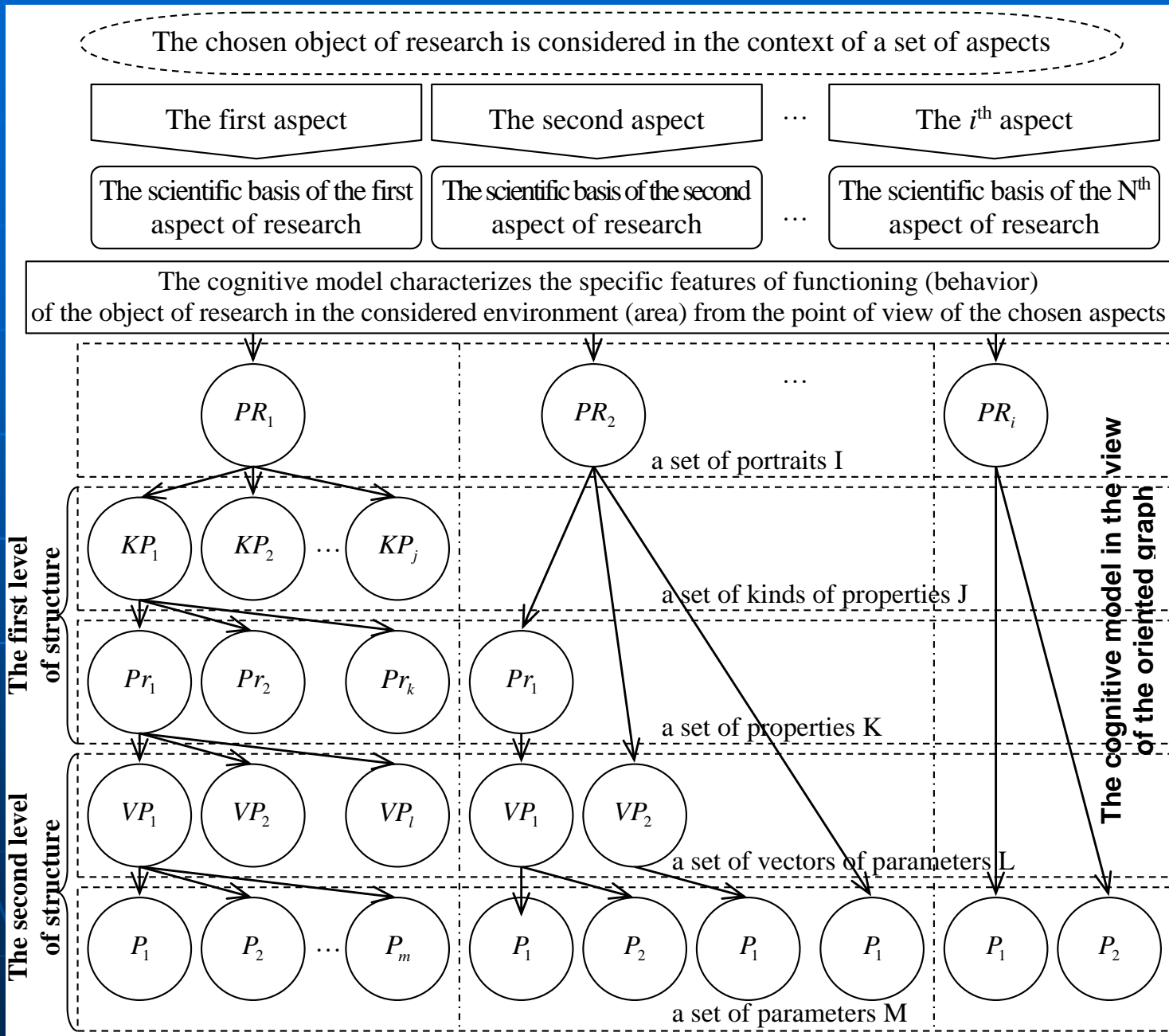


# The recommended bases for the construction of the structure of cognitive model

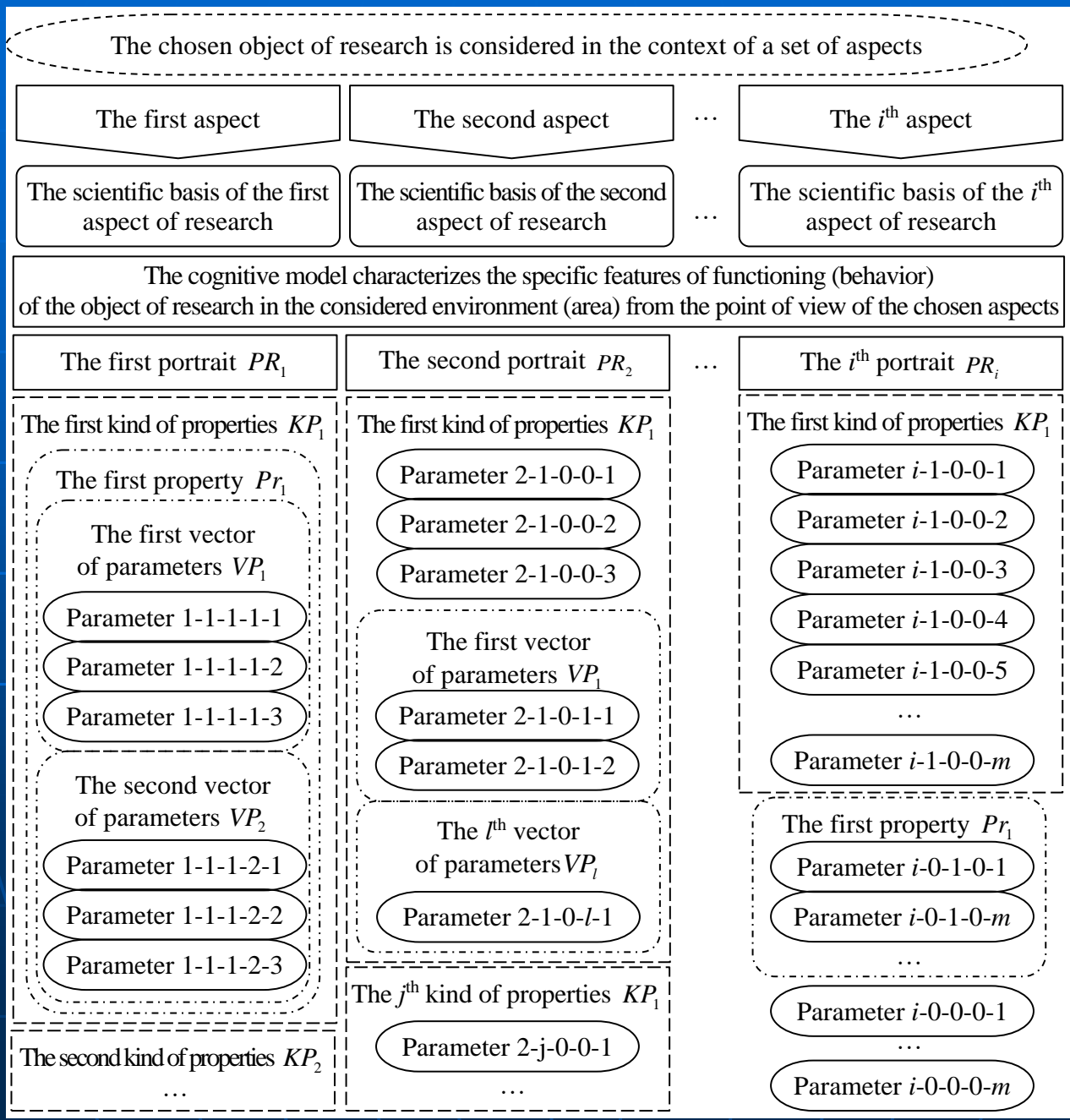


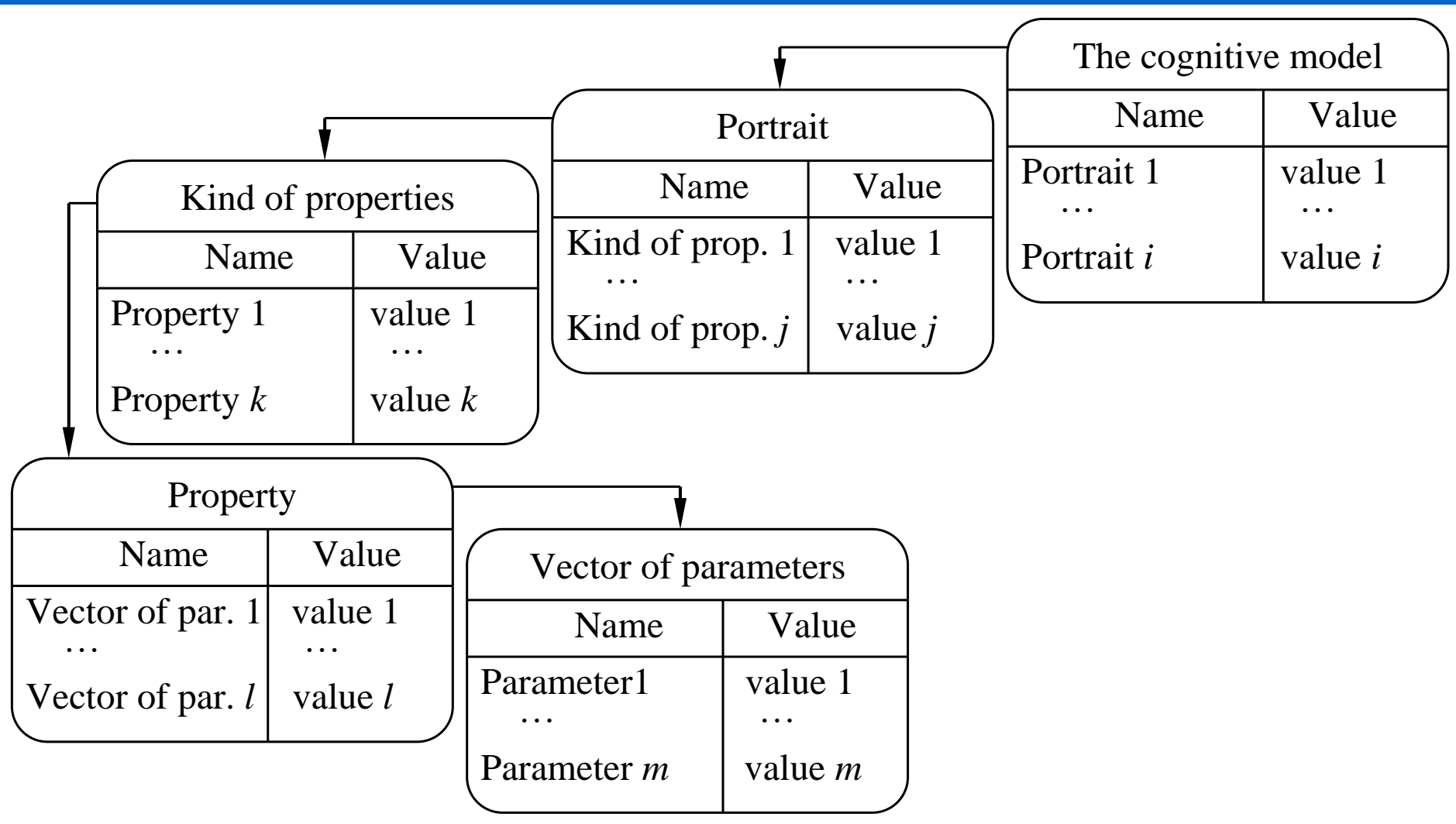


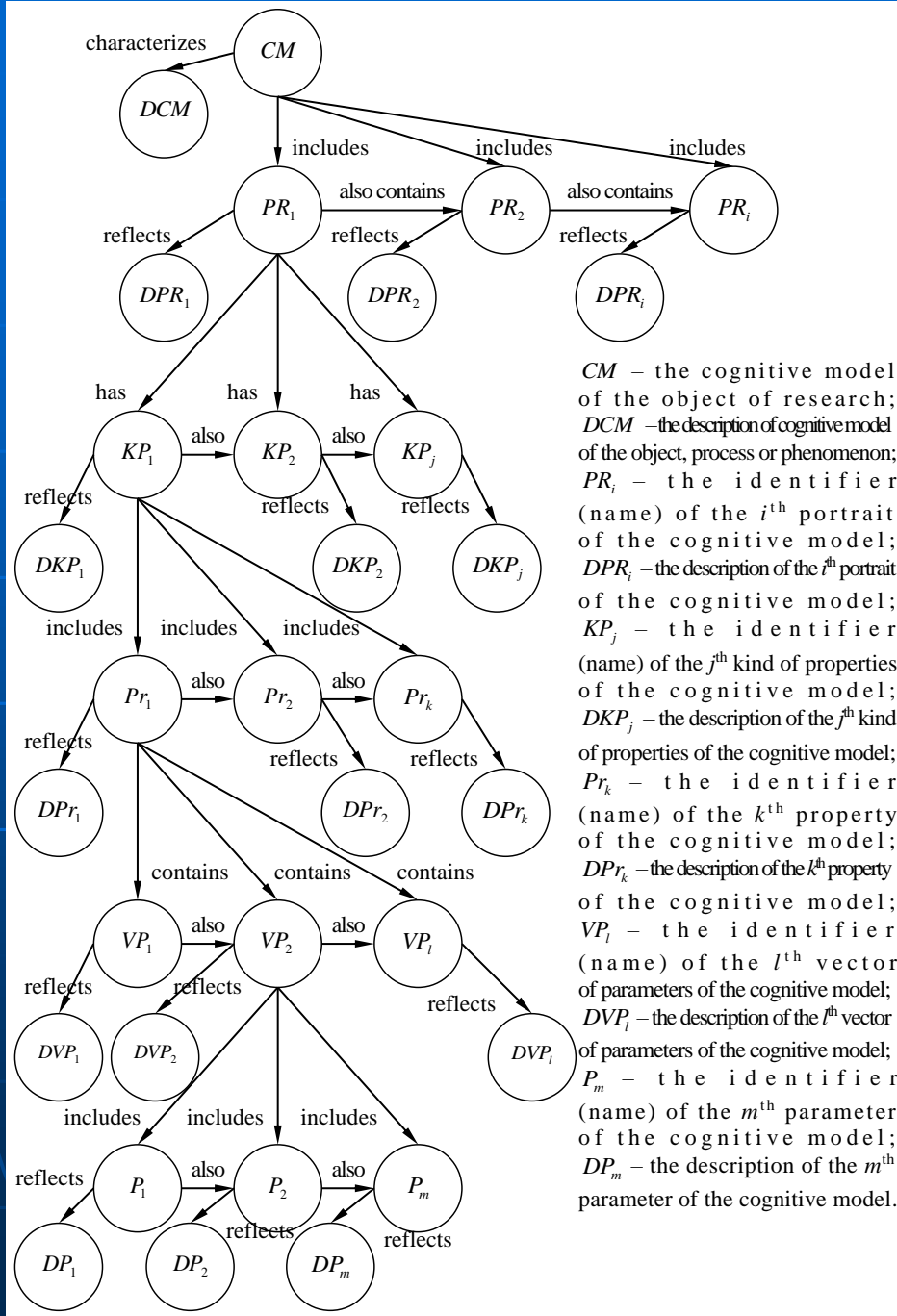
# The recommended basis for the construction of the structure of cognitive model in the view of the oriented graph combining the theory of sets



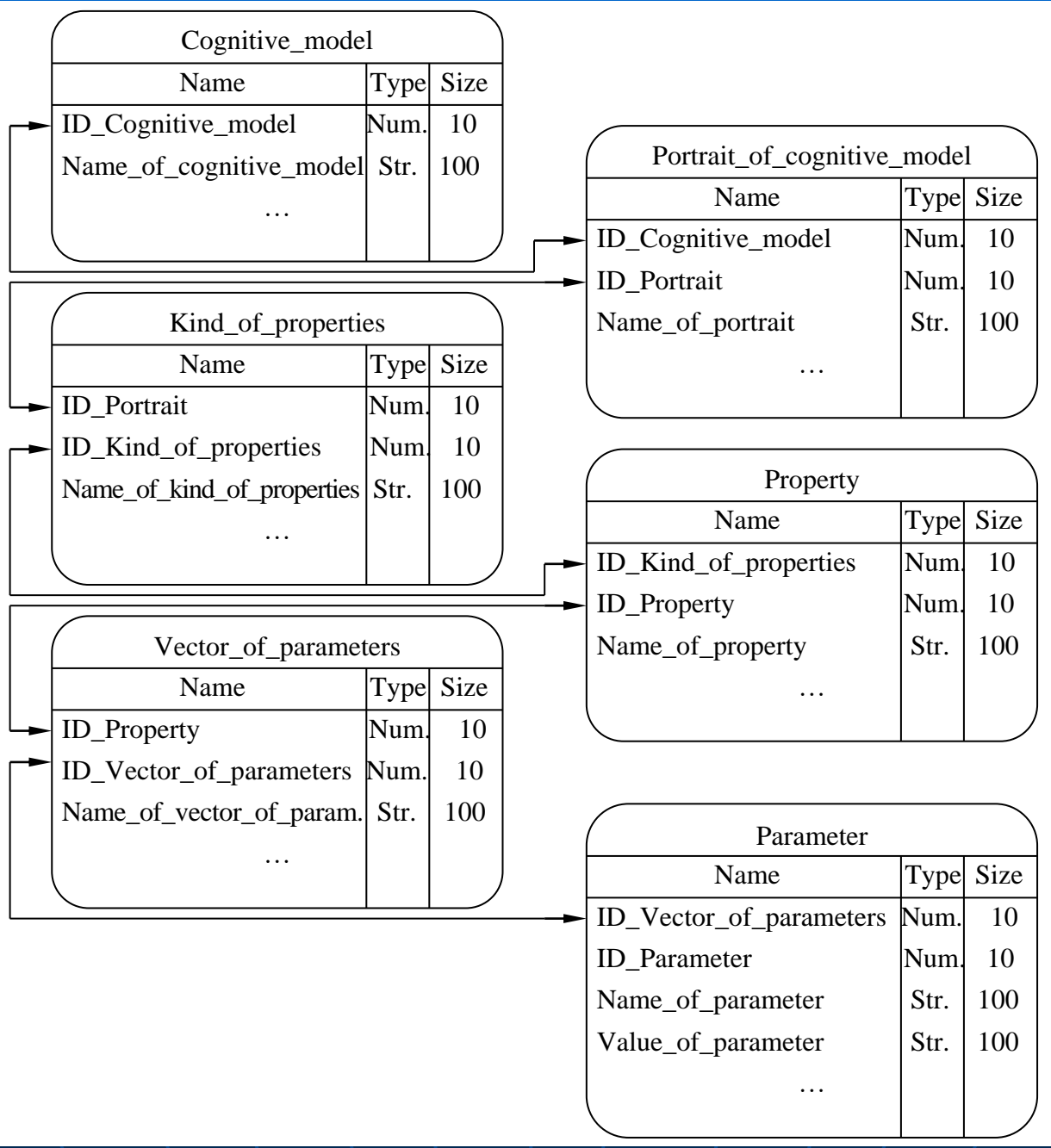
# The recommended basis for the construction of the structure of cognitive model in the view of the structural scheme (without connections between information elements)







*CM* – the cognitive model of the object of research;  
*DCM* – the description of cognitive model of the object, process or phenomenon;  
*PR<sub>i</sub>* – the identifier (name) of the *i*<sup>th</sup> portrait of the cognitive model;  
*DPR<sub>i</sub>* – the description of the *i*<sup>th</sup> portrait of the cognitive model;  
*KP<sub>j</sub>* – the identifier (name) of the *j*<sup>th</sup> kind of properties of the cognitive model;  
*DKP<sub>j</sub>* – the description of the *j*<sup>th</sup> kind of properties of the cognitive model;  
*Pr<sub>k</sub>* – the identifier (name) of the *k*<sup>th</sup> property of the cognitive model;  
*DPr<sub>k</sub>* – the description of the *k*<sup>th</sup> property of the cognitive model;  
*VP<sub>l</sub>* – the identifier (name) of the *l*<sup>th</sup> vector of parameters of the cognitive model;  
*DVP<sub>l</sub>* – the description of the *l*<sup>th</sup> vector of parameters of the cognitive model;  
*P<sub>m</sub>* – the identifier (name) of the *m*<sup>th</sup> parameter of the cognitive model;  
*DP<sub>m</sub>* – the description of the *m*<sup>th</sup> parameter of the cognitive model.



At the stage  
of identification

1 Proceeding from the received primary representations, it is required to define the necessary quantity of portraits ( $PR_i$ ) in the base of structure of cognitive model sufficient for the carrying out of the analysis of the object of research, considered in the context of a set of scientific aspects

At the stage  
of conceptualization

2 It is necessary to allocate (to add) a set of kinds of properties ( $KP_j$ ), which characterize the object of research from the point of view of a certain scientific aspect and to bring them in the corresponding portrait ( $PR_i$ ) of cognitive model

On the first  
step

2.1 It is required to characterize each kind of properties ( $KP_j$ ) of the object of research by a set of elementary properties ( $Pr_k$ ): if in the kind of properties it is impossible to mark out the elementary properties, then it is elementary property

On the second  
step

2.2 Each elementary property ( $Pr_k$ ) of the object of research needs to be characterized by the vector of parameters ( $VP_l$ ): if in the elementary property it is impossible to allocate the vector of parameters, then it is the vector of parameters

On the third  
step

2.3 It is required to determine the elementary parameters ( $P_m$ ) entering into the basis of each vector of parameters ( $VP_l$ ): if in the vector of parameters it is impossible to allocate the elementary parameters, then it is elementary parameter

At the stage  
of structuring

3 It is necessary to unite the received results of previous technological stage and to form the structure of cognitive model (newly created or to decompose the existing with taking into account the new components and possible restrictions)

At the stage  
of formalization

4 It is necessary to choose one of the formal (logical, graph, theory of sets and etc.) or informal (conceptual model, ontology of the object of research and etc.) models of representation of structural components of cognitive model

On the first  
step

4.1 It is necessary to create the first level of cognitive model: according to the chosen aspects of research and received earlier results it is necessary to form a set of portraits of CM (I), then to set up a set of kinds of properties (J) and a set of properties (K)

On the second  
step

4.2 It is required to create the second level of cognitive model: it is necessary to add the received structure of cognitive model (the first level), having formed a set of vectors of parameters (L) and having given a set of parameters (M)

At the stage  
of the structural  
analysis

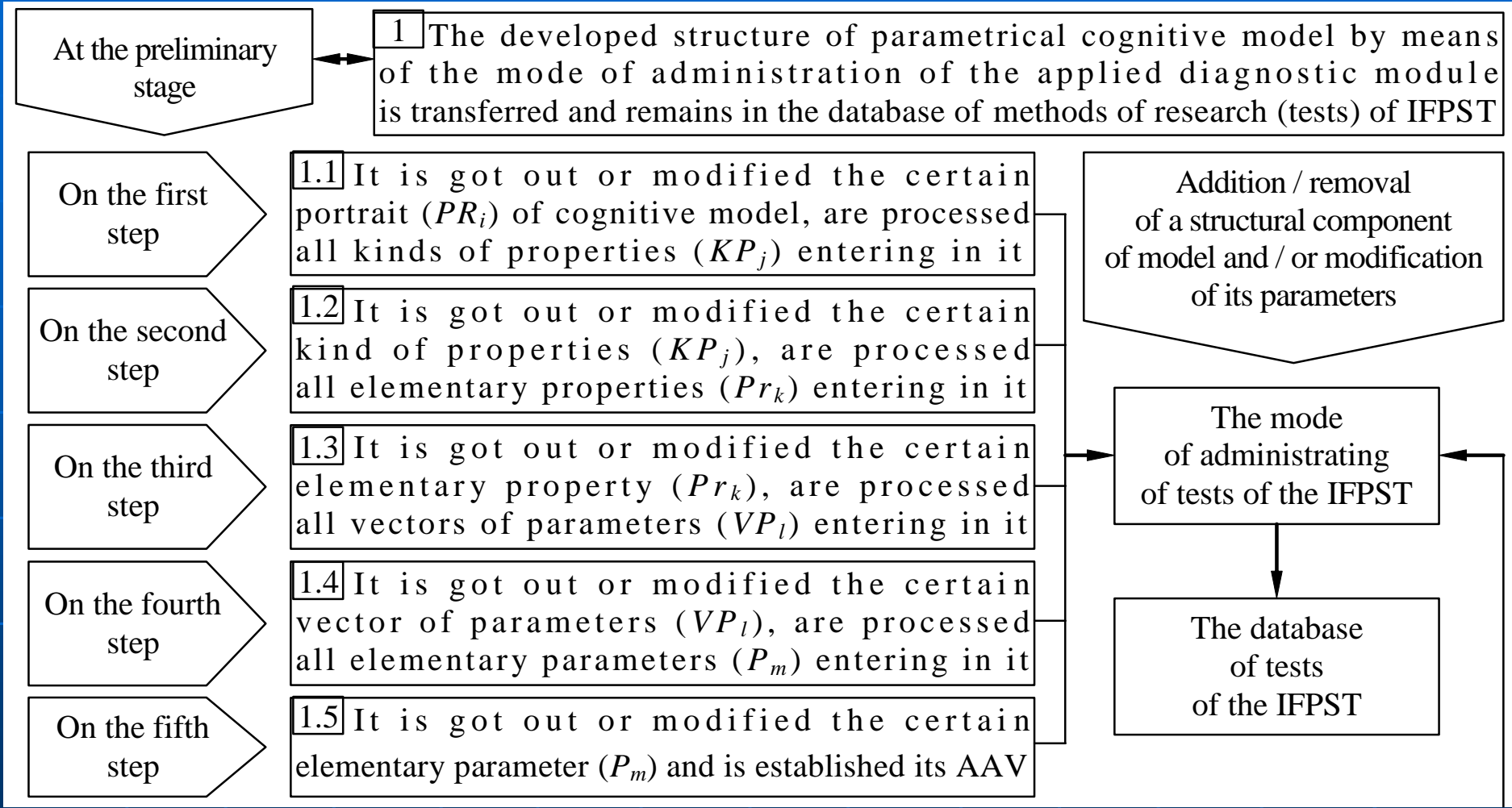
5 It is carried out the system analysis of structure of received cognitive model at the first level – a set of kinds of properties (J) and properties (K): components in a corresponding sets qualitatively characterize the object of research

At the stage  
of the parametrical  
analysis

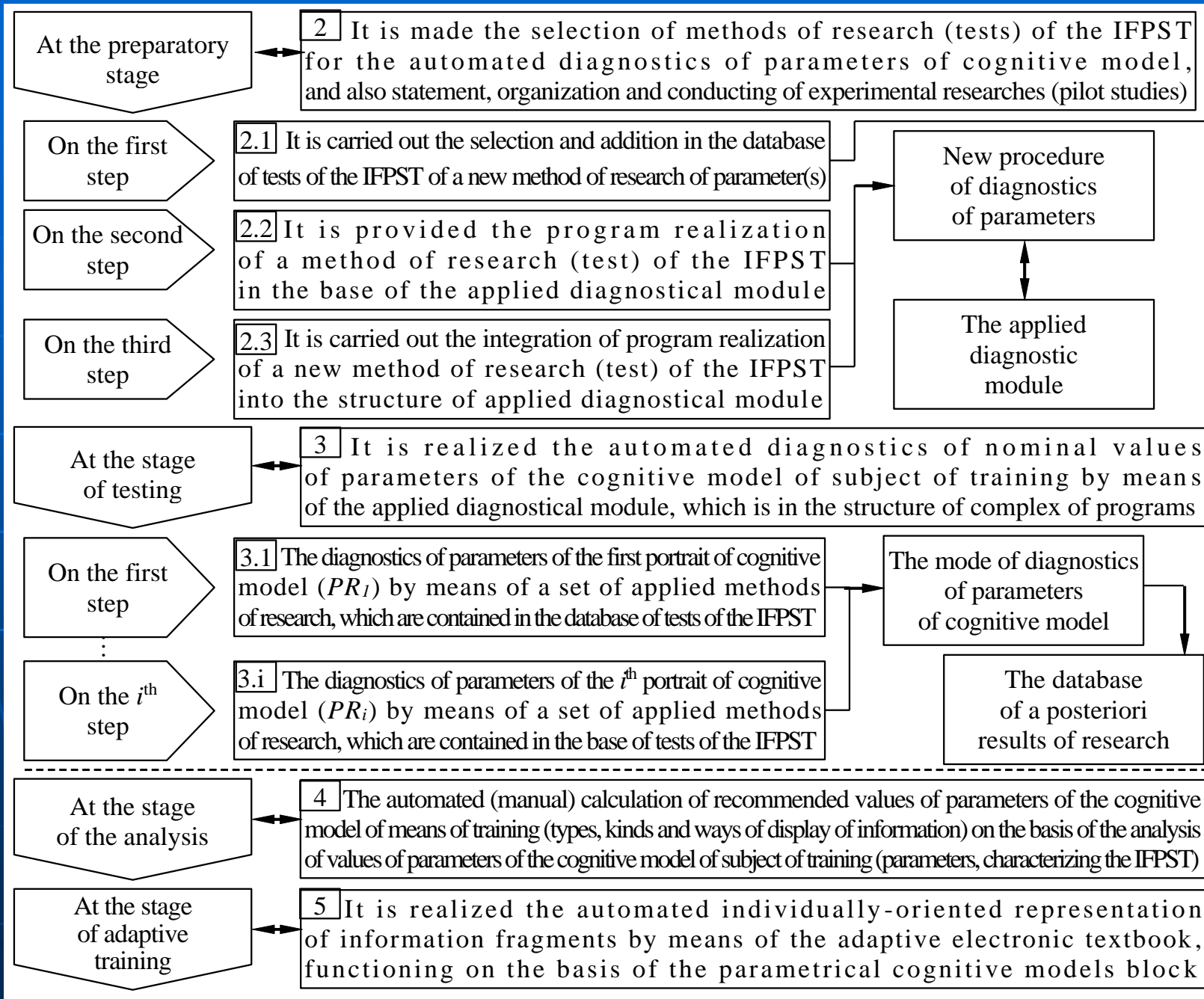
6 It is realized the analysis of structure of received cognitive model at the second level – a sets of vectors of parameters (L) and parameters (M): values of parameters of the second level of structure of cognitive model characterize the IFPST and should not be contradictory

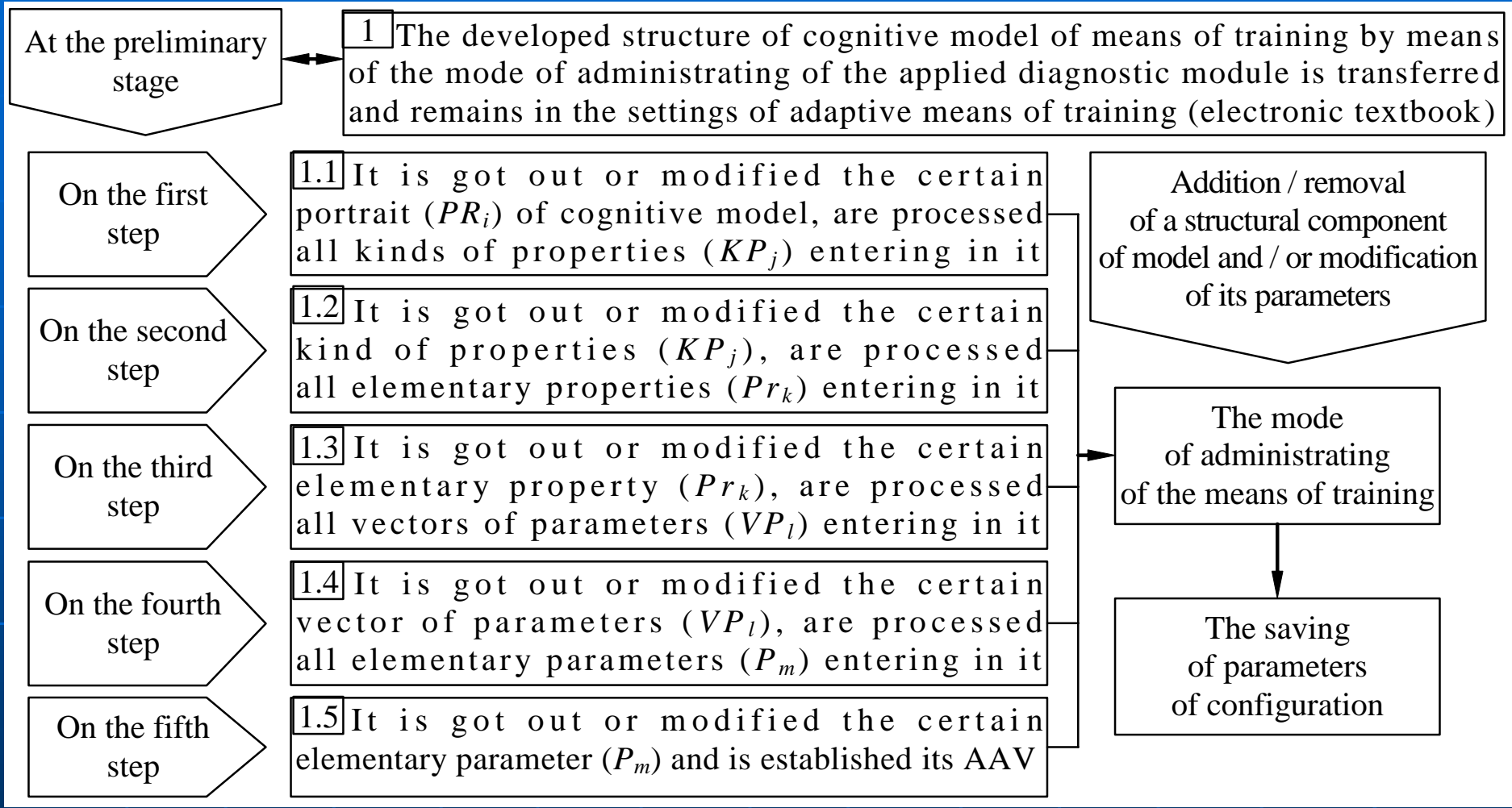
At the stage of realization  
and subsequents

7 It is carried out the encapsulation of received structure of cognitive model in the basis of information-educational environment, the filling of parameters of model by a posteriori data of modeling, their statistical analysis and subject interpretation

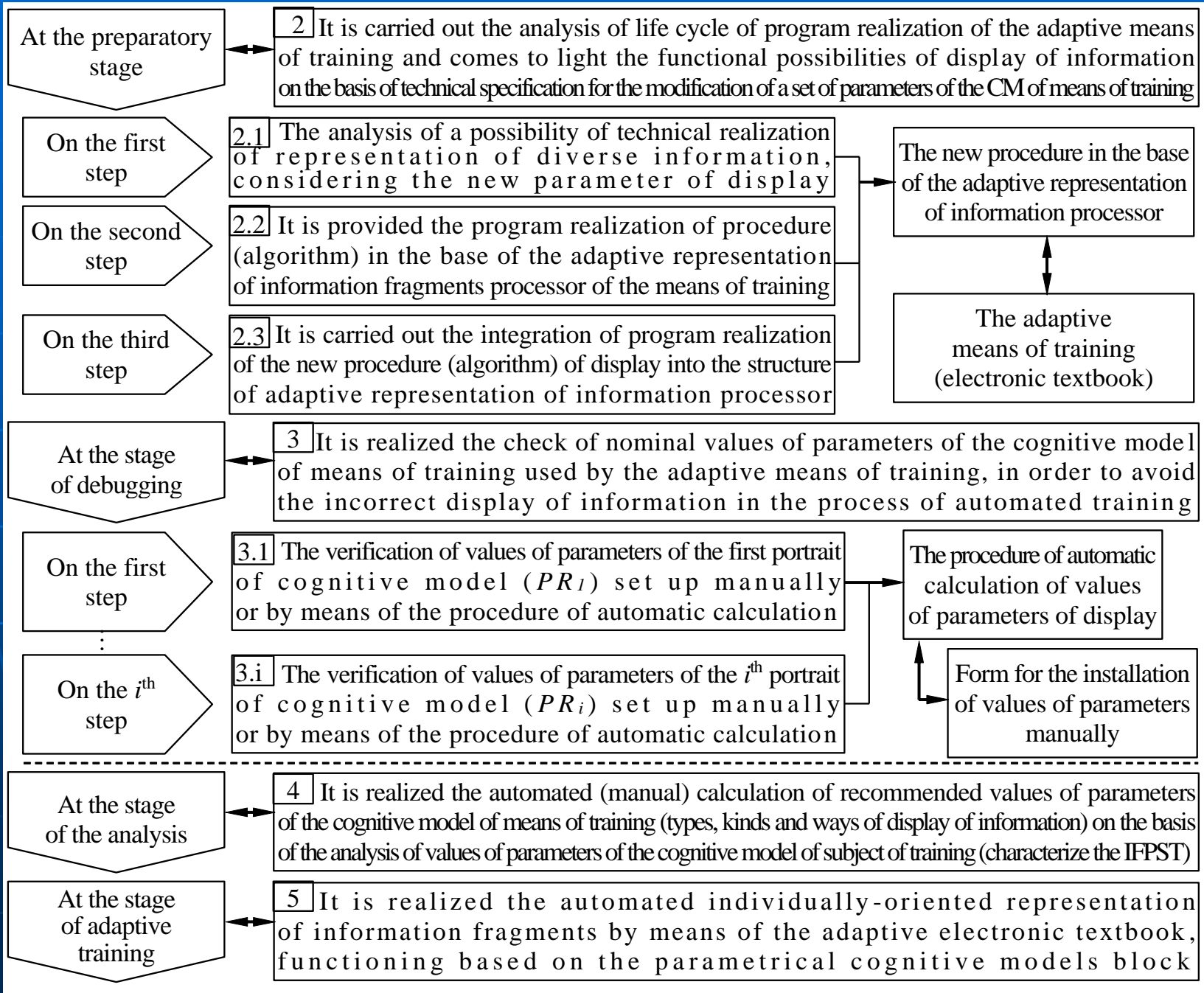








# The technique of research of parameters of the cognitive model of means of training (2 from 2)



At the preliminary stage

1 In the result of the analysis of question-answers structures of test is reached the calculation of indicators necessary for the conducting of testing: it is formed the interval scale and function of estimation

$$\begin{cases} b_0 = 0; \\ b_{\max} = n \end{cases}$$

On the first step

1.1 It is defined the maximally and minimally possible number of correct answers for the procedure of estimation and formation of function of estimation

On the second step

1.2 There are set up the lower and top threshold values of sums of correct answers (points) for the exposure of corresponding nominal values of estimates

On the third step

1.3 There are formed the intermediate borders of intervals on the basis of sums of correct answers (points) for the set up of intermediate nominal values of estimates (is formed the interval scale of estimation)

On the fourth step

1.4 On the basis of interval scale the function of estimation of the diagnostical module is set up

$$\begin{cases} [b_0 = 0] - mark(nominal) = 1; \\ [b_1, b_2] - mark(nominal) = 2; \\ [b_2, b_3] - mark(nominal) = 3; \\ [b_3, b_4] - mark(nominal) = 4; \\ [b_4, b_5 = n] - mark(nominal) = 5; \\ b_0 < b_1 < b_2 < b_3 < b_4 < b_5 \\ \mu(x) = \begin{cases} 1, b_0 < x < b_1; \\ 2, b_1 < x < b_2; \\ 3, b_2 < x < b_3; \\ 4, b_3 < x < b_4; \\ 5, b_4 < x < b_5 = n; \end{cases} \end{cases}$$

At the stage of testing

2 There is carried out the preparation of software to the testing of target indicators: the interval scale and function of estimation in the mode of administrating is brought for the support of functioning of algorithmic structure

At the stage of the analysis of results

3 The saved-up a posteriori data are exposed to the statistical processing, allowing to carry out the analysis and to formulate the conclusions about current condition (level of residual knowledge of examinee and his personal characteristics)

3.1 The coefficient of difficulty of task, proceeding from which value is defined: at  $K > 0,9$  – the task is difficult, at  $K < 0,2$  – the task is easy

$$K_j = \frac{N_j}{N}$$

3.2 Total result of performance of all tasks by the  $i^{\text{th}}$  examinee

$$y_j = \sum_{j=1}^M x_{ij}$$

3.9 Standard deviation of results of testing on  $j^{\text{th}}$  task

$$\delta_j = \sqrt{\delta_j^2}$$

3.3 Total result of performance of the  $j^{\text{th}}$  task by all examinees

$$x_j = \sum_{i=1}^N x_{ij}$$

3.10 Estim. of conn. of the each  $j^{\text{th}}$  task with the sum of points on all test

$$r_j = \frac{\sum_{i=1}^N (x_{ij} y_i)^2}{N \delta_j^2 \delta_y} - p_j \bar{Y} \cdot \frac{N}{N-1}$$

3.4 Average level of testing on results of performance of all tasks

$$\bar{Y} = \frac{\sum_{i=1}^N y_i}{N}$$

3.11 Average arithmetical of independent expert estimates

$$\bar{Z} = \frac{\sum_{i=1}^N Z_i}{N}$$

$$\delta_Z = \sqrt{\frac{\sum_{i=1}^N (Z_i - \bar{Z})^2}{N-1}}$$

3.5 Average level of performance of  $j^{\text{th}}$  task by all examinees

$$p_j = \frac{x_j}{N}$$

3.12 Standard deviation of expert estimates

3.6 Dispersion of total points of all examinees (subjects of training)

$$\delta_y^2 = \frac{\sum_{i=1}^N (y_i - \bar{Y})^2}{N-1}$$

3.13 Coefficient of correlation of results of testing and independent expert estimates (validity of test)

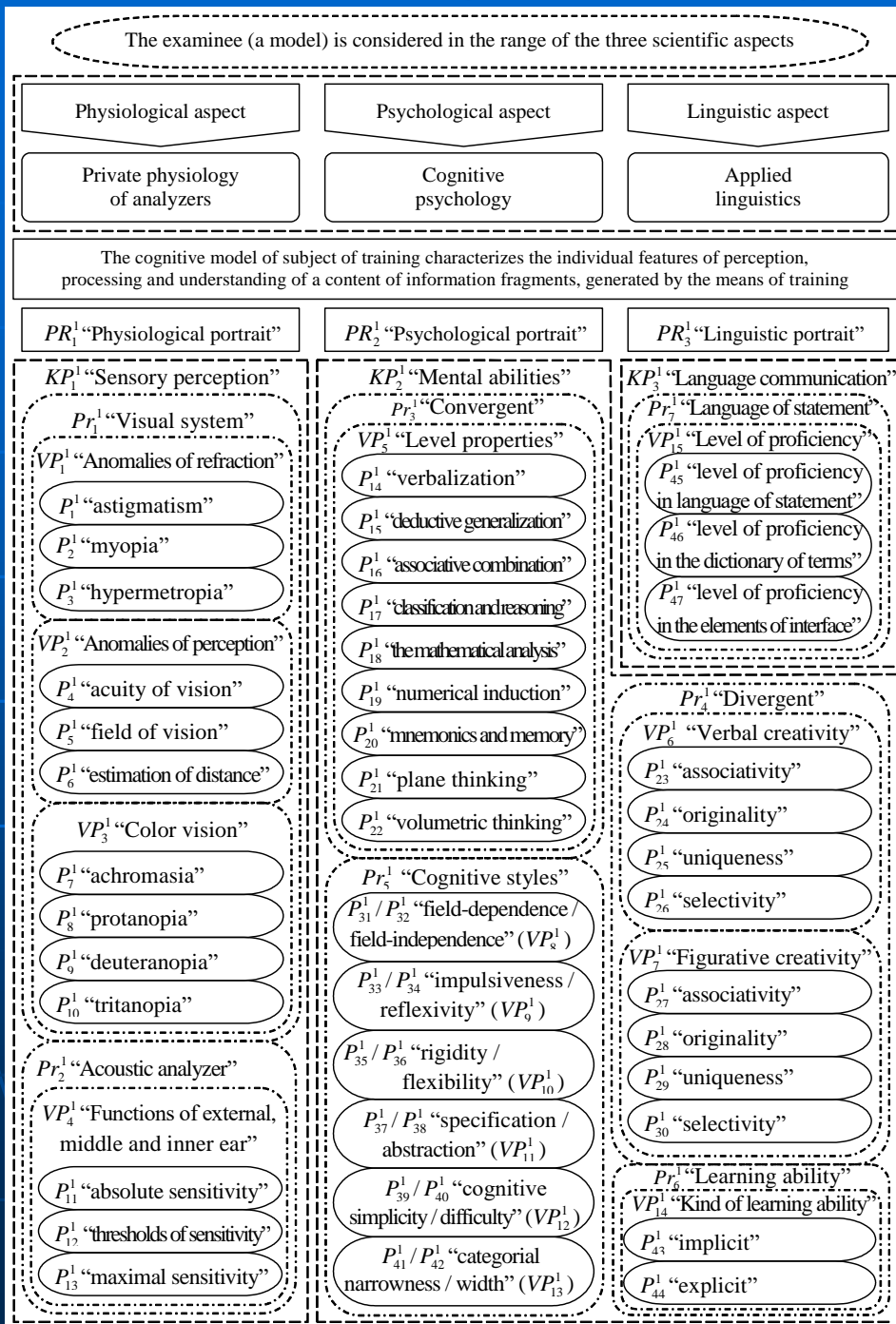
$$V = \frac{\sum_{i=1}^N (Z_i y_i)}{N} - \bar{Z} \bar{Y} \cdot \frac{N}{N-1}$$

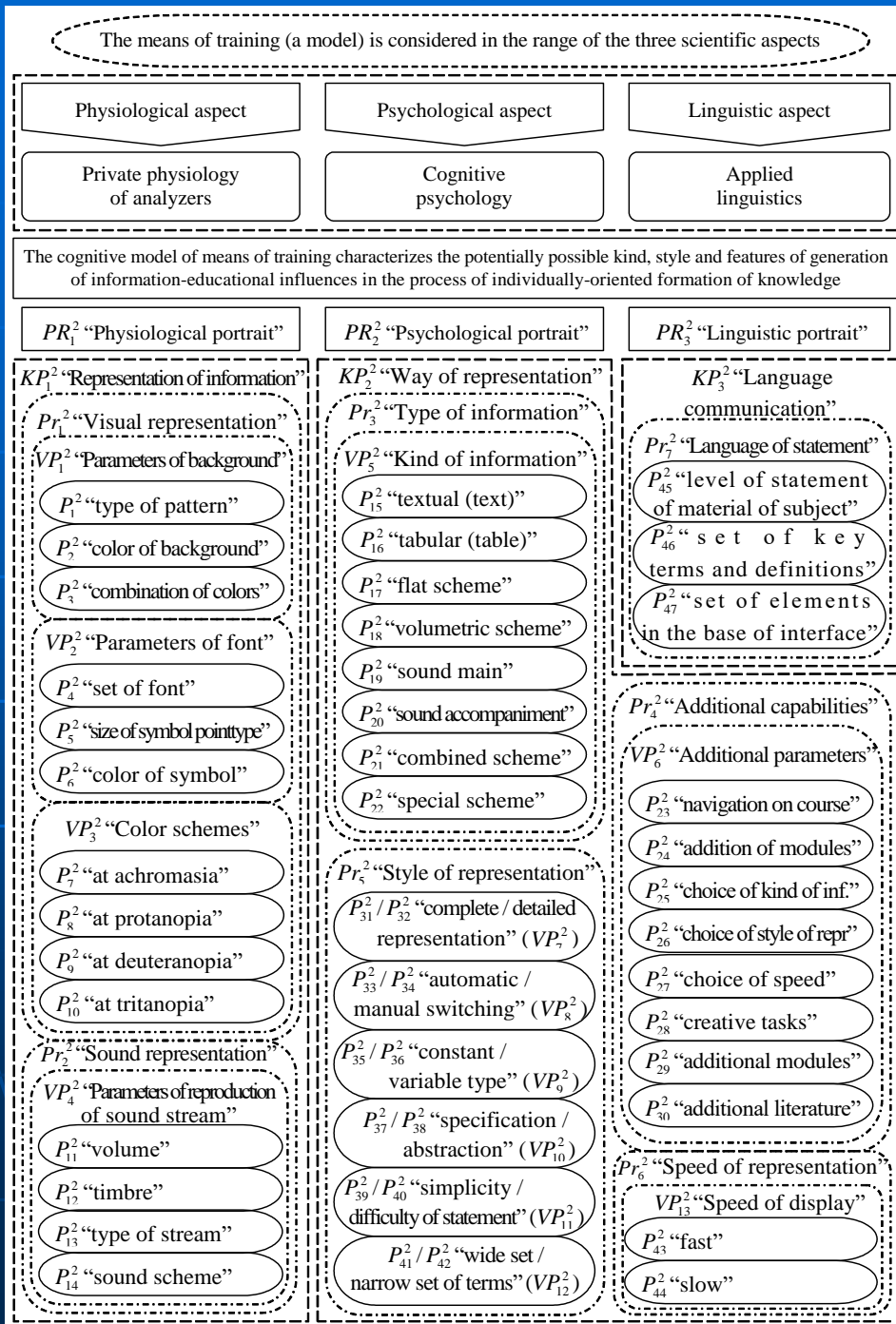
3.7 Standard deviation of total points of examinees

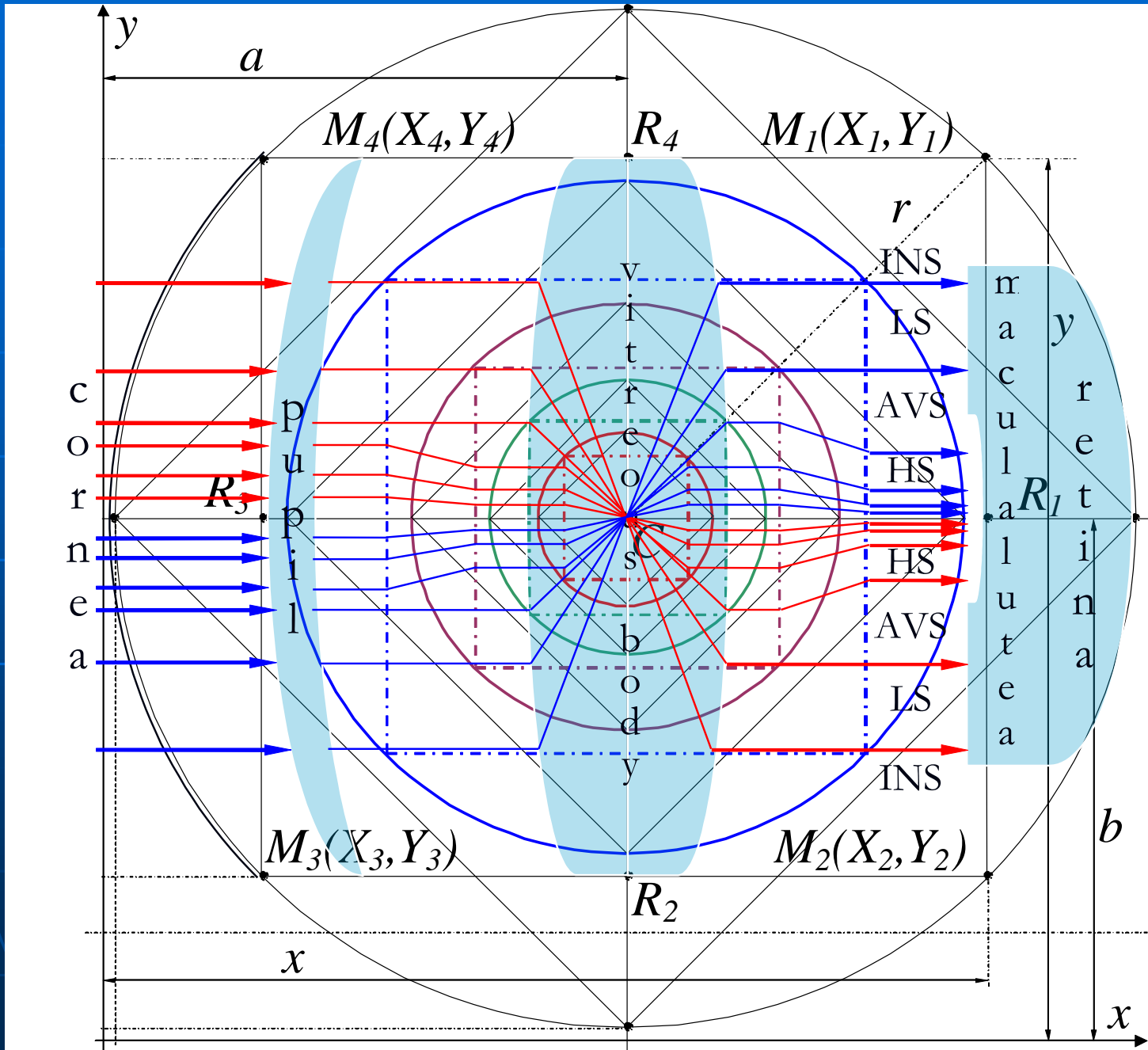
$$\delta_y = \sqrt{\delta_y^2}$$

3.8 Dispersion of results of testing on the  $j^{\text{th}}$  task

$$\delta_j^2 = \frac{\sum_{i=1}^N (x_i - p_j)^2}{N-1}$$

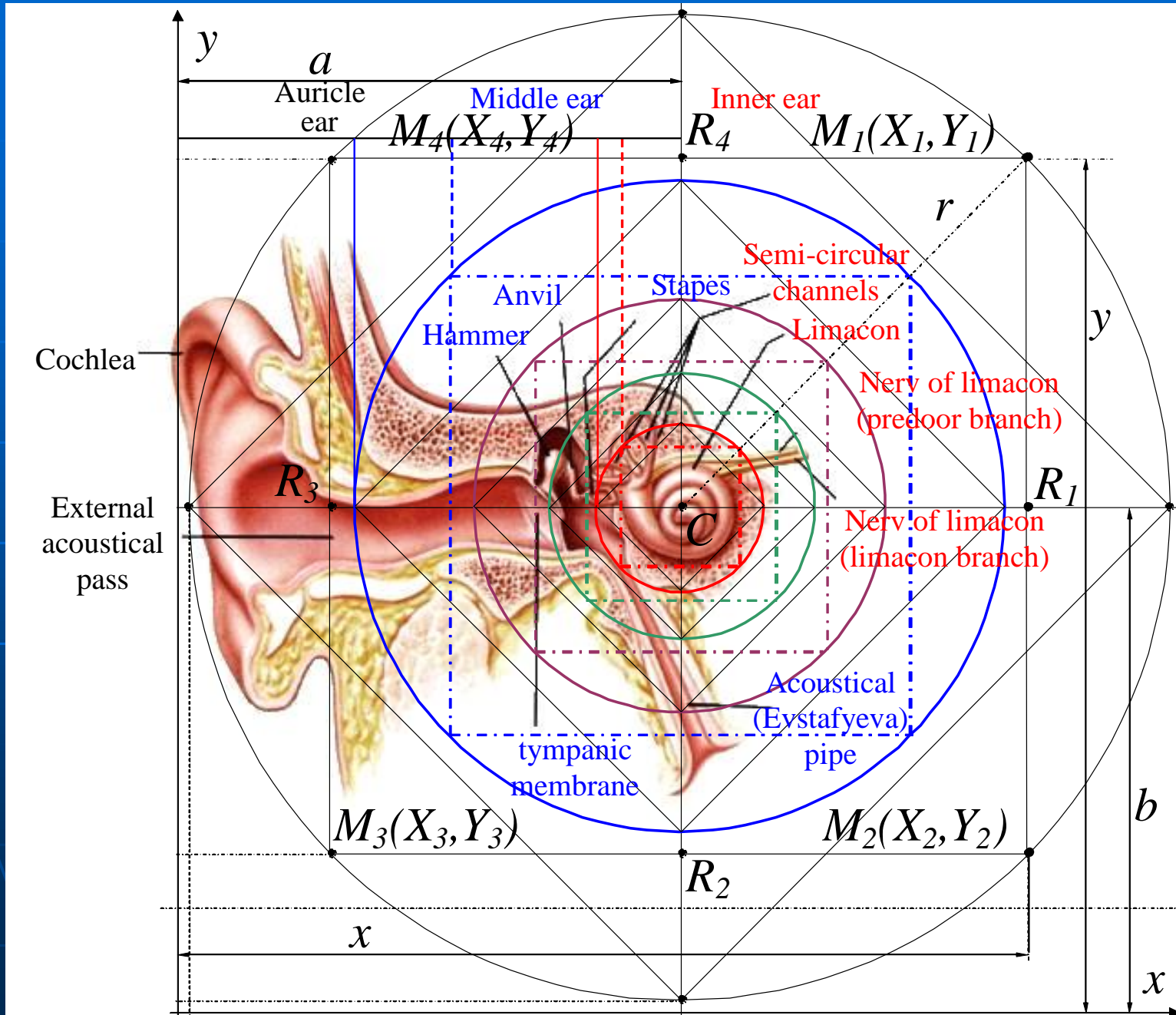






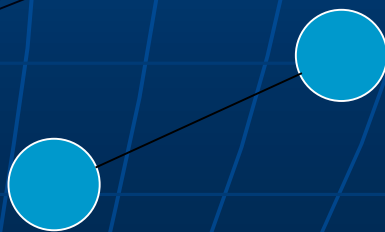
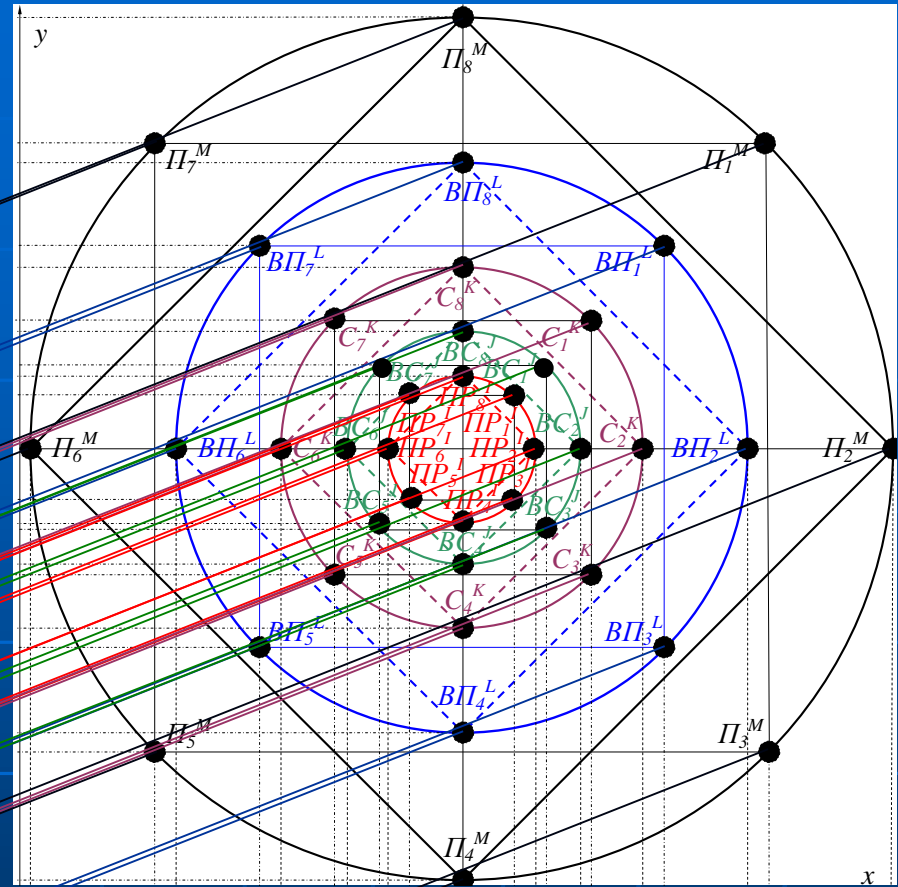
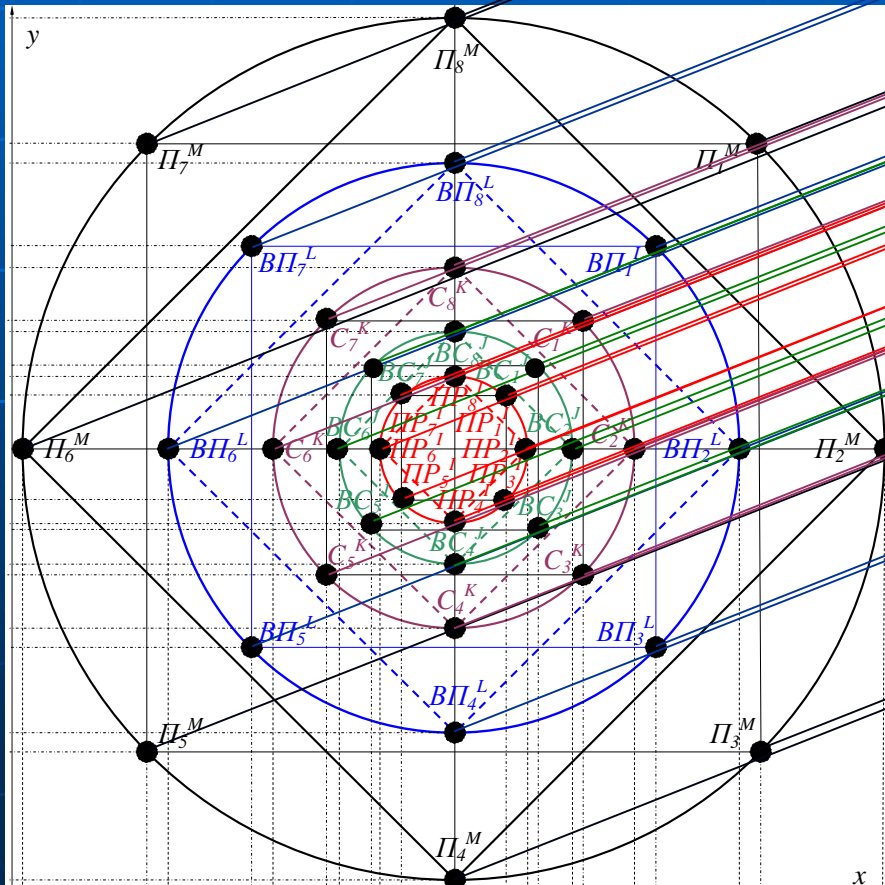


# The structure of the modified model of reduced ear of human



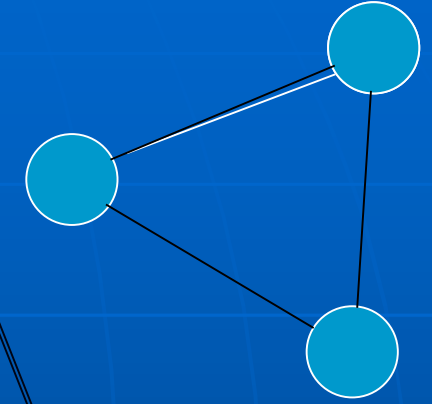
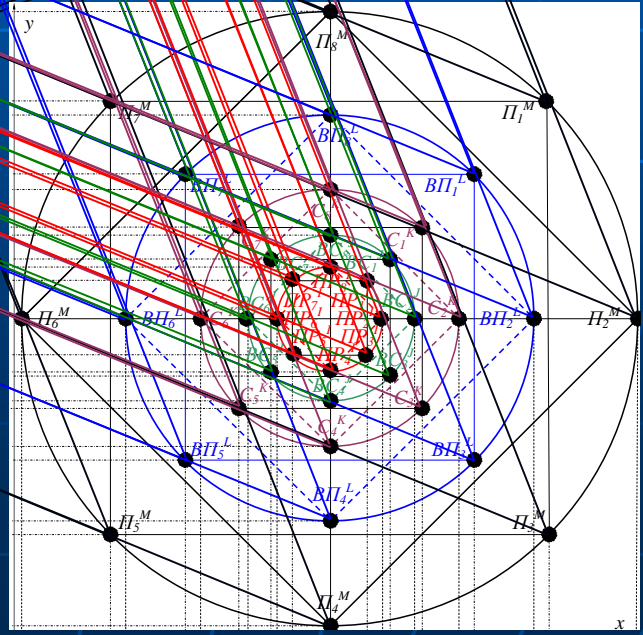
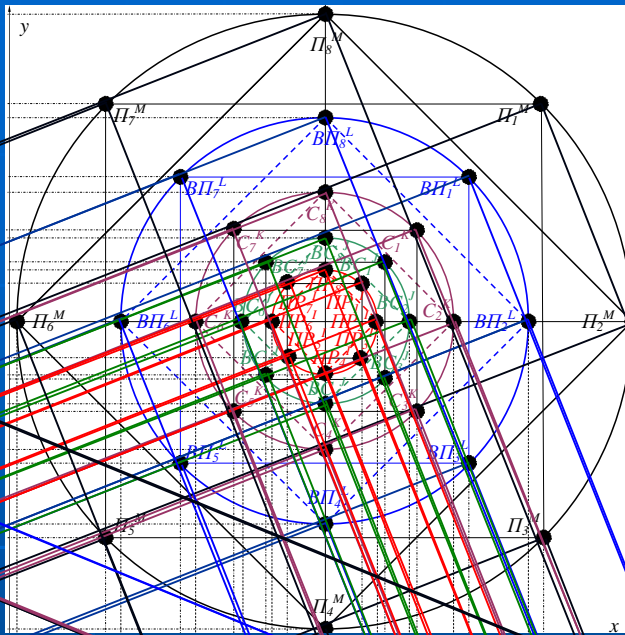
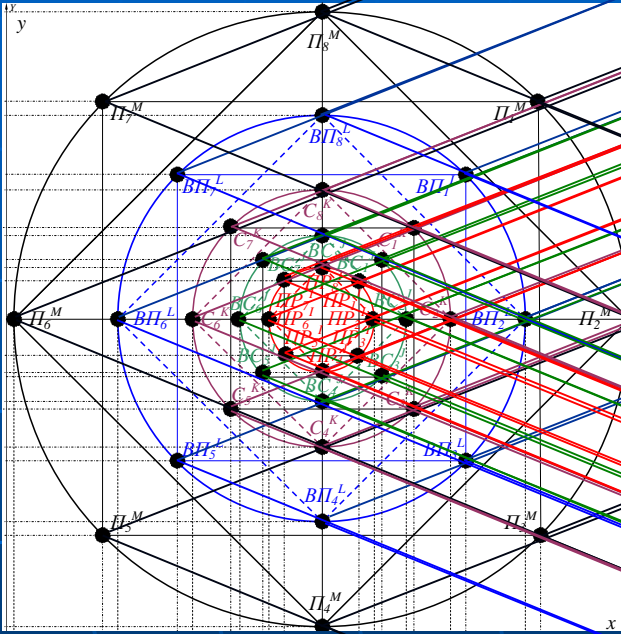
The structure of the cognitive model of chemical element (nuclear polymer) with two nucleus (plasmatic formations) in the view of the two-cognitive sphere

The structure of chemical element with two nucleus (PF)



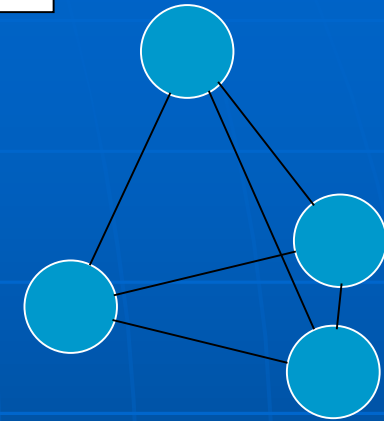
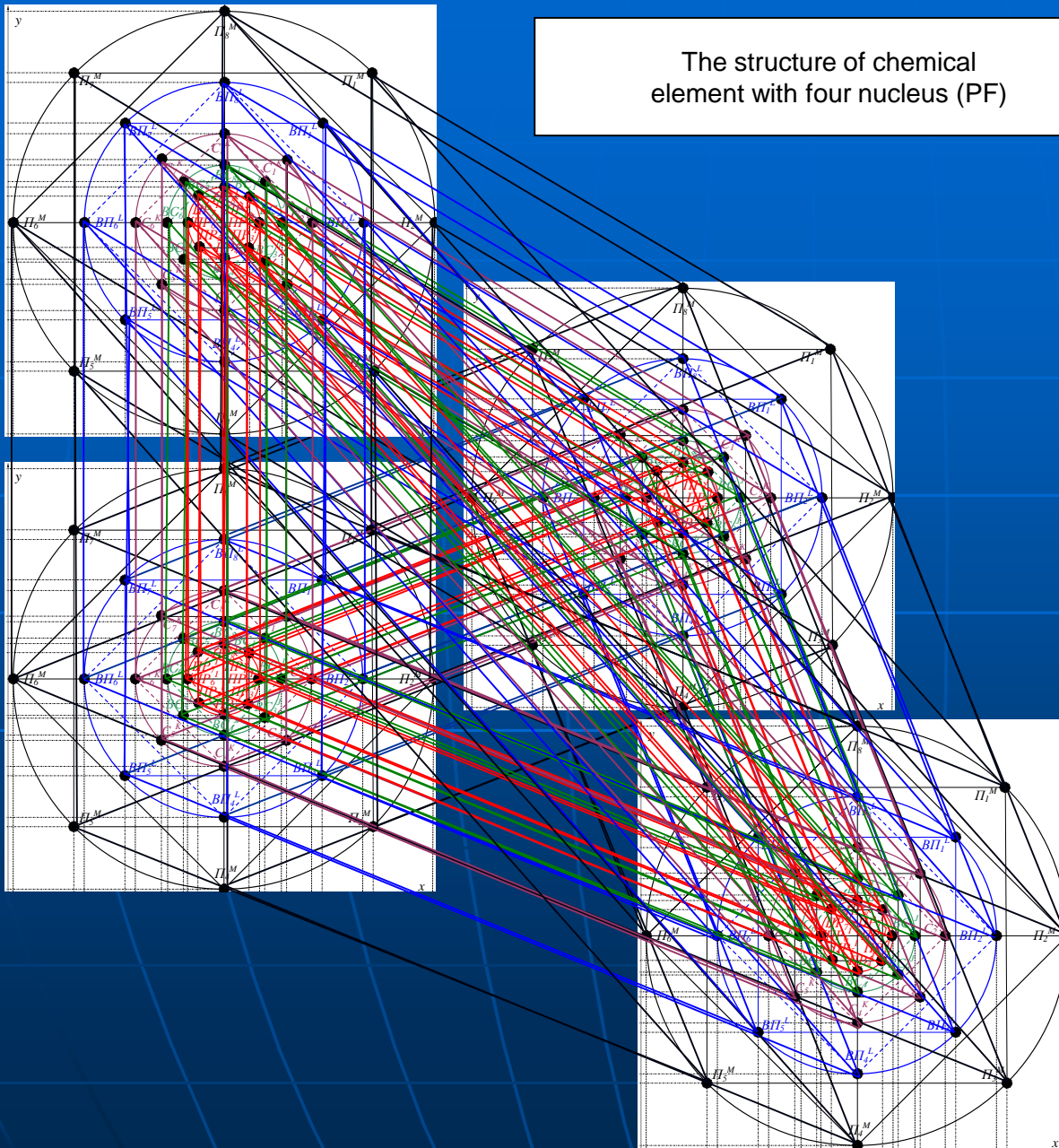
# The structure of the cognitive model of chemical element (nuclear polymer) with three nucleus (plasmatic formations) in the view of the three-cognitive sphere

The structure of chemical element with three nucleus (PF)



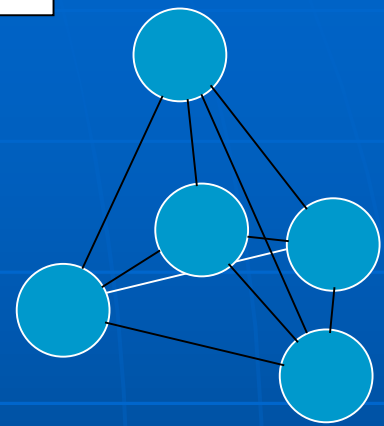
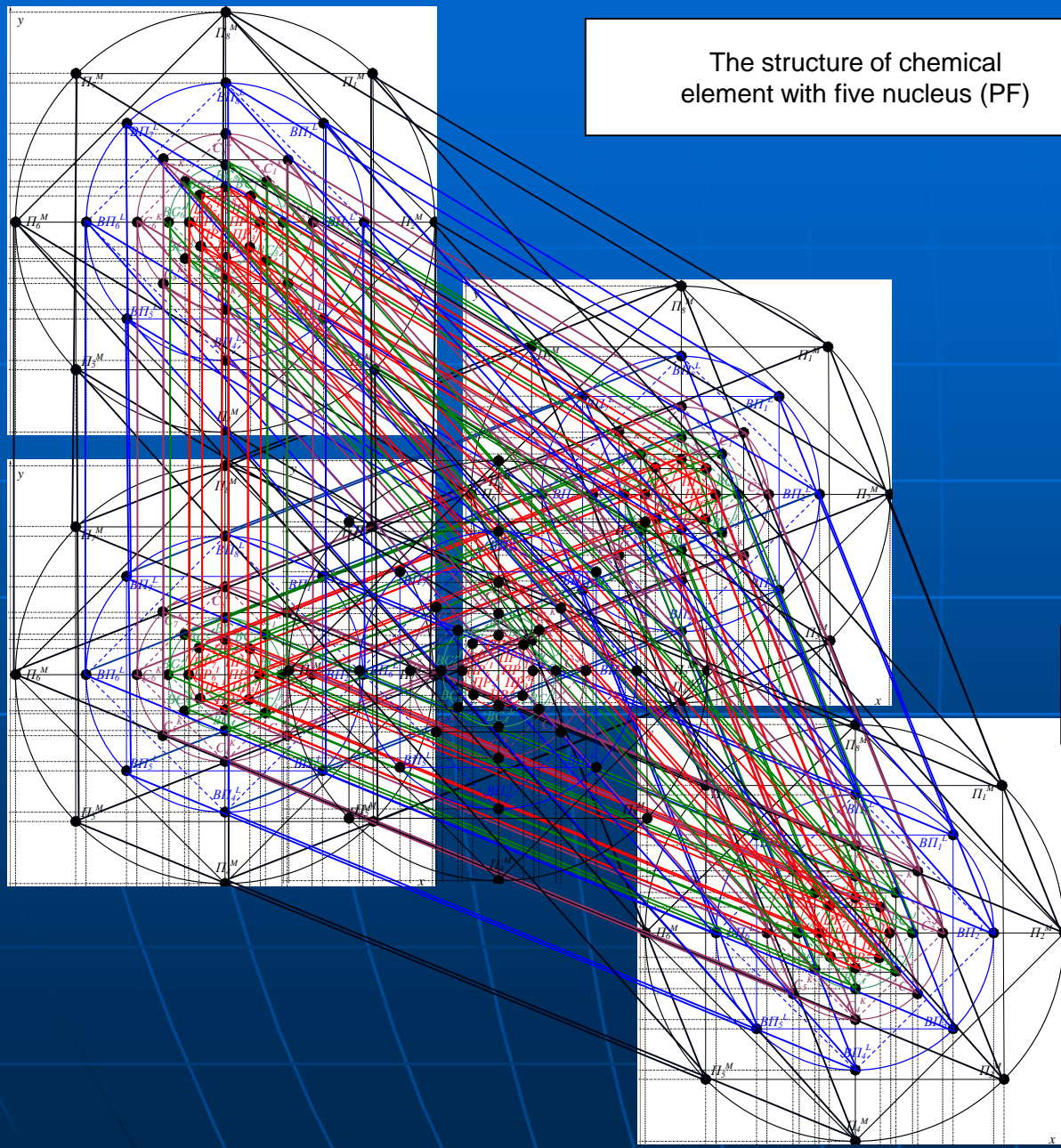
# The structure of the cognitive model of chemical element (nuclear polymer) with four nucleus (plasmatic formations) in the view of the four-cognitive sphere

The structure of chemical element with four nucleus (PF)

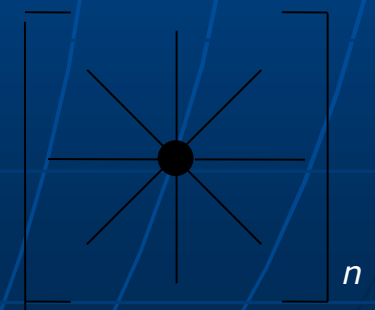


The structure of the cognitive model of chemical element (nuclear polymer) with five (and more) nucleus (plasm. formations) in the view of the five (and more)-cognitive sphere

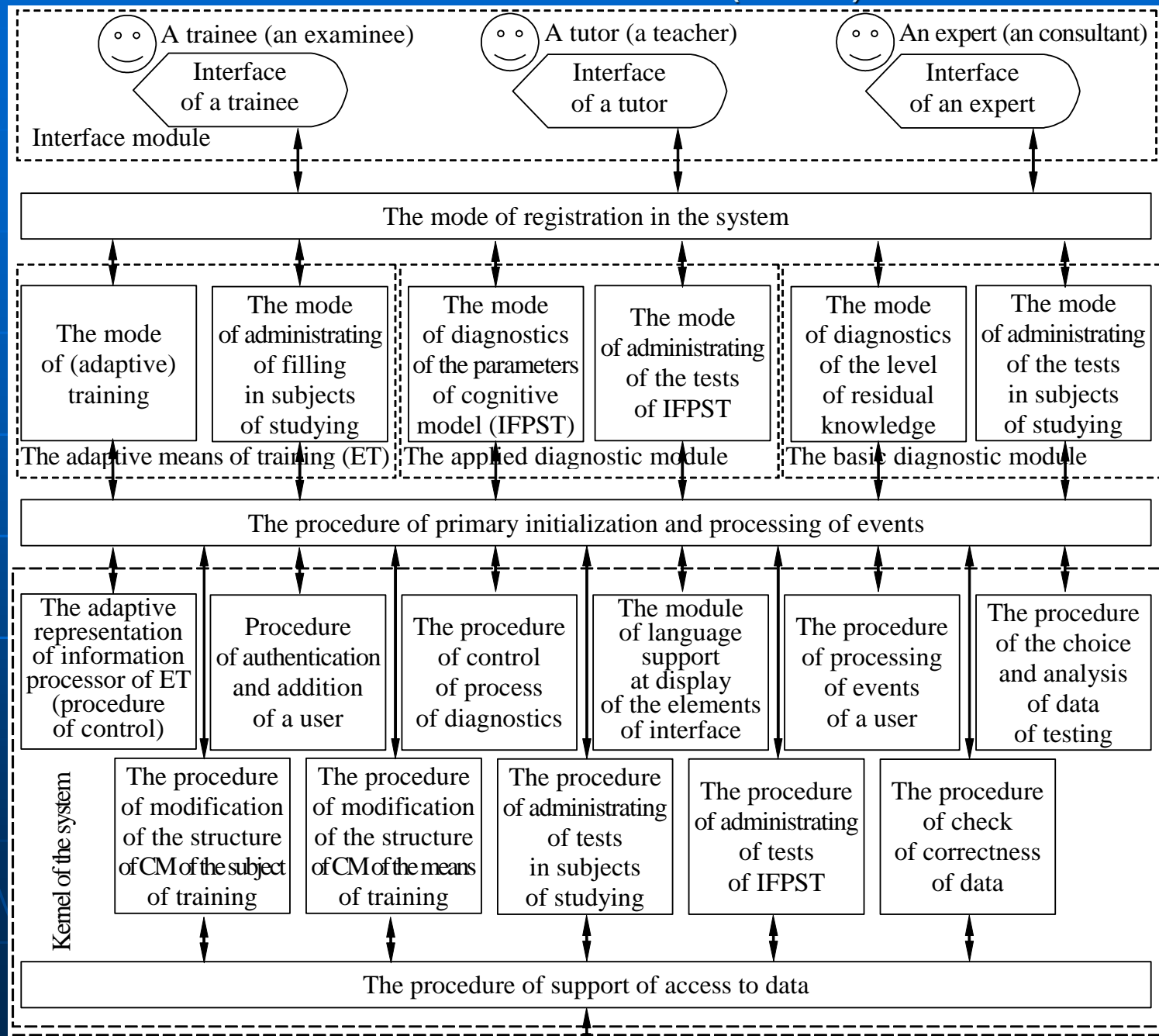
The structure of chemical element with five nucleus (PF)



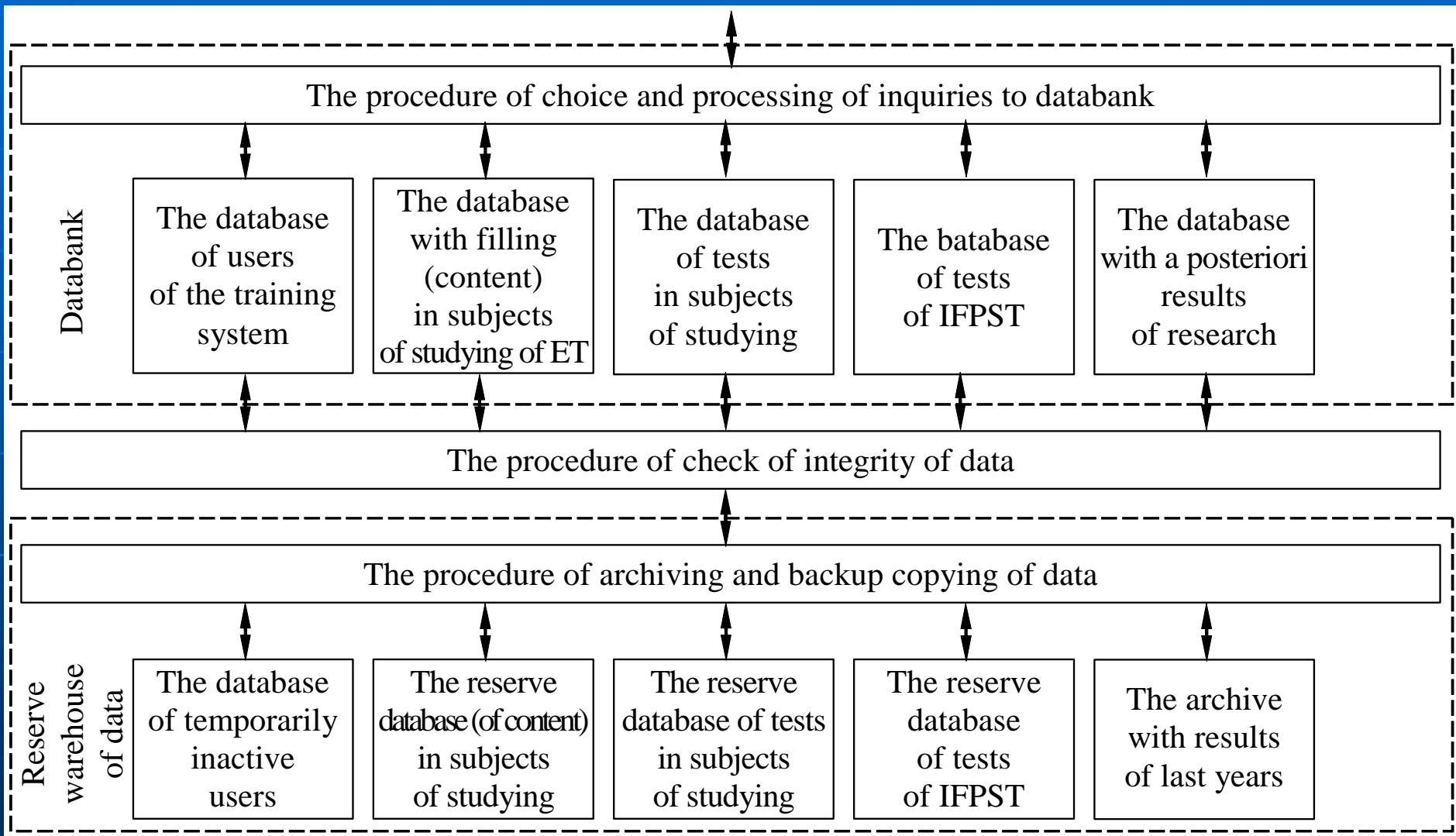
The structure of chemical element with  $n$ -nucleus (PF)



# The structurally-functional scheme of the complex of programs for the automation of research tasks (1 from 2)

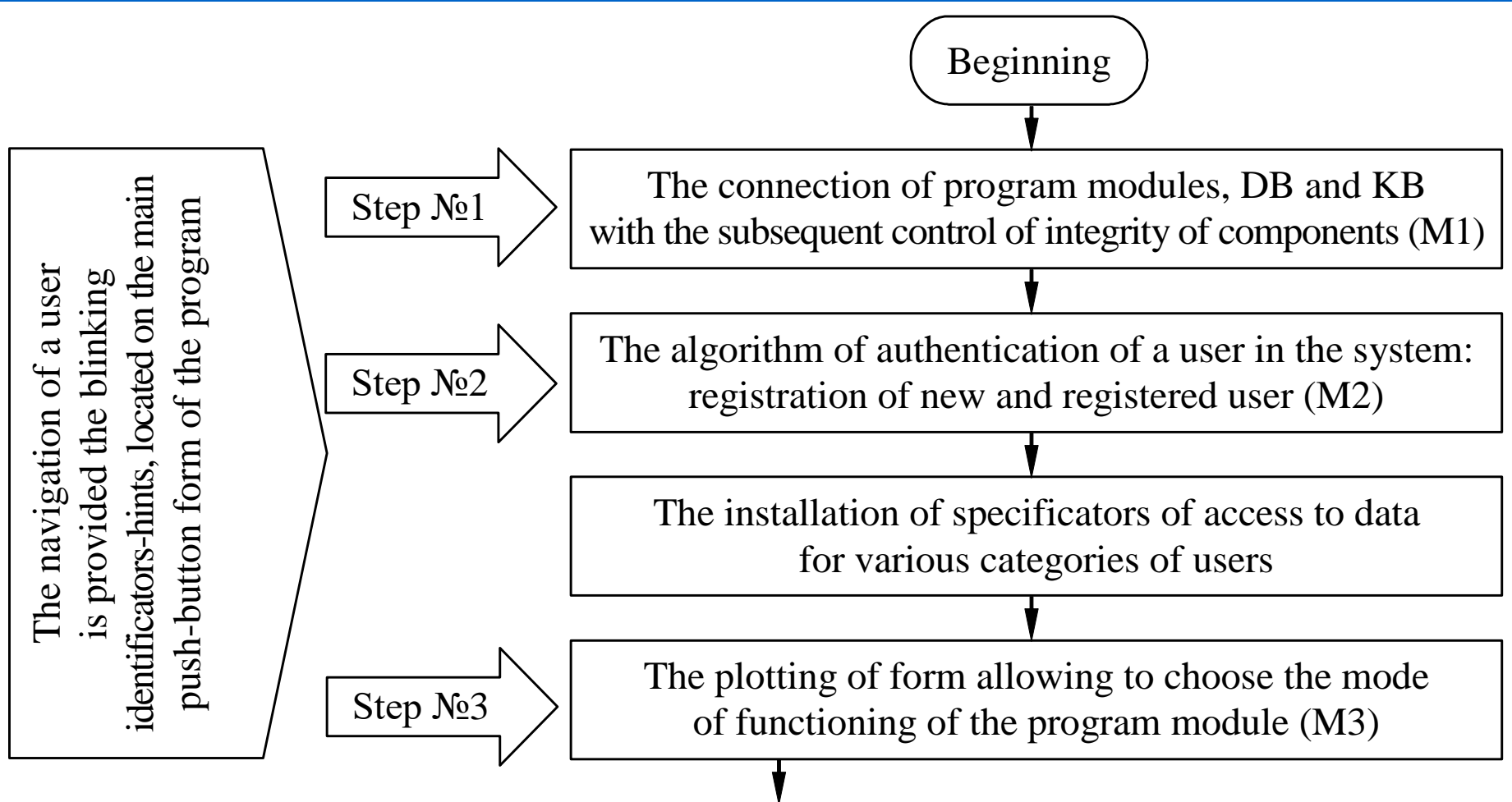


# The structurally-functional scheme of the complex of programs for the automation of research tasks (2 from 2)



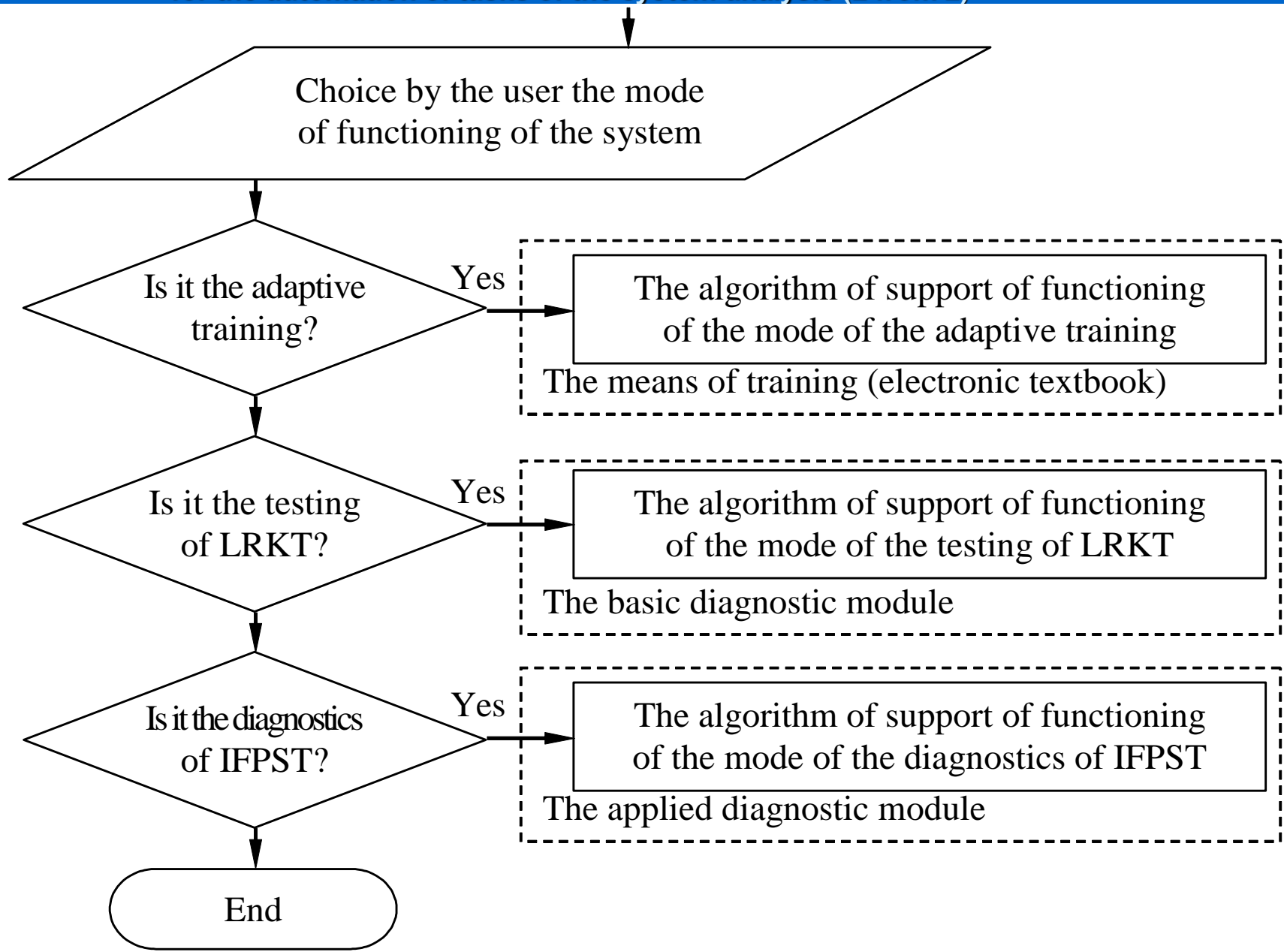
The algorithm of primary initialization of database and switching of the modes of functioning of the complex of programs for the automation of tasks of the system analysis (1 from 2)

4.2.1

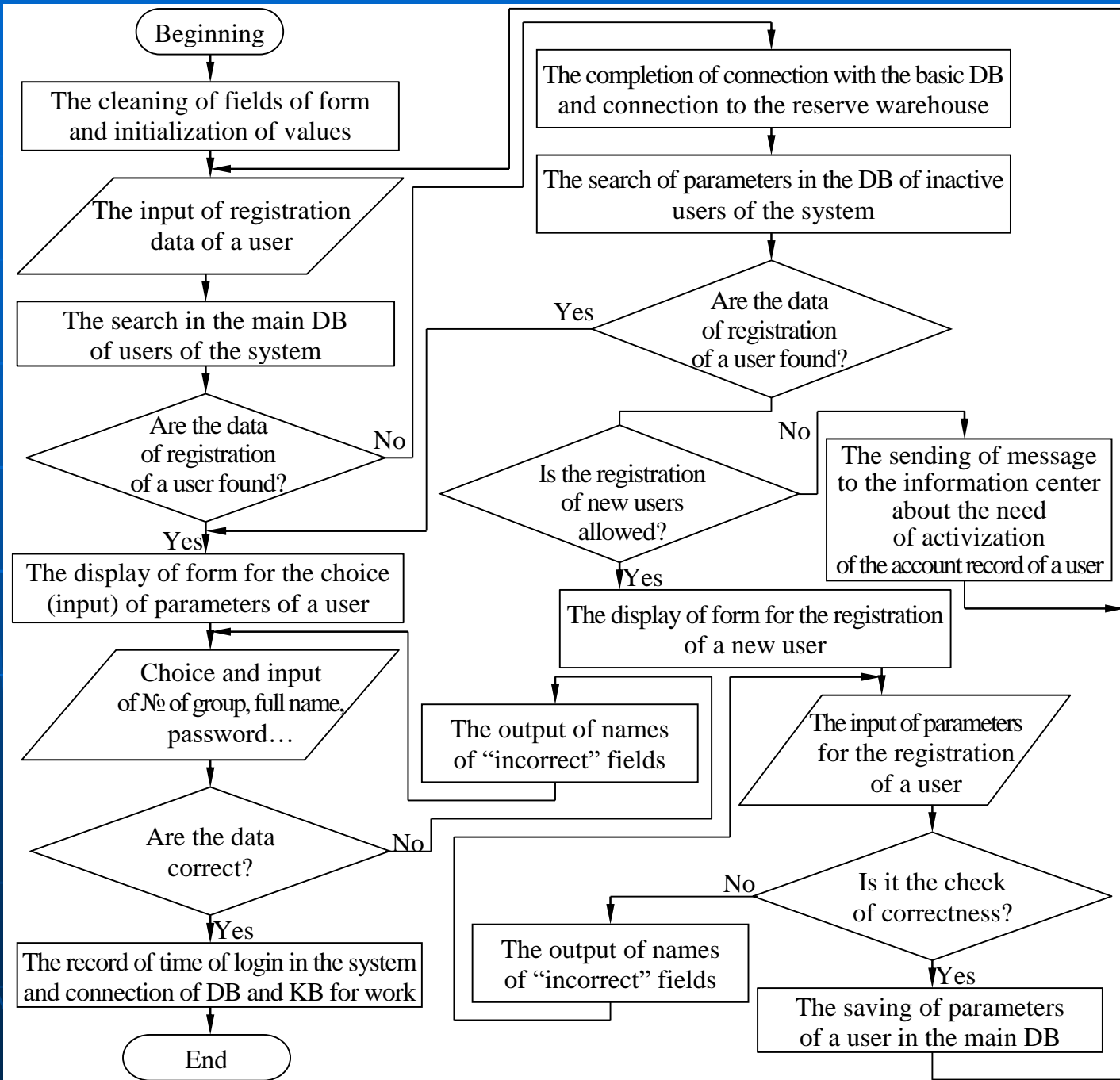




The algorithm of primary initialization of database and switching of the modes of functioning of the complex of programs for the automation of tasks of the system analysis (2 from 2)

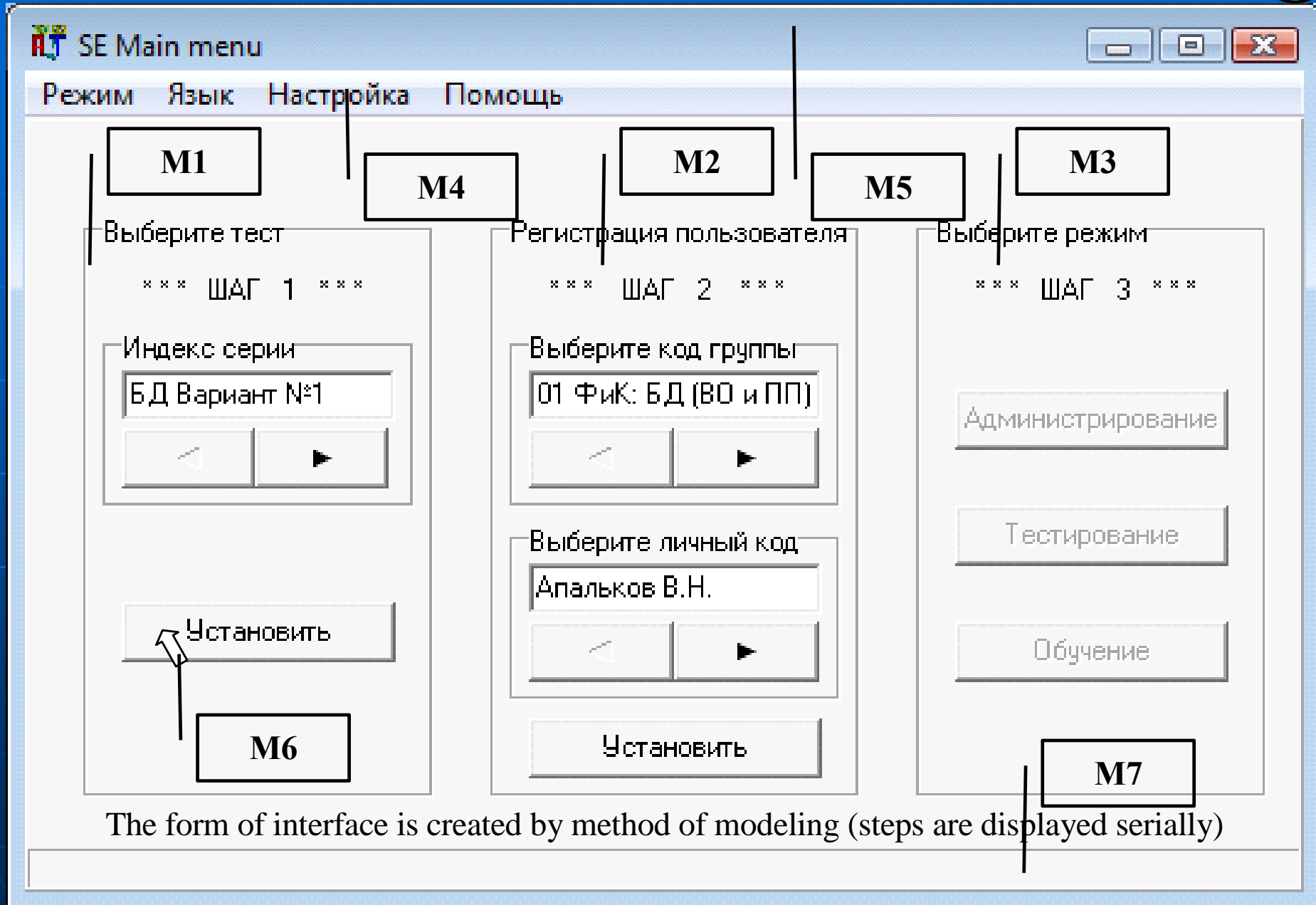


# The algorithm of authentication of a user in the automated training system

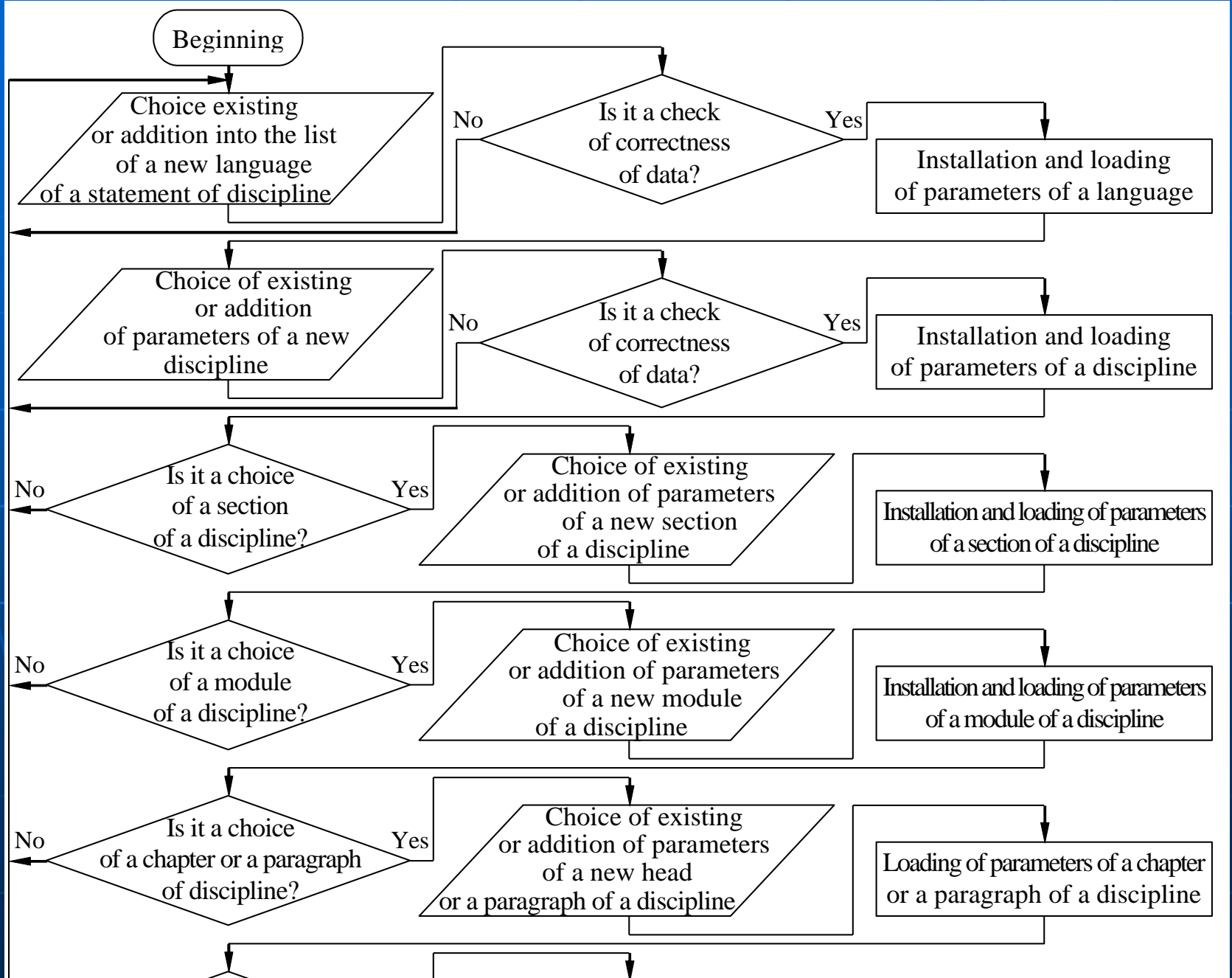


The interface of the complex of programs in the mode of main button form:  
the basic diagnostic module

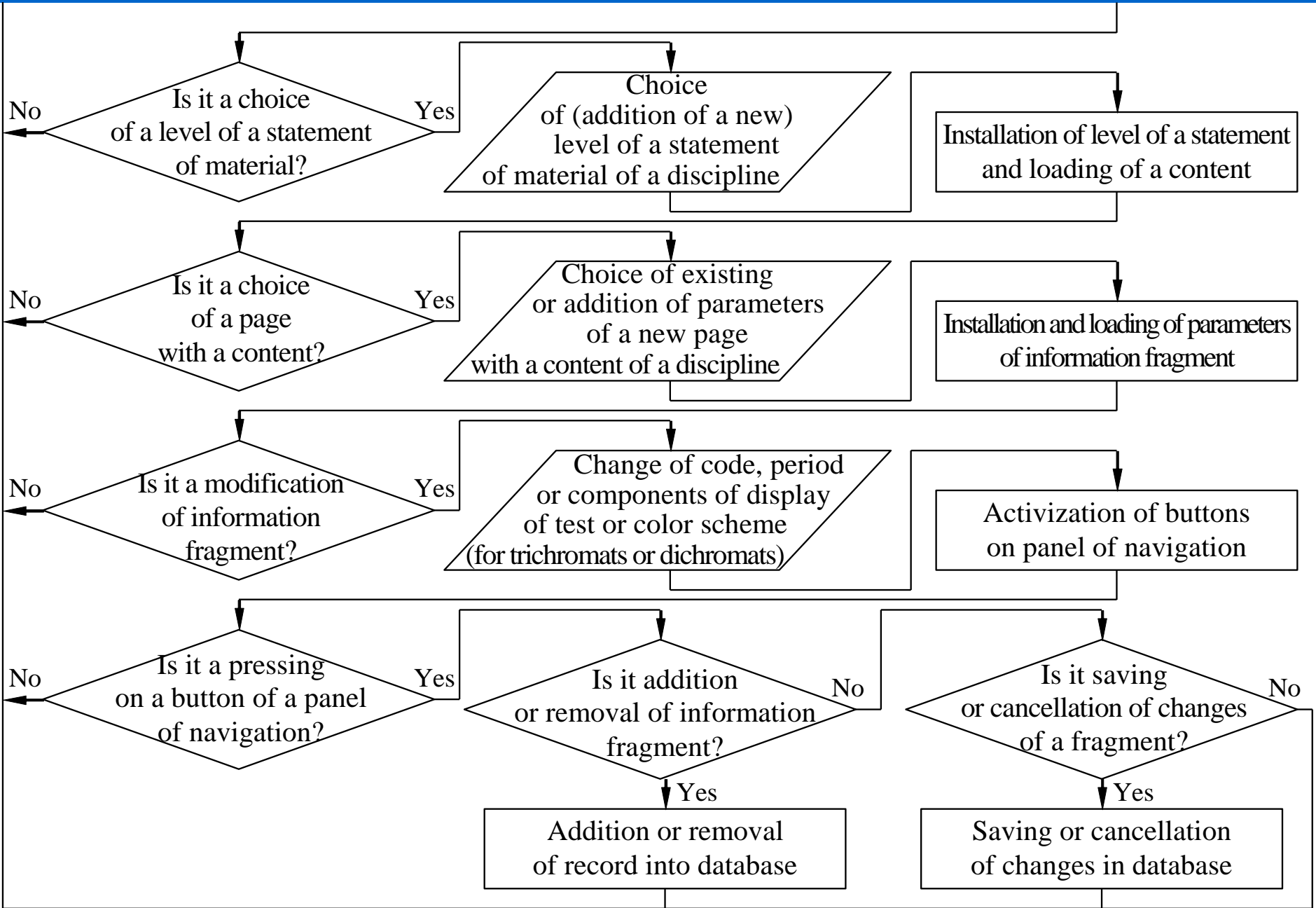
4.3.2



# The algorithm of filling of content of the adaptive electronic textbook on the basis of the information (semantic) model of a subject of studying (1 from 2)

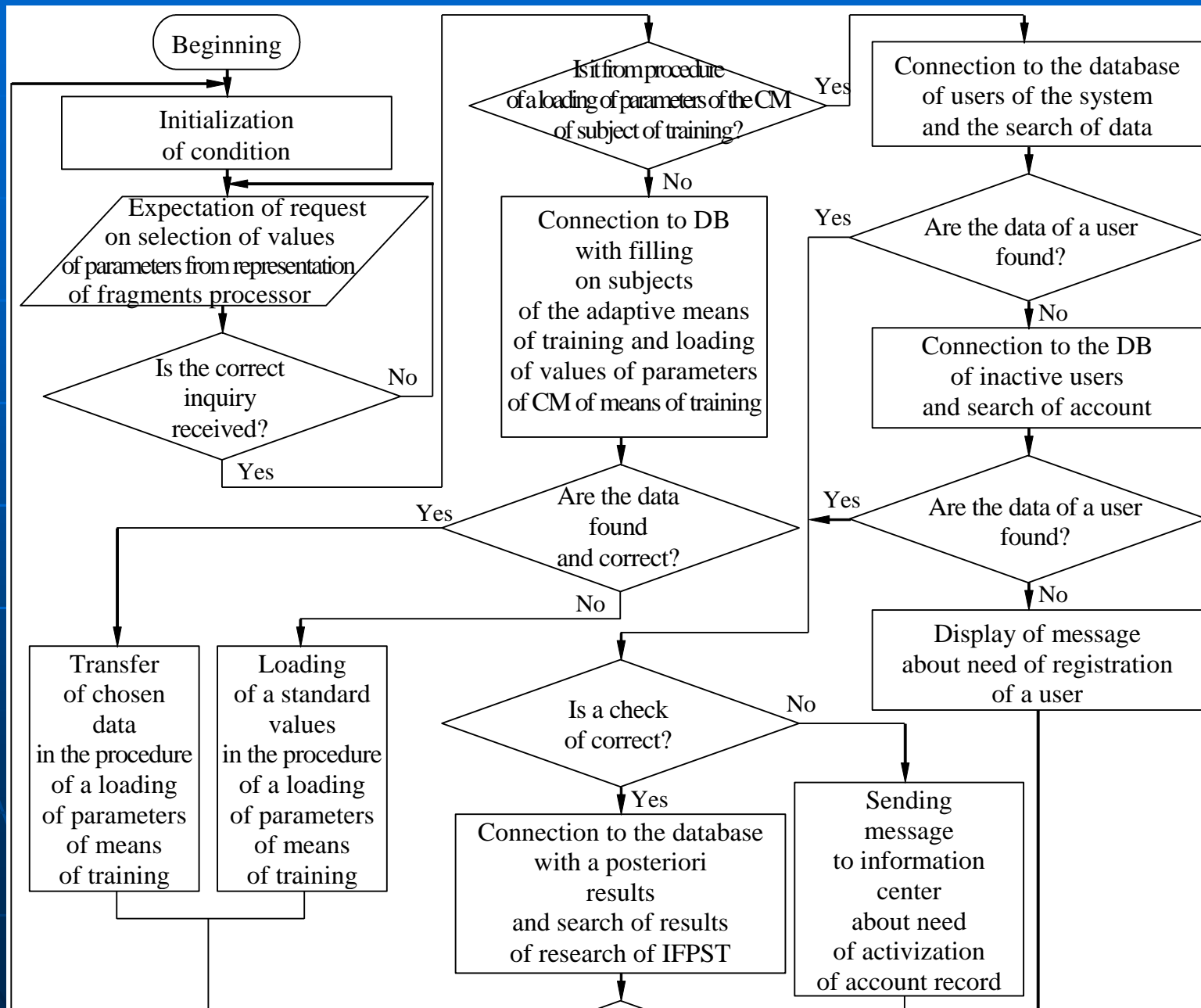


The algorithm of filling of content of the adaptive electronic textbook on the basis of the information (semantic) model of a subject of studying (2 from 2)

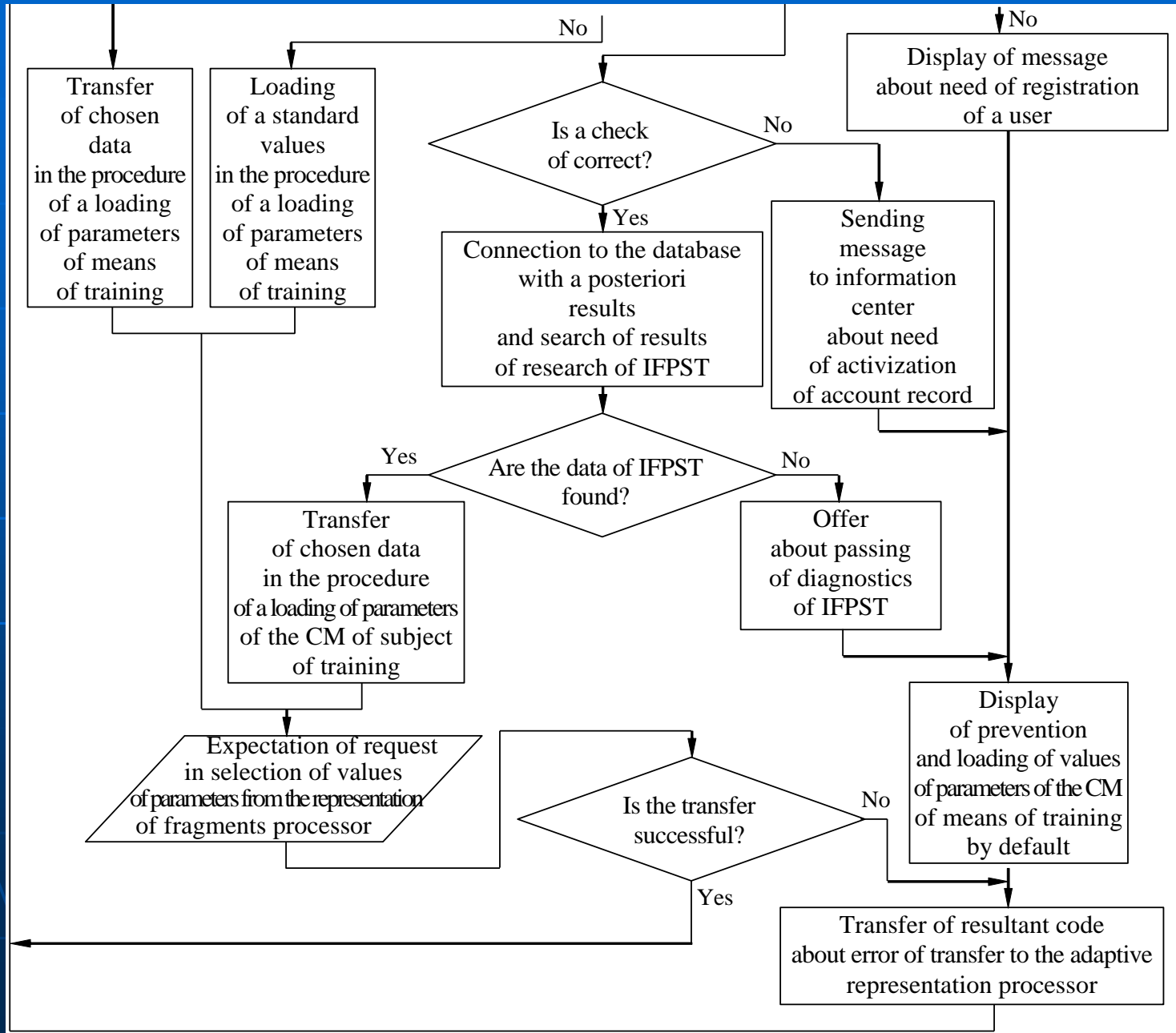


# The algorithm of extraction of information fragments of the adaptive means of training (electronic textbook)

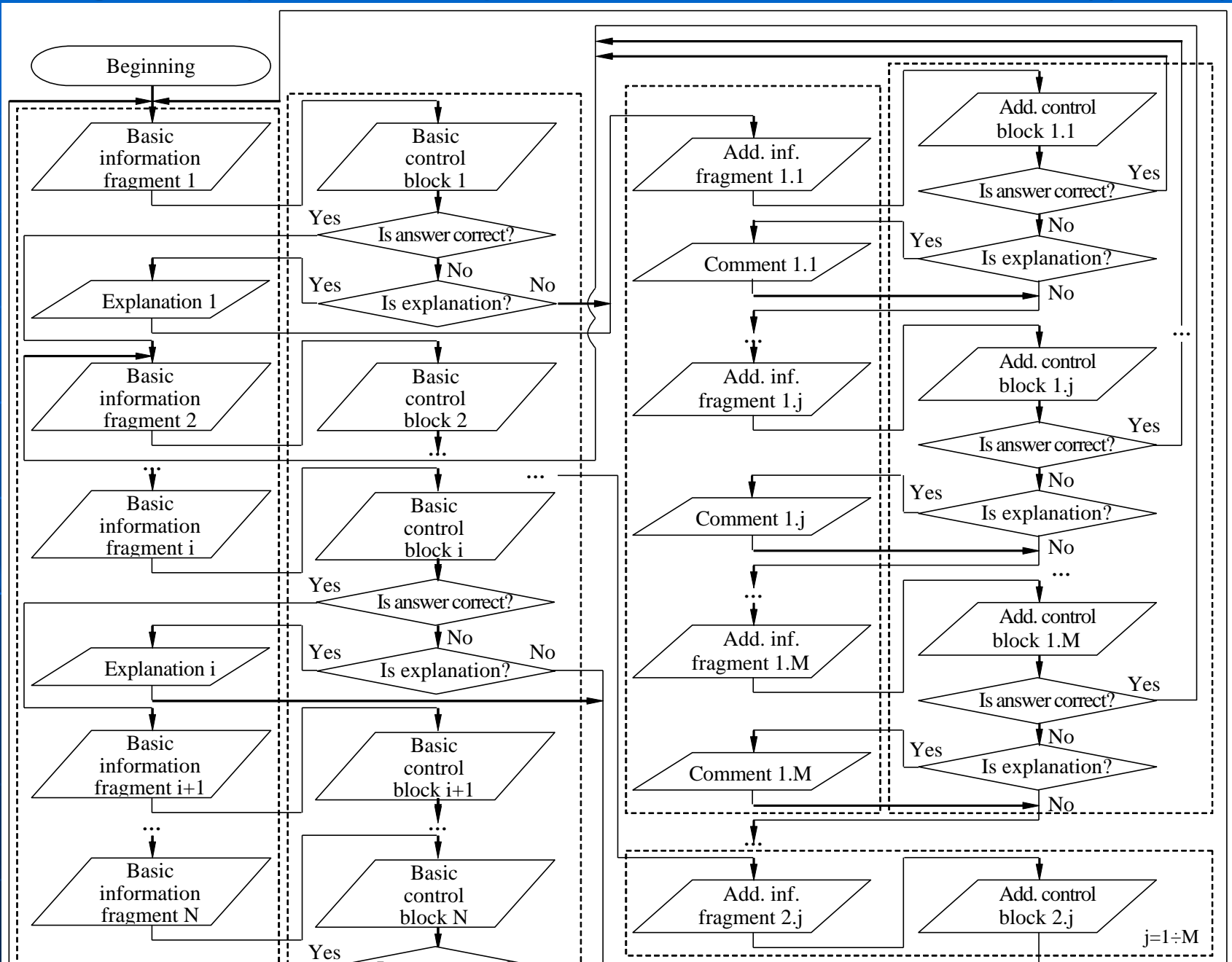
## on the basis of the adaptive representation of information fragments processor (1 from 2)



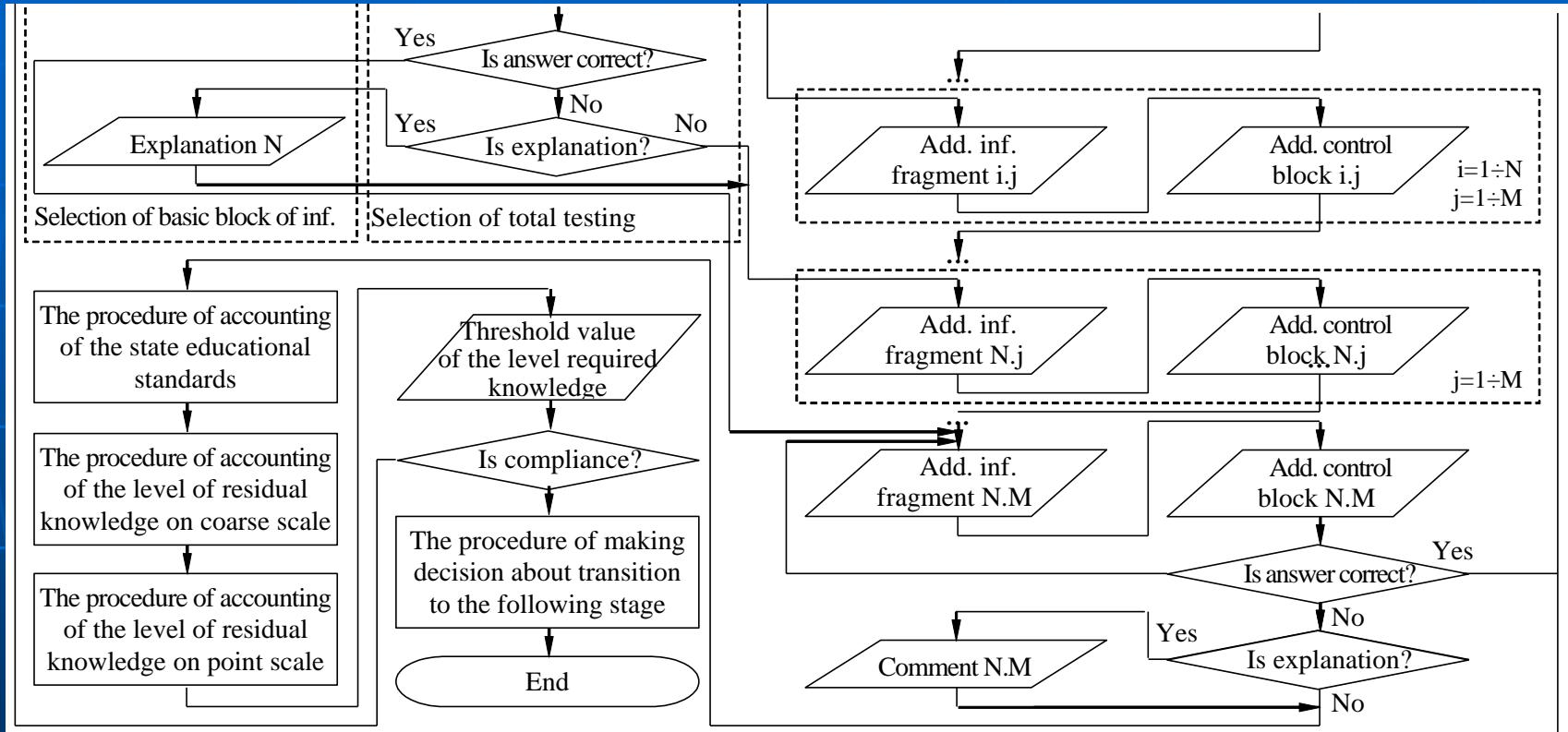
The algorithm of extraction of information fragments  
of the adaptive means of training (electronic textbook)  
on the basis of the adaptive representation of information fragments processor (2 from 2)



The algorithm of functioning of the adaptive electronic textbook jointly with the diagn. module (realized the more precise definition of the level of statem. of mat.) (1 from 2)







# The interface of the adaptive electronic textbook in the mode of administrating: the review and modification of the parameters of the subjects of studying

4.7.1

**Administrator mode**

Languages/Disciplines | Units | Modules | Pages | Database

Language parameters

Code: ENG **AL1.1**

Name: English **AL1.2**

**AL1.3**

Discipline parameters | Cognitive model of training system with default parameters for discipline **AL2.5**

Discipline parameters

Code: Inf\_eng **AL2.1**

Name: Informatics **AL2.2**

Set to display description **AL2.3**

Enter or edit description

The discipline "Computer science" is focused on studying by students the theoretical bases of computer science, information and information interaction. It includes consideration of arithmetic, logic bases of digital automatic devices, tendencies of development of information systems architecture, and also hardware and software of the modern PC. The discipline has a practical orientation on the formation of skills to operate with numbers in various notations and skills of simplification of logic expressions by the development of block diagrams of logic devices.

**AL2.4**

# The interface of the adaptive electronic textbook in the mode of administrating: the review and modification of the parameters of units of the subject of studying

4.7.2

**Administrator mode**

Languages/Disciplines | **Units** | Modules | Pages | Database

Unit parameters

Code: CH4 — **AU3.1**

Name: Origin and theoretical bases of construction of information systems — **AU3.2**

Set to display description — **AU3.3**

Enter or edit description

In computer science the concept "system" is widely distributed and has a set of semantic values. More often it is used with reference to a set of means and programs. As a system the hardware of a computer can refer to. The set of programs for the decision of the concrete applied problems added with the procedures of conducting the documentation and management by calculations can be considered as system also.

— **AU3.4**

⏪ ⏩ + - ✓ ✕ — **AU3.5**

The interface of the adaptive electronic textbook in the mode of administrating:  
the review and modification of the parameters of modules of unit of the subject of studying

4.7.3

**Administrator mode**

Languages/Disciplines | Units | **Modules** | Pages | Database

Module parameters

Code: M4.1

Name: Concept of information system

Set to display description

Enter or edit description

Concept of information system review

Navigation icons: Home, Previous, Next, End, Add, Subtract, Confirm, Cancel

The interface of the adaptive electronic textbook in the mode of administrating:  
the review and modification of the parameters of page of module of unit of the subject of studying  
(the localization of interface in the international foreign English language)

4.7.4

**Administrator mode**

Languages/Disciplines | Units | Modules | Pages | Database

Select discipline  
Code: ENG **AP1**  
Name: English

Select unit  
Code: CH4 **AP2**  
Name: Origin and theoretical bases of construc

Select module  
Code: M4.1 **AP3**  
Name: Concept of information system

Page parameters  
Code: P1 **AP5.1** Display time: 30 sec **AP5.3** Display:  text only  picture only  all **AP5.4**

Content

Enter or edit textual content

Definition:  
SYSTEM is any object which is simultaneously considered as a unit and as the set of diverse elements incorporated for achievement object.

Attributes of system:  
- consists of elements;  
- represents functional unity;  
- occurrence of each element and its performing function is not casual.

**AP5.2**

Add or remove picture  
for trichromats | for protanops | for deuteranops | for tritanops

System's ... **AP5.5**

Definition: It is any object which is simultaneously considered as a unit and as the set of diverse elements incorporated for achievement object.

Attributes:  
- Consists of elements.  
- Represents functional unity.  
- occurrence of each element and its performing function is not casual.

Picture control panel  
Paste from CB | Copy to CB | Cut to CB | Clear **AP5.6**

**AP5.7**

The interface of adaptive electronic textbook in the mode of administrating:  
the review and modification of the parameters of page of module of unit of the subject of studying  
(the localization of interface in the national Russian language)

4.7.5

**Режим администрирования**

Языки/Дисциплины | Разделы | Модули | Страницы | База данных

Выберите дисциплину  
Код: ENG **AP1**  
Наим. English

Выберите раздел  
Код: CH4 **AP2**  
Наим. Origin and theoretical bases of construction of

Выберите модуль  
Код: M4.6.4 **AP3**  
Наим. External memory

Параметры страницы  
Код: P4 **AP5.1** Вр. отобр.: сек **AP5.3**

Выберите Ваш вариант ответа **AP5.4**  
 текст  рисунок  комбинир.

Содержание

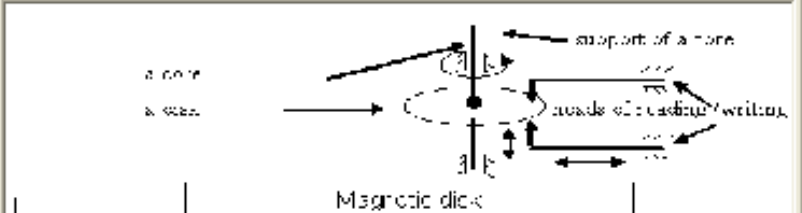
Введите или отредактируйте текстологическое содержание

Definition  
Magnetic disk is plastic (for flexible disks) either aluminium or ceramic (for hard disks) a circle with magnetic covering. In case of a hard disk such circles can be a little, and all of them in the center are put in one core. For a flexible disk such circle is one, when locating in the disk drive it is fixed in the center. In an operating time the disk is untwisted. The circuit of the disk drive is shown further.  
The head of reading - record can synchronously move in a horizontal and vertical direction (it is shown with arrows) that allows them to come nearer to any point of a surface of a disk. Each point of a surface is considered as a separate bats of external memory.

**AP5.2**

Добавьте или удалите рисунок

Для трихроматов | Для протанопов | Для дейтеранопов | Для тр...



Magnetic disk

Definition

**AP5.5**

Panel of management of graphical images

Вст. из БО | Скопир. в БО | Вырез. в БО | Очистить **AP5.6**

**AP5.7**

# The administrating of database with the values of parameters of the param. cogn. models block: the review and modification of the parameters of the cognitive model of subject of training

4.8.1

**Administration mode**

Languages/Disciplines | Units | Modules | Pages | Database

Groups of users: Code: GR6321 **AD6.1** Name: Грынна 6321 **AD6.3** Users: Name: Беляев Н.А. Password: \*\*\*\*\* Gender:  male **AD6.2**  female

Age: 03 **AD6.4**

Cognitive model of user | Cognitive model of training system for current user

**Physiological portrait**

Visual sensor system parameters

Anomalies of refraction	
Astigmatism (K1):	N/A
Miopia (K2):	N/A
Hypermetropia (K3):	N/A
Anomalies of pereption	
Acuity of vision (K4)	N/A
Field of vision (K5):	N/A
Estimation of distance (K6):	N/A
Color perception	
Achromasia (K7):	24
Protanopia (K8):	12
Deutanopia (K9):	11
Tritanopia (K10):	0

**Psychological portrait**

Mental abilities

Convergental abilities	
Verbal intelligence (K1):	12
Mnemonic and memory (K2):	4
Deduction (K3):	13
Combination (K4):	12
Reasoning (K5):	4
Analyticity (K6):	14
Induction (K7):	12
Plane thinking (K8):	11
Volumetric thinking (K9):	10

Verbal creativity

Associativity (K10):	2,65
Originality (K11):	7,93
Uniqueness (K12):	21
Selectivity (K13):	0

Visual creativity

Associativity (K14)	1,7
Originality (K15):	2
Uniqueness (K16):	4
Selectivity (K17):	0

Kind of training

Fast training (K18):	N/A
Slow training (K19):	N/A

Cognitive styles

Field dependence (K20):	N/A
Impulsiveness (K21):	N/A
Flexibility (K22):	N/A
Abstraction (K23):	N/A
Cognitive complexity (K24):	N/A
Concept breadth (K25):	N/A

Linguistic portrait (Language aspects of the communications)

Level of mastery (K1):	3
Knowledge of terms (K2):	4
Knowledge of interface (K3):	4

# The administrating of database with the values of parameters of the param. cogn. models block: the review and modification of the parameters of the cognitive model of means of training

The screenshot shows the 'Administration mode' window with several sections:

- User Management:** Includes fields for Code (GR6321), Name (Група 6321), Name (Беляев Н.А.), Age (03), Password (\*\*\*\*\*), and Gender (male/female).
- Cognitive Model of User:** Divided into Physiological and Psychological portraits.
- Physiological portrait:** Visual representation parameters (Background, Pattern type, Color, Combination of colors), Font (Name, Size, Color), and Color scheme (For trichomat, protanop, deuteranop, tritanop).
- Psychological portrait:** Representation way (Kind of information: Textual, Tabulated, Plane scheme, Volumetric scheme, Basic sound sch., Support sound sch., Combined scheme, Special sheme) and Additional options (Correction of seq., Navigation, Modules addition, Kind of inf. choice, Style of repr. ch., Speed of repr. ch., Creative tasks, Additional modules, Additional literature).
- Representation speed and style:** Fast/Slow, Complete/detailed, Automatic/manual sw., Constant/variable, Deep concrete/abstract, Simplicity/complexity, Wide/narrow terms set.
- Linguistic portrait:** Language aspects of the communications (Level of a statement material, Set of key words and definitions, Set of elements of interface).

Annotations AD6.1 through AD6.5 highlight specific fields and sections within the interface.



The interface of the adaptive electronic textbook in the mode of adaptive training:  
the textual representation of information fragment (text)

4.9.1

The screenshot shows a software window titled "Educational mode". At the top, it says "Now You study...". Below this, there are two main sections: "Unit" and "Module".

**Unit:** Name: "Origin and theoretical bases of construction". It has four navigation buttons: a double left arrow, a single left arrow, a single right arrow, and a double right arrow.

**Module:** Name: "Concept of information system". It also has four navigation buttons: a double left arrow, a single left arrow, a single right arrow, and a double right arrow.

To the right of the Module section, there is a "Page" indicator showing "1" from "3", with four navigation buttons: a double left arrow, a single left arrow, a single right arrow, and a double right arrow.

The main content area is titled "Informational content" and contains the following text:

**Definition:**  
SYSTEM is any object which is simultaneously considered as a unit and as the set of diverse elements incorporated for achievement object.

**Attributes of system:**

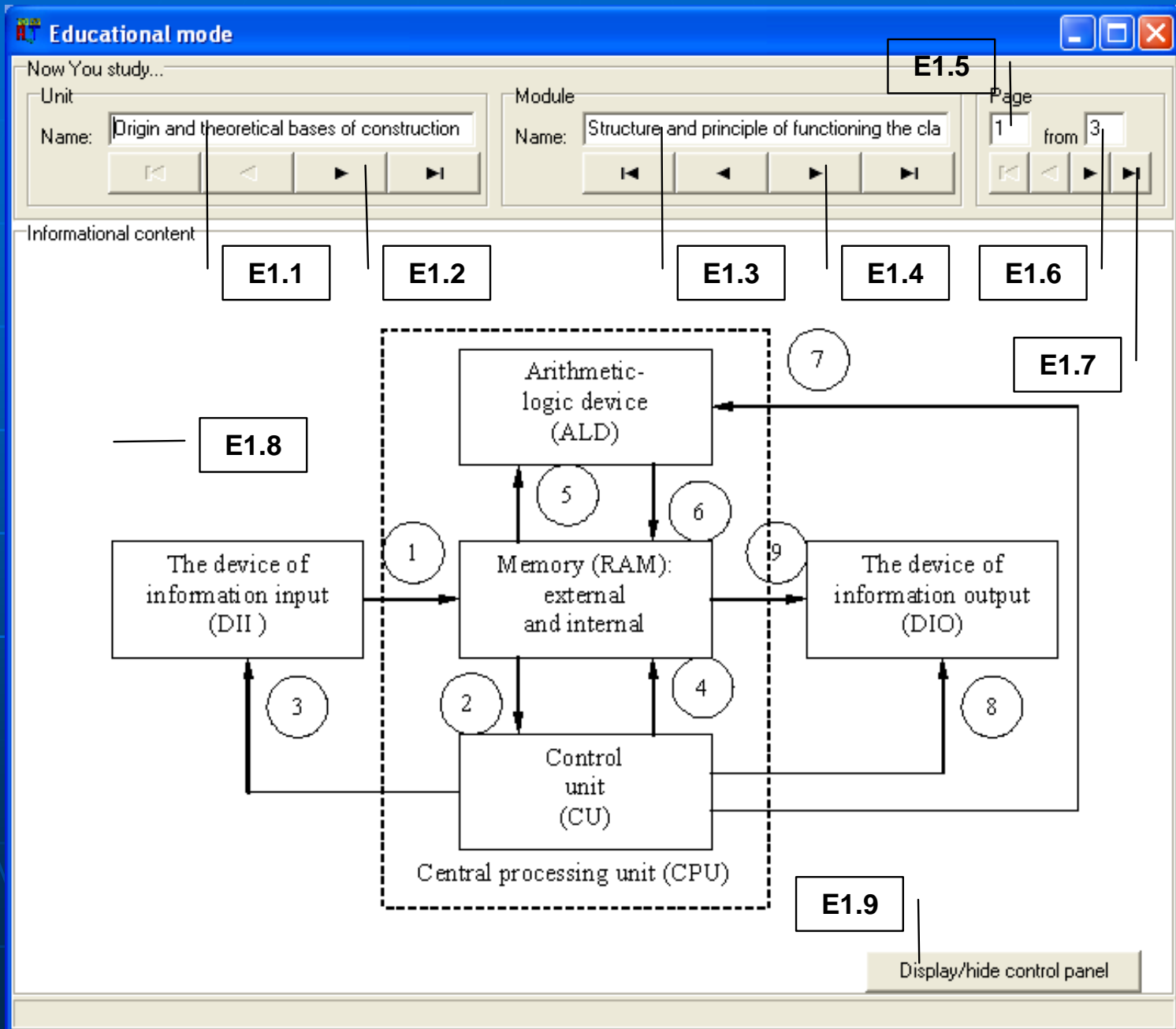
- consists of elements;
- represents functional unity;
- occurrence of each element and its performing function is not casual.

Annotations E1.1 through E1.8 are placed over the text:

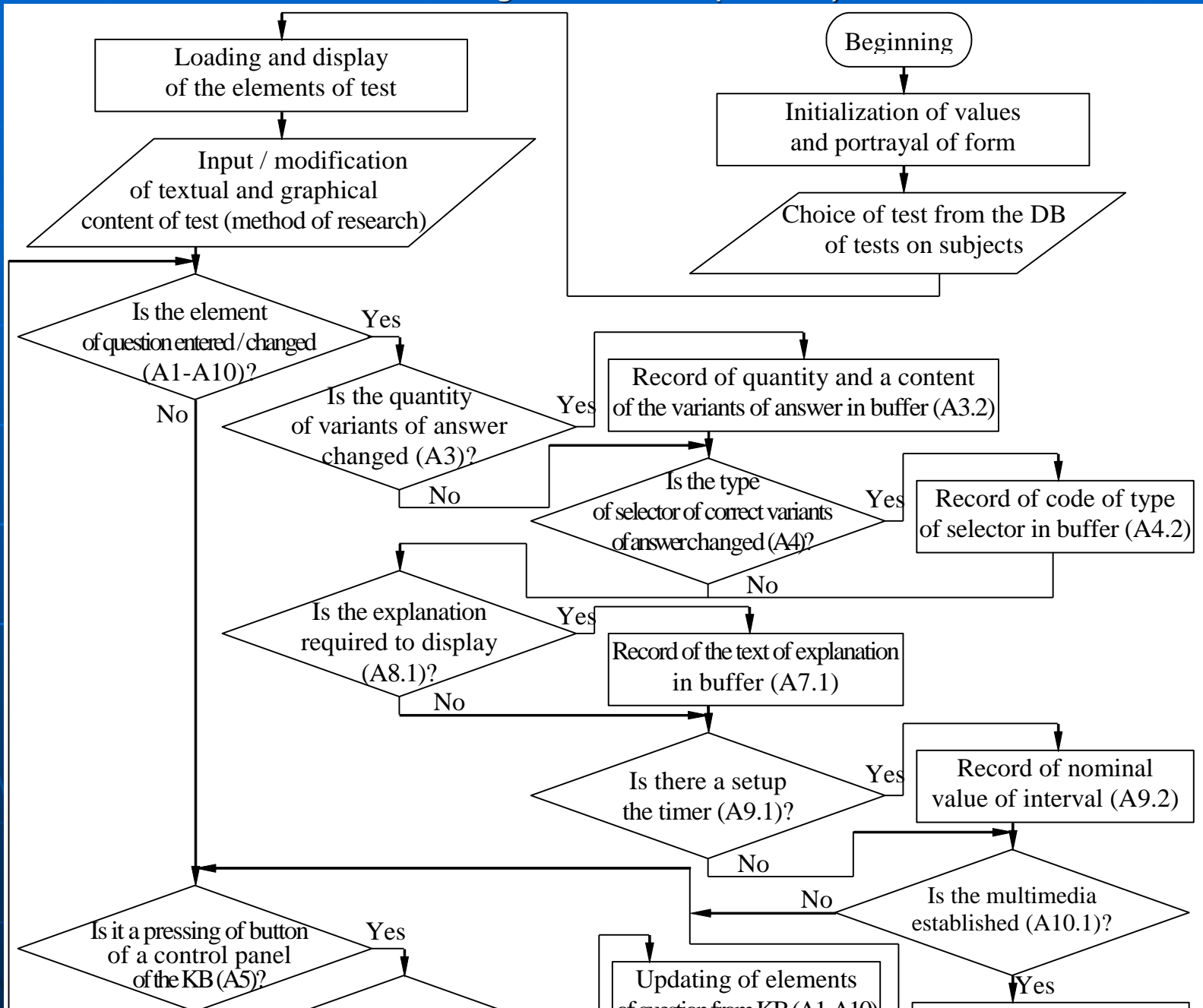
- E1.1** is over the word "simultaneously".
- E1.2** is over the word "unit".
- E1.3** is over the word "set".
- E1.4** is over the word "diverse".
- E1.6** is over the word "elements".
- E1.7** is over the word "achievement".
- E1.8** is over the word "casual".

Annotation **E1.5** is in a box above the Module navigation buttons.

# The interface of the adaptive electronic textbook in the mode of adaptive training: the graphical representation of information fragment (flat scheme)

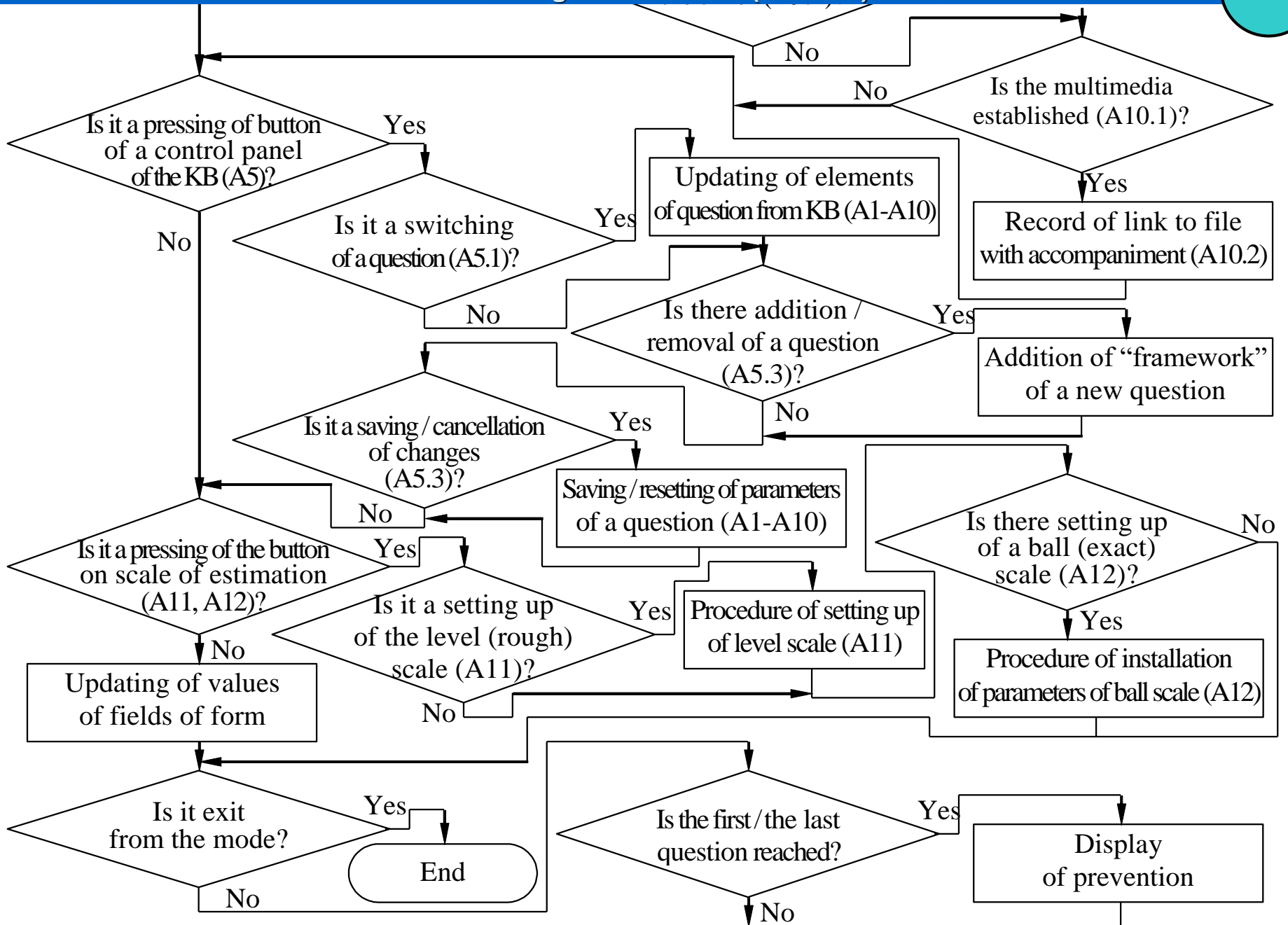


# The algorithm of functioning of the mode of administrating of the basic diagnostic module (1 from 2)



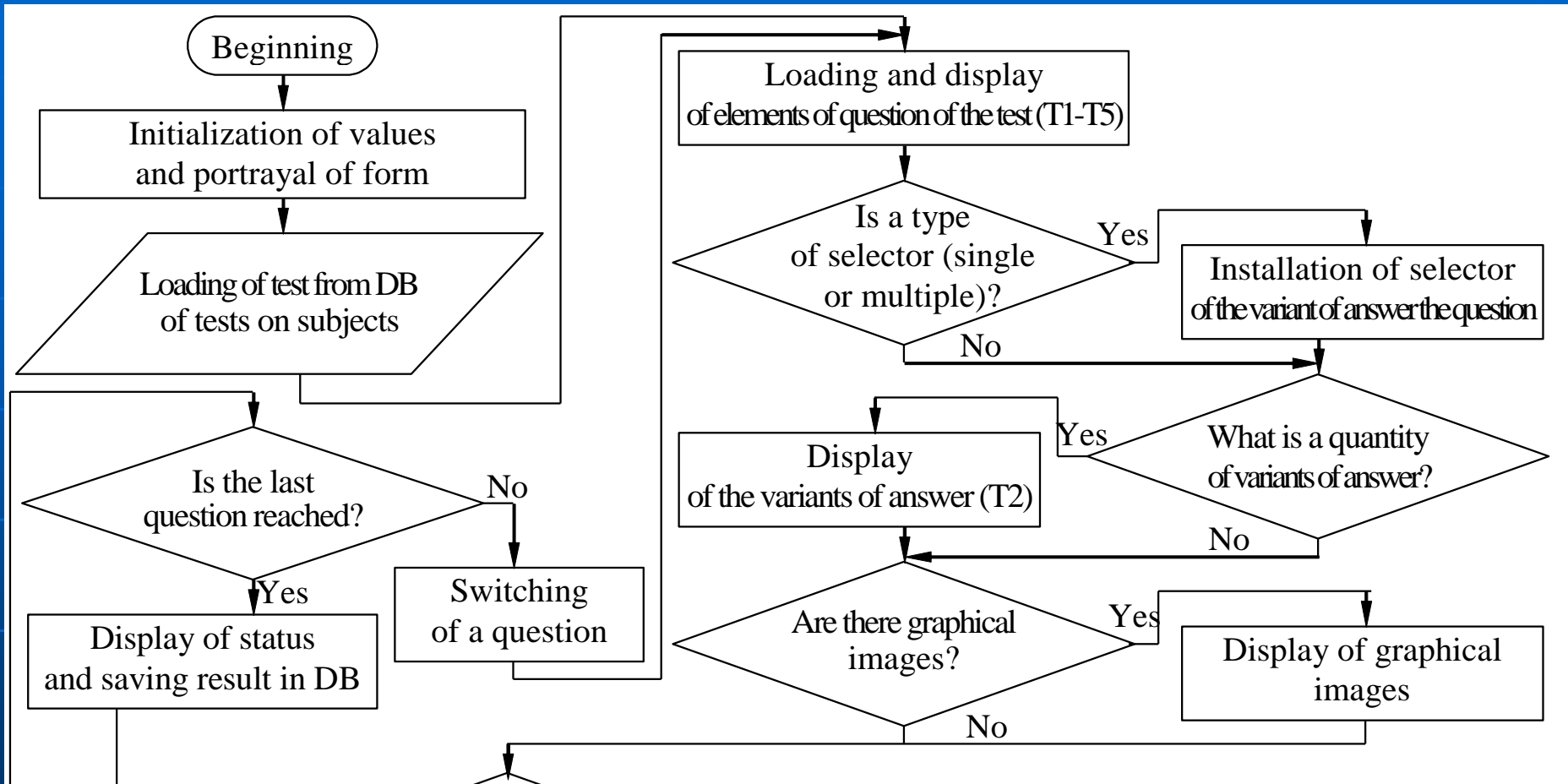
# The algorithm of functioning of the mode of administrating of the basic diagnostic module (2 from 2)

4.10.2

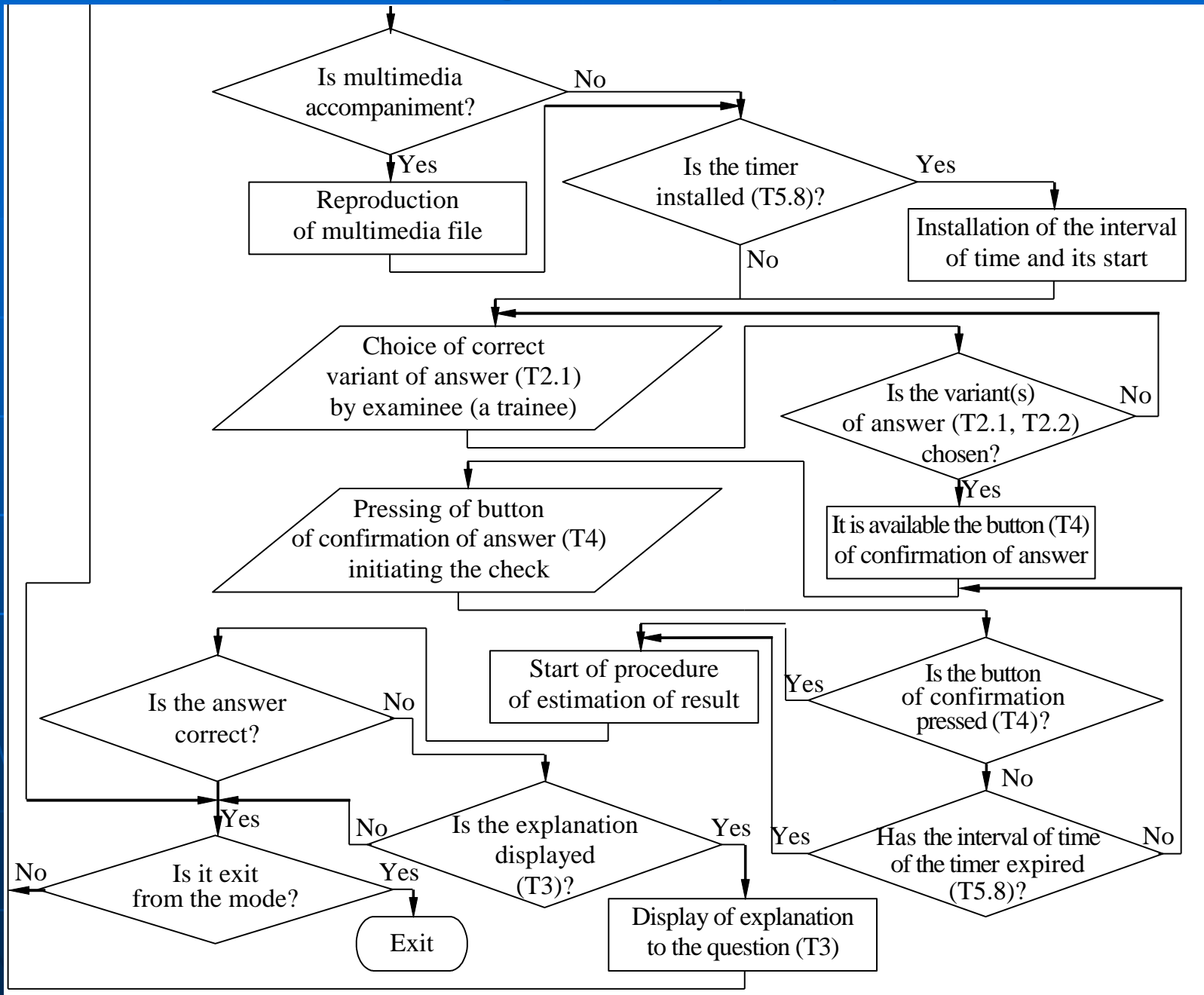


# The algorithm of functioning of the mode of diagnostics in the form of testing of the basic diagnostic module (1 from 2)

4.11.1



# The algorithm of functioning of the mode of diagnostics in the form of testing of the basic diagnostic module (2 from 2)



**Administrator mode**

Вопрос номер 13 из 80

К характерным чертам информации относят...

A1

A2

A3

A4

Количество вариантов

Уст.

Выберите число вариантов

2  3  4  5  6

Тип селектора

Set

Выберите тип селектора

1 (Radio)  2 (Check)

Выберите Ваш вариант ответа

<input type="checkbox"/> 1:	исчерпаемый ресурс при потреблении	0,5
<input checked="" type="checkbox"/> 2:	неисчерпаемый ресурс при потреблении	0,25
<input checked="" type="checkbox"/> 3:	накапливается на различных носителях	0,25
<input checked="" type="checkbox"/> 4:	обуславливает появление новых специальностей	0,25
<input type="checkbox"/> 5:	не является объектом преобразования	0,5
<input checked="" type="checkbox"/> 6:	является объектом преобразования	0,25

A5

A12

A13

A6

A7

A8

A9

Уровень № 1 из 6

Имя: N/A

Вес: 1

Панель управления БЗ

Скачок: 1

Введите объяснение

Правильными вариантами ответа являются 2, 3, 4, 6

Область баллов

Активизировано

Статус пользоват

Верных: 71

Неверн: 31

Уровни: Отл.

Баллов: 0,99

Оценки: Отл.

Штраф: 0

Пояснение

Уст.

Таймер

Уст. вр.: 35 s.

Мультимедиа

Уст. фай.

A14

A15

A16

A10

# The interface of the basic diagnostic module in the mode of diagnostics (the version for the carrying out of express diagnostics, without use of graphical images)

4.12.2

The screenshot displays a software window titled "Test mode" with standard Windows window controls. The main content area shows a question: "Вопрос номер 12 из 80" and "При рассмотрении прикладных основ Информатики к средствам преобразования информации относят...". Below the question is a list of six options, each with a checkbox and a label: "1: Hardware (аппаратное обеспечение вычислительной системы)", "2: Neural networks (нейронная сеть)", "3: Software (программное обеспечение вычислительной машины)", "4: Brainware (алгоритмическое обеспечение компьютера)", "5: Operational system (операционная система)", and "6: Data Mining (получение данных об исследуемом объекте)". A "Ваш ответ неверен" (Your answer is incorrect) message is displayed, stating "Вы ошиблись! Правильными вариантами ответа являются 1, 3, 4" (You are wrong! The correct answer options are 1, 3, 4). A "Нажмите для продолжения" (Click to continue) button is at the bottom.

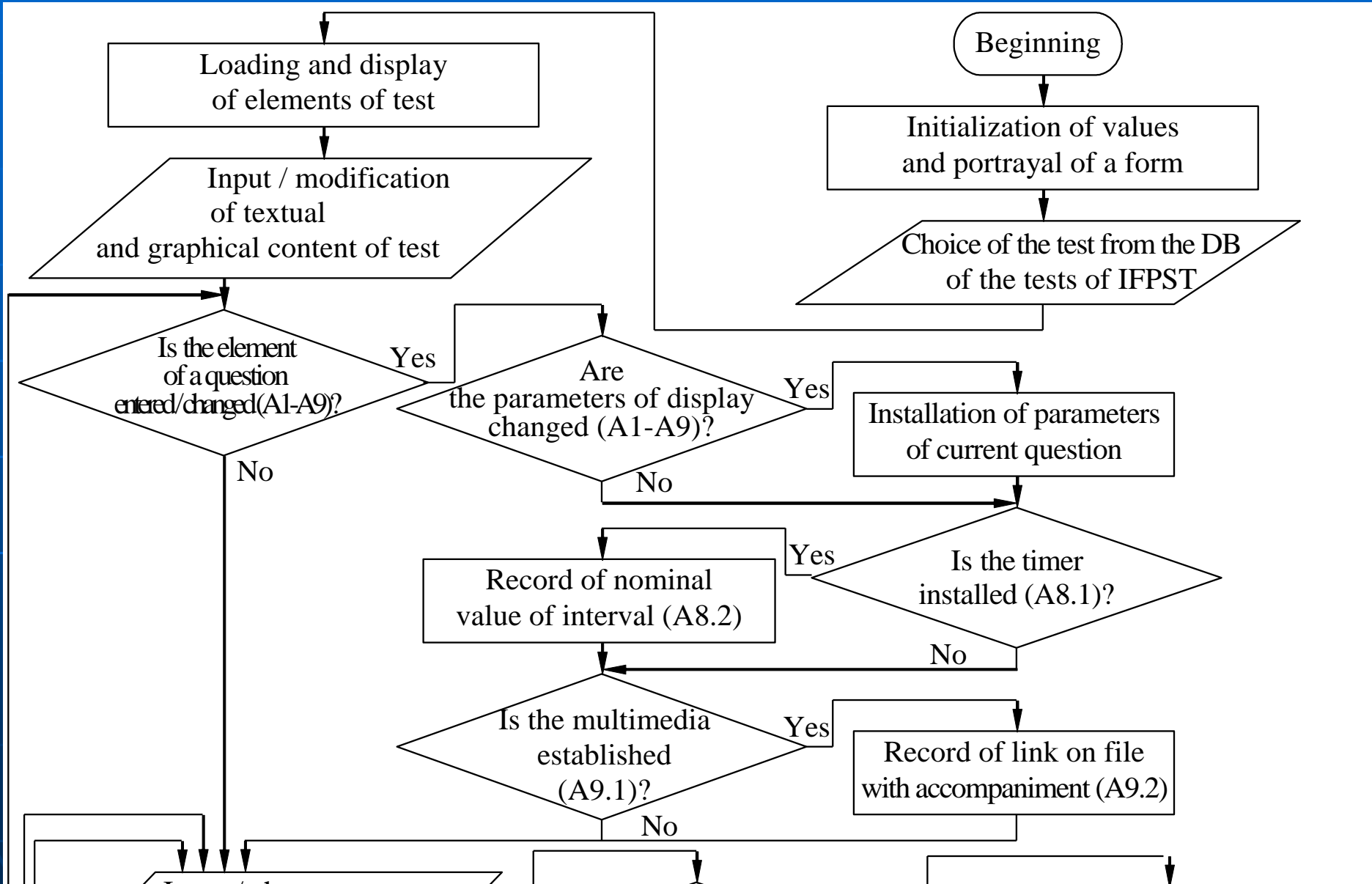
On the left side, there is a "СТАТУС" (STATUS) panel with the following information: "Пользователь: Г: GR6321, И: Абатуров В.С.", "Ответы: верных: 10, неверных: 2", "баллов: 10,36, штраф: 0", "Уровень 3 Неуд. из 6", "Оценка 3 Неуд. из 6", and "Время 18 из 27 сек".

At the bottom right, there is a vertical list of radio buttons numbered 1 through 6. The interface also features several callout boxes labeled T1 through T5, with arrows pointing to specific elements: T1 points to the question text, T2 to the "3: Software" option, T3 to a "Нажмите здесь чтобы дать ответ" (Click here to give an answer) button, T4 to the "Ваш ответ неверен" message, and T5 to the "Оценка 3 Неуд. из 6" status line.

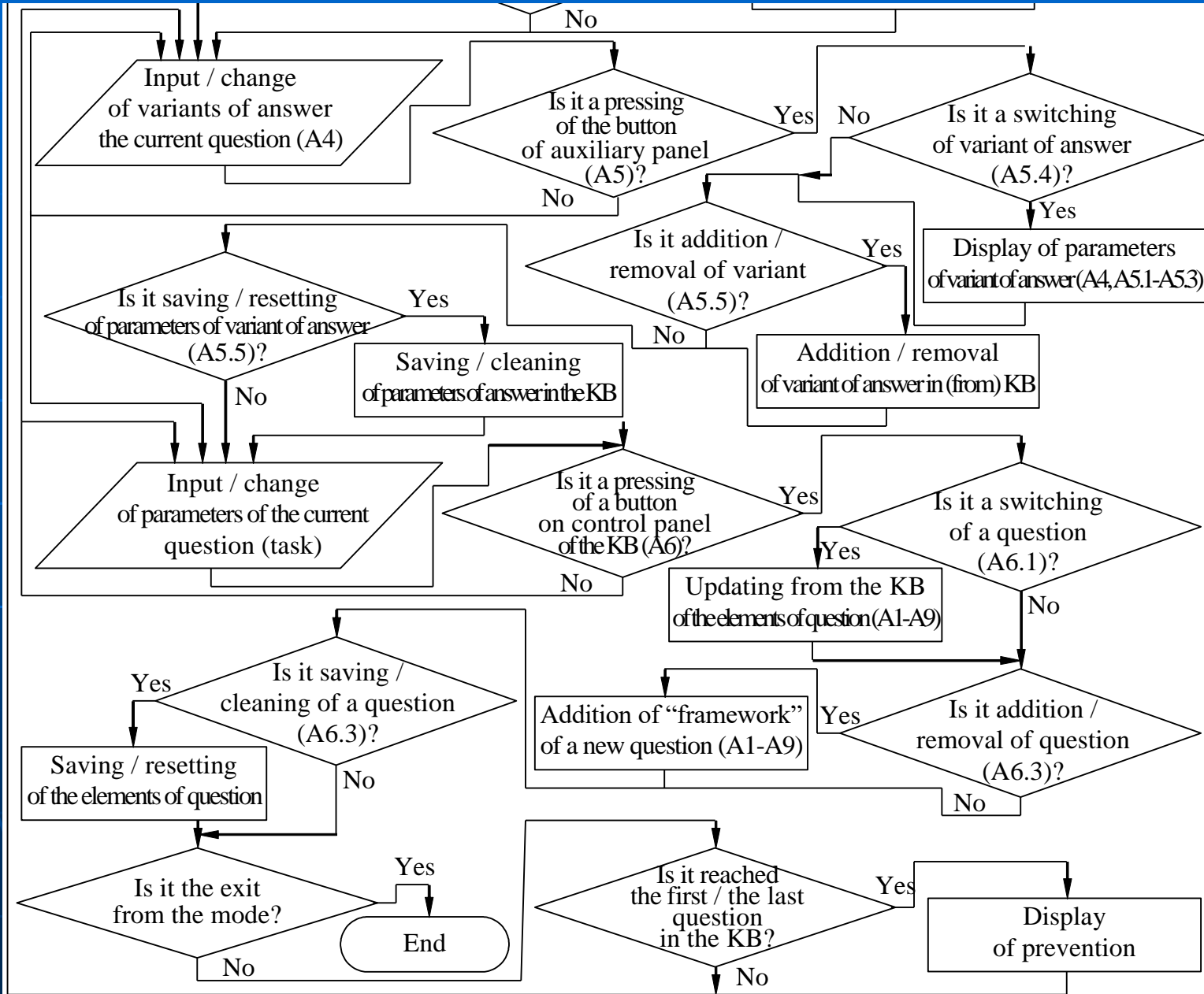


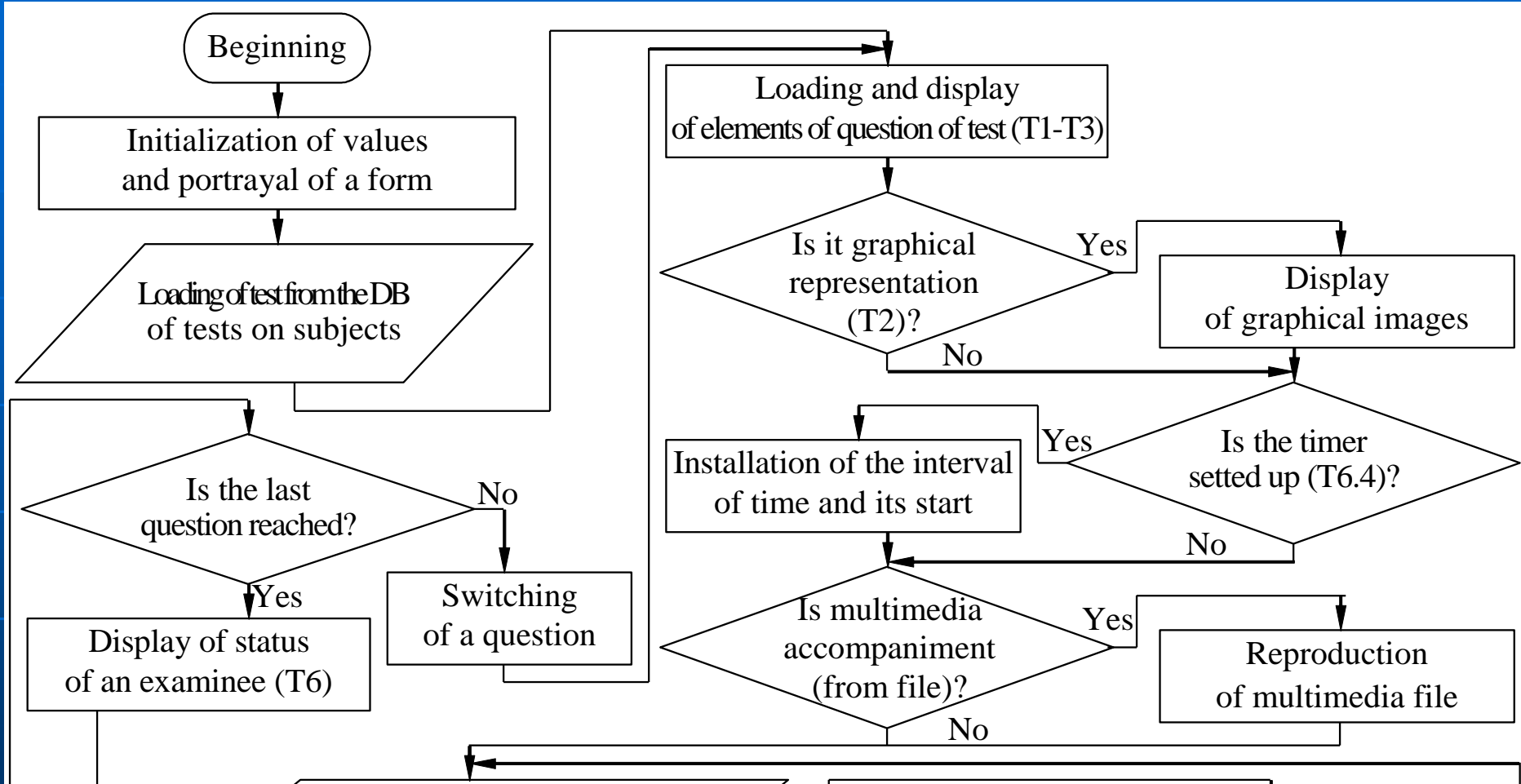
The algorithm of functioning of the applied diagnostic module  
in the mode of administrating of the question-answers structures of the methods of research  
of the individual features of the contingent of examinees (1 from 2)

4.13.1



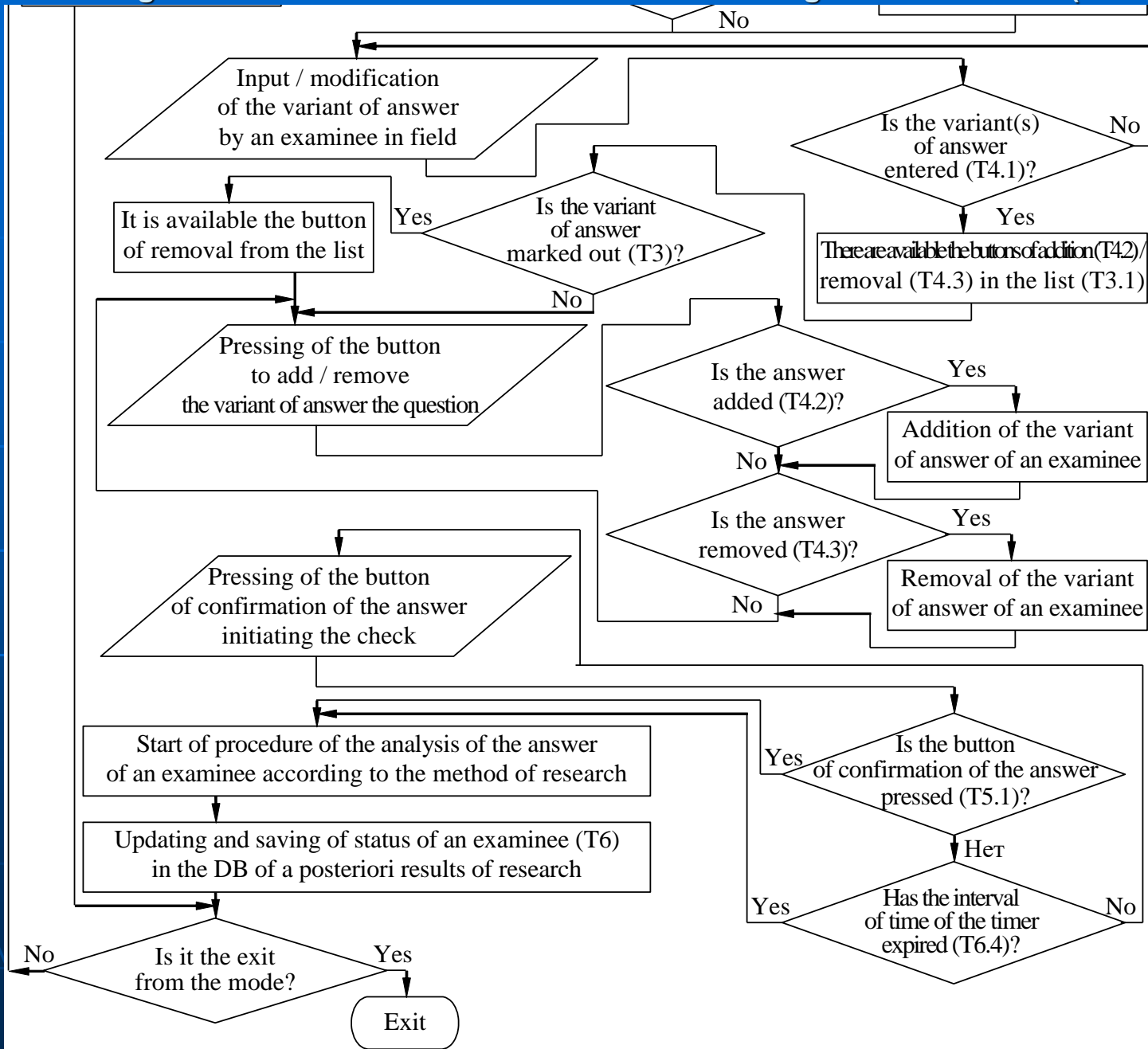
The algorithm of functioning of the applied diagnostic module  
in the mode of administrating of the question-answers structures of the methods of research  
of the individual features of the contingent of examinees (2 from 2)





# The algorithm of functioning of the applied diagnostic module in the mode of diagnostics of the individual features of the contingent of examinees (2 from 2)

4.14.2



The interface of the applied diagnostic module in the mode of administrating of the question-answers structures of the method of research of the color perception of Rabkin E.E. 4.15.1

**Administrator mode**

Вопрос номер 3 из 27

Что изображено на графическом изображении?

**AD1** \_\_\_\_\_

Панель управления БЗ

←← [-] →→ + -  
Ok Undo

Переход 1 Start

Графическое изображение

**AD2**

**AD7**

**AD8**

Параметры вопроса

Уст. \_\_\_\_\_ **AD3**

Отображать

текст  изображения  все

Добавьте новый или выберите для редактирования существующий

Номер ответа 1 from 2

VARTEXT
5 _____ <b>AD4</b>
9

Параметры текущего варианта ответа

Статус:  Учитывать в расчетах

Выбранный вариант ответа

Текст. код: 5 \_\_\_\_\_ **AD5**

Диагноз

Трихроматия  Протанопия  
 Дейтеранопия  Триганопия

Перв. Выше + -  
Посл. Ниже Ok Отм.

Изображение

Вст. из 60  
Коп. в 60  
Выр. в 60  
Освободить

Таймер

Уст. вр.: 90 с. **AD9**

Мультимедиа

Уст. фай.

Группы пользователей

Код: GR6321  
Имя: Группа 6321

Пользователи

Имя: Абагуров В.С. Возраст: 17  
Пол:  мужск.  женск.  
Пароль:

Статус пользователя Попытка №: 0 из -1  
Тип исслед.: Rabkin tables K1= 4  
Дата/Время 29.12.2006 1:29:18 K2= 3  
K3= 3  
K4= 0

**AD10** **AD11** **AD12**

# The interface of the applied diagnostic module in the mode of diagnostics of the color perception by means of the method of research of Rabkin E.B.

4.15.2

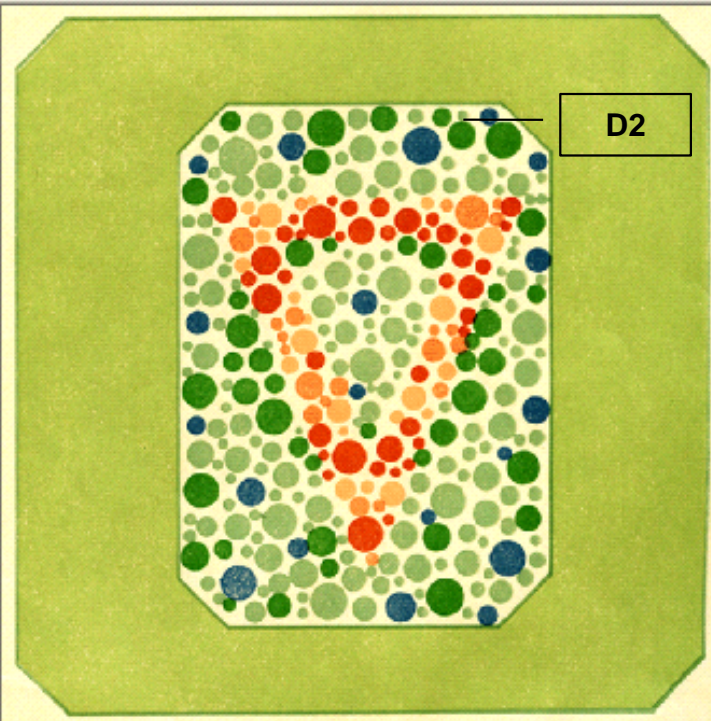
**Test mode**

Вопрос номер 4 из 27

Что изображено на графическом изображении?

— **D1**

**Графическое изображение**



— **D2**

**СТАТУС**

Вид исследования  
Rabkin tables

Наименование теста  
Universal

Пользователь  
Г: GR6321  
И: Абатуров В.С.

Время 39 из 90 сек

Результаты тестирования

K1(Трихроматия)=	3
K2(Протанопия)=	2
K3(Дейтеранопия)=	2
K4(Тританопия)=	0

**Список Ваших ответов**

All Your associations are listed below

▶ треугольник

— **D3**

Введите новую ассоциацию или отредактируйте

круг

— **D4**

Добавить в список | Удалить из списка

Нажмите здесь

чтобы дать ответ (на след. вопрос)

— **D5**

**D6**

**D7**

The interface of the applied diagnostic module in the mode of administrating of the question-answers structures of the subtest of plane thinking by means of the eighth block of questions "Plane figures" of the method of research of R. Amthauer

**Administrator mode**

Выберите локализацию  
Код: RUS  
Имя: Русский

Субтест № 8 из 9  
Имя: Субтест 8. Фигуры

Вопрос номер 3 из 20

Соедините мысленно части, и ту фигуру, которая у вас при этом получится, найдите в ряду фигур

Графическое изображение

Параметры вариантов ответа  
Укажите количество вариантов ответа: 1, 2, 3, 4, 5  
Укажите наполнение вариантов: текст, графика, комбиниро  
Укажите тип представления вариантов: отобраз. система, вводит пользов.

Укажите правильный вариант ответа  
1:   
2:   
3:   
4:   
5:

Панель управления вопросами  
Вставить из БД, Вырезать в БД, Копировать в БД, Очистить, Таймер на отображение изображения:  Уст. s.

ADD1

ADD2

ADD3

ADD4

ADD5

ADD6

ADD7

A8

ADD9

ADD10

The interface of the applied diagnostic module in the mode of diagnostics of the plane thinking by means of the eighth block of questions "Plane figures" of the method of res. of R. Amthauer

4.16.2

**Test mode**

Вопрос номер 1 из 20

Соедините мысленно части, и ту фигуру, которая у вас при этом получится, найдите в ряду фигур

— **DD1**

**СТАТУС**

Локализация  
Русский

Субтест  
Субтест8. Фигуры

Пользователь  
Г: GR01  
И: Федоров Ф.Ф.

Время 5 из 27 сек

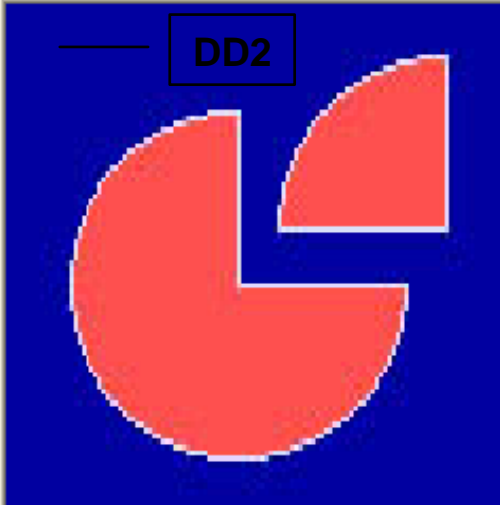
Результаты тестирования

K1= 8 K4= 8 K7= 8

K2= 10 K5= 9 K8= 0


K3= 12 K6= 11 K9= 0

**Графическое изображение**



— **DD2**

**DD3**



1 2 3 4 5

Нажмите здесь

— **DD4**

чтобы дать ответ (на след. вопрос)

**DD5**



The interface of the applied diagnostic module in the mode of administrating of the question-answers structures of the subtest of figurative creativity by means of the method of research of Torrance E.P.

4.17.1

**Administrator mode**

Question number 1 from 6

Возьмите карандаш и лист бумаги, попробуйте дополнить данный графический объект, запишите в поле ответа ассоциации, возникающие у Вас с полученным Вами рисунком.

— AAD1

— AAD7

Question parameters — AAD3

Set

Display

text only  picture only  all

Control panel of KB

←← ← → →→ + -

Goto: 1 Start Ok Undo

Add new or choose for editing an existing variant of the answer

Answer number 1 from 8

Status	Textual contents
<input checked="" type="checkbox"/>	1 Брови — AAD4
<input type="checkbox"/>	1 Кость
<input type="checkbox"/>	1 Облако
<input type="checkbox"/>	1 Очки
<input type="checkbox"/>	1 Птицы
<input type="checkbox"/>	1 Пятачок
<input type="checkbox"/>	1 Сердце

Current variant of answer parameters: AAD5

Status:  To take into account in calculations

Selected association

Textual contents: Брови

Index of originality: 0,74 pts.

Picture

1

— AAD2

— AAD6

— AAD8

Picture

Paste from CB

Copy to CB

Cut to CB

Clear

Timer

Set time: 300 s.

Multimedia

Set file — AAD9

Groups of users

Code: GR01

Name: Группа 1

Users

Name: Петров П.П. Age: 23

Gender  male  female

Password: petr345

User status

Attemp number 1 from 2

Type name: Visual Creativity K1= 1,666

Date/Time: 24.05.2005 14:59:27 K2= 0,89

K3= 8

AAD10

AAD11

AAD12

# The interface of the applied diagnostic module in the mode of diagnostics of the figurative creativity by means of the method of research of Torrance E.P.

**Test mode**

Question number 1 from 6

Возьмите карандаш и лист бумаги, попробуйте дополнить данный графический объект, запишите в поле ответа ассоциации, возникающие у Вас с полученным Вами рисунком.

— **DDD1**

**Picture**

— **DDD2**

**STATUS**

Kind of research  
Visual creativity

Test name  
2.1. Test for teenagers

User  
G: GR01  
N: Петров П.П.

Time 264 from 300 sec

Test results  
K1= 0  
K2= 0  
K3= 0

The list of answers (can be edited)

- All Your associations are listed below
- чайка
- облако
- ▶ кость

— **DDD3**

Write new association or edit selected in list

птица — **DDD4**

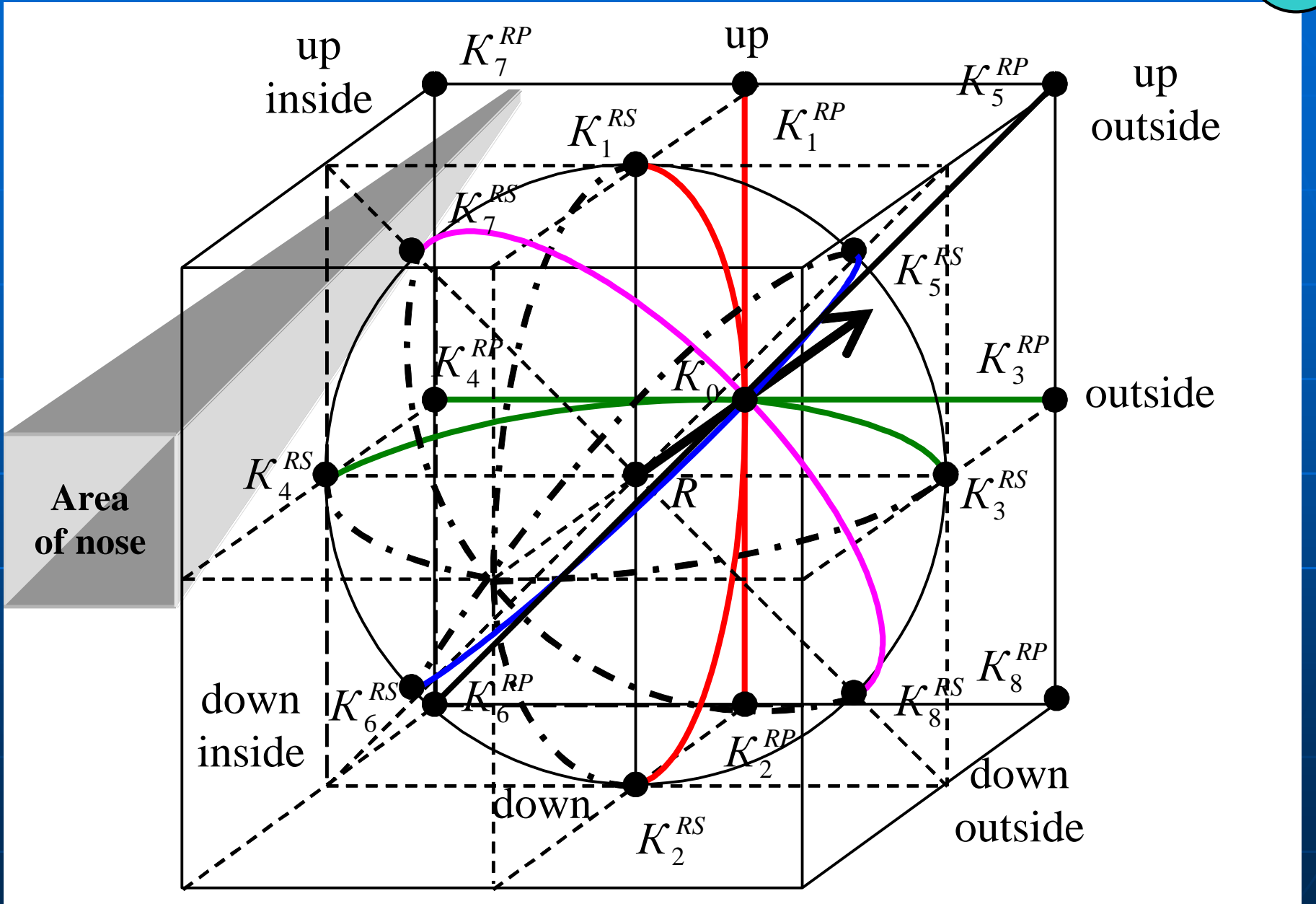
Add to list Remove from list

Click here

to give answer (goto next question)

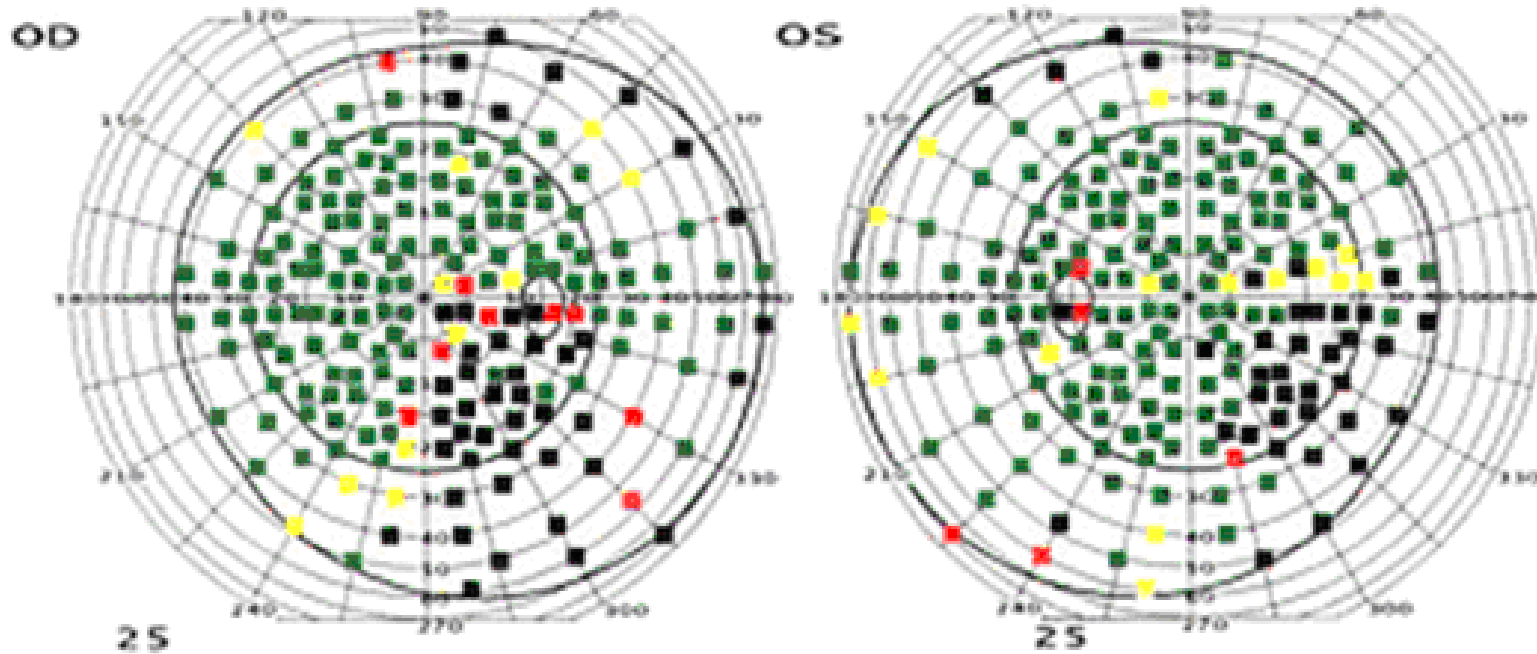
**DDD5**

**DDD6**



# The features of a posteriori data of research of the achromatic and chromatic field of vision of examinee

4.18.2



The interface of the applied diagnostic module in the mode of administrating of the question-answers structures of the method of research of the achromatic and chromatic field of vision of examinee by means of the computer perimetry: the parameters of the method of research

**Administrator mode**

Method parameters | Display parameters | Database parameters

Select kind of research

Code: RUS

Name: хроматическое **AAA1.1**

Set to display popup description

Enter or edit description

Сейчас будет проведено исследование хроматического поля зрения

Select type of research 2 from 2

Name: полихроматическое **AAA1.2**

Set to display popup description

Enter or edit description

Исследование полихроматического поля зрения будет осуществлено с использованием всех основных цветов цветовой палитры (красный, оранжевый, желтый, зеленый, голубой, синий, фиолетовый)

Set to display help in status bar

Enter or edit help in status bar

Исследование полихроматического поля зрения

Select Eye

Name: Левый глаз

Set to display popup description

Enter or edit description **AAA1.3**

Для исследования полихроматического поля зрения левого глаза Вам необходимо смотреть левым глазом в центр, а правый глаз закрыть шторой или правой рукой

Select color 1 from 7

Name: красный

Set to popup description

Enter or edit description **AAA1.4**

Исследование монохроматического поля зрения осуществляется последствием отображения "мишени" на черном (сером) фоне с использованием красного цвета

Select direction 1 from 8

Name: кверху

Index: K1

Set to display popup description

Enter or edit description **AAA1.5**

Сейчас будет осуществляться перемещение "мишени" красного цвета в вертикальной плоскости сверху вниз до точки пересечения всех направлений (меридианов). Пожалуйста смотрите только в центр

Select step (measure point)

Name: point one **AAA1.6**

Nominal: 70 degrees

· santimeters

Set to display popup description

Enter or edit description

Будьте внимательны!  
Сейчас будет осуществлено отображение "мишени" с заданными параметрами и реализовано измерение точки в данном направлении (меридиане).

Enter or edit normal values

Minimum normal value: 50 degrees

· santimeters

Maximum normal value: 55 degrees

· santimeters

Average normal value: 52,5 degrees

**AAA1.7** · santimeters

The interface of the applied diagnostic module in the mode of administrating of the question-answers structures of the method of research of the achromatic and chromatic field of vision of examinee by means of the computer perimetry: the parameters of display

4.19.2

**Administrator mode**

Method parameters | **Display parameters** | Database parameters

Select kind of research  
Name:

Select type of research  
Name:  **AAA2.2**

Representation time  
Interval of display:  ms. **AAA2.1**

Interval between symbols:  ms.

Number of measure levels:  ms. **AAA2.3**

Maximum attempts to display:  ms.

Select type of research  
Symbol type  
Select symbol type  
 number **AAA2.4**  
 letter  
 icon

Symbol generation **AAA2.5**  
 random  
 specified

Quantity of symbols

Color of symbol  
Select palette of colors  
 monochromatic  
 polychromatic **AAA2.6**

Select quantity of colors  
 one (green)  
 all (7 colors)  
 direct colors **AAA2.7**

Select colors  
 red  
 green  
 violet  
 orange  
 blue  
 yellow  
 dark (deep) blue **AAA2.8**

The basic directions (meridians) of moving  
Select quantity of directions  
 standart **AAA2.9**  
 specified

Select directions  
Standart directions  
 4 directions (90 deg)  
 8 directions (45 deg)  
 12 directions (30 deg)

Specified directions  
Enter number of directions:   
Number of degrees between directions:

Multimedia  
 Set file **AAA2.10**

**AAA2.11**

**AAA2.12**

**AAA2.13**

The interface of the applied diagnostic module in the mode of administrating of the question-answers structures of the method of research of the achromatic and chromatic field of vision of examinee by means of the computer perimetry: the parameters of database

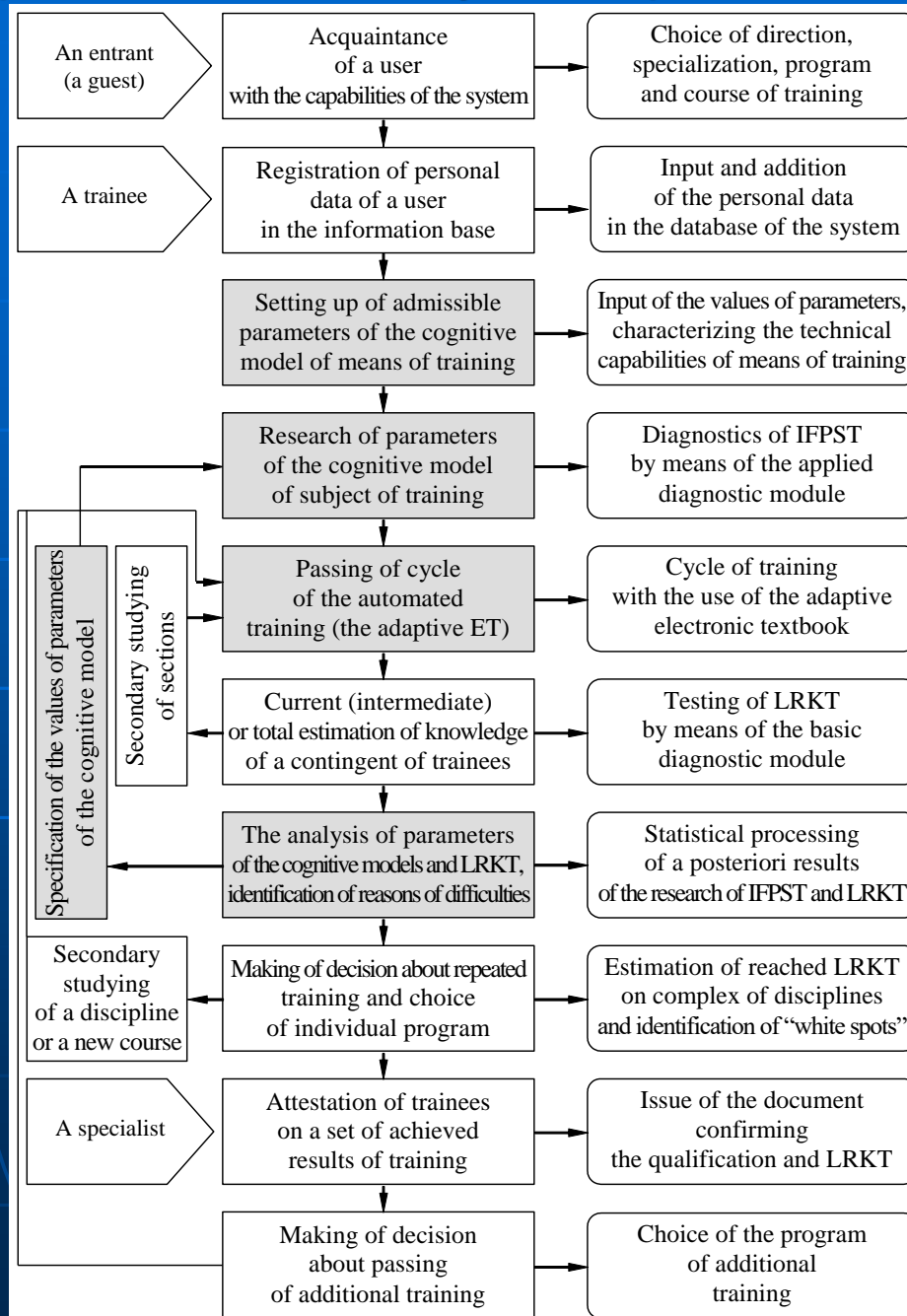
# The interface of the applied diagnostic module in the mode of diagnostics of the achromatic and chromatic field of vision of examinee by means of the computer perimetry

4.20.1





# The scheme, reflecting the sequence of actions for the support of researches of the cycle of adaptive automated training



## The summary results of the mathematical processing of a posteriori data of the experiment (1 from 4)

Previously there was carried out the analysis of the dynamics of a change of the indicator of resultativity of training (LRKT) for the last three years and there was estimated the efficiency of the use of the CMT in the educational process (from 2004-2006 y.), the results of which are presented in the tab. 1.

Table 1

### The results of the preliminary statistical analysis of resultativity of the (adaptive) training

Name of indicator	Number of group of examinees							
	1	2	3	4	5	6	7	8
The indicators of resultativity of the training for 2004 year (without CMT in the three groups, private estimation on the fourth section of discipline "Computer science")								
Quantity of trainees	20	21	25	18	18	15	0	0
Average point $Y_1$	4,05	4,286	4,24	4,611	4,056	4,4	-	-
AQD of average point	0,686	0,845	0,779	0,502	0,802	0,507	-	-
The indicators of resultativity of the training for 2005 year (without CMT in the three groups, private estimation on the fourth section of discipline "Computer science")								
Quantity of trainees	24	22	24	25	24	22	23	21
Average point $Y_2$	4,333	4,046	4,375	4,16	4,042	4,091	4,696	4
AQD of average point	0,817	0,785	0,824	0,8	0,859	0,811	0,559	0,894
The indicators of resultativity of the training for 2006 year (with CMT in the three groups, private estimation on the fourth section of discipline "Computer science")								
Quantity of trainees	26	23	29	24	25	22	22	22
Average point $Y_3$	4,5	4,609	4,379	3,708	3,92	3,773	4,455	3,818
AQD of average point	0,707	0,656	0,775	0,751	0,572	0,612	0,858	0,853

## The summary results of the mathematical processing of a posteriori data of the experiment (2 from 4)

Previously there was carried out the analysis of the dynamics of a change of the indicator of resultativity of training (LRKT) for the last three years and there was estimated the efficiency of the use of the CMT in the educational process (from 2007-2009 y.), the results of which are presented in the tab. 1.

Table 1

### The results of the preliminary statistical analysis of resultativity of the (adaptive) training

Name of indicator	Number of group of examinees							
	1	2	3	4	5	6	7	8
The indicators of resultativity of the training for 2007 year (with CMT in the three groups, private estimation on the fourth section of discipline "Computer science")								
Quantity of trainees	21	16	17	23	21	16	20	18
Average point $Y_3$	4,524	4,5	4,588	4,174	4,571	4,375	3,9	3,167
AQD of average point	0,680	0,633	0,507	0,778	0,507	0,619	0,968	0,384
The indicators of resultativity of the training for 2008 year (with CMT in the three groups, private estimation on the fourth section of discipline "Computer science")								
Quantity of trainees	17	20	19	18	20	18	15	18
Average point $Y_3$	4,588	4,550	4,684	4,167	4,45	4,778	3,933	4,111
AQD of average point	0,507	0,759	0,582	0,707	0,686	0,428	0,799	0,758
The indicators of resultativity of the training for 2009 year (with CMT in the three groups, private estimation on the fourth section of discipline "Computer science")								
Quantity of trainees	15	14	14	14	14	14	18	-
Average point $Y_3$	4,6	4,571	4,714	4	4,357	4,786	3,944	-
AQD of average point	0,507	0,756	0,469	0,679	0,633	0,426	0,725	-

The summary results of the mathematical processing  
of a posteriori data of the experiment (3 from 4)

End of the tab. 1

Total results of the statistical analysis								
The indicators, reflecting the change of the efficiency of the training for 2004-2005 year								
$k_1$	0,283	-0,240	0,135	-0,451	-0,014	-0,309	-	-
$k_2$	1,07	0,944	1,032	0,902	0,997	0,93	-	-
$k_3, \%$	6,996	-5,606	3,184	-9,783	-0,343	-7,025	-	-
Change of AQD	0,13	-0,06	0,045	0,298	0,056	0,304		
The indicators, reflecting the change of the efficiency of the training for 2005-2006 year (with the use of CMT)								
$k_1$	0,167	0,563	0,004	-0,452	-0,122	-0,318	-0,241	-0,182
$k_2$	1,039	1,1392	1,001	0,891	0,970	0,922	0,949	0,955
$k_3, \%$	<b>3,846</b>	<b>13,923</b>	0,099	-10,857	-3,01	-7,778	-5,135	-4,546
Change of AQD	-0,109	-0,129	-0,049	-0,049	-0,287	-0,199	0,299	-0,042
The indicators, reflecting the change of the efficiency of the training for 2006-2007 year (with the use of CMT)								
$k_1$	0,024	-0,109	0,209	0,466	0,651	0,602	-0,555	-0,652
$k_2$	1,005	0,976	1,048	1,126	1,166	1,160	0,876	0,829
$k_3, \%$	0,529	-2,359	<b>4,771</b>	12,555	16,618	15,964	<b>-12,449</b>	<b>-17,064</b>
Change of AQD	-0,028	-0,024	-0,268	0,027	-0,065	0,007	0,110	-0,469

The summary results of the mathematical processing  
of a posteriori data of the experiment (4 from 4)

End of the tab. 1

Total results of the statistical analysis

The indicators, reflecting the change of the efficiency of the training for 2007-2008 year  
(with the use of CMT)

$k_1$	0,064	0,050	0,096	-0,007	-0,121	0,403	0,033	0,944
$k_2$	1,014	1,011	1,021	0,998	0,973	1,092	1,009	1,298
$k_3, \%$	<b>1,424</b>	<b>1,111</b>	<b>2,092</b>	-0,174	-2,656	<b>9,206</b>	0,855	<b>29,825</b>
Change of AQD	-0,172	0,127	0,075	-0,071	0,179	-0,191	-0,169	0,375

The indicators, reflecting the change of the efficiency of the training for 2008-2009 year  
(with the use of CMT)

$k_1$	0,012	0,021	0,030	-0,167	-0,093	0,008	0,011	-4,111
$k_2$	1,003	1,005	1,006	0,960	0,979	1,002	1,003	0,000
$k_3, \%$	0,256	0,471	0,642	-4,000	-2,087	0,166	0,283	<b>-100 [? ]</b>
Change of AQD	0,000	-0,003	-0,114	-0,028	-0,053	-0,002	-0,074	-0,758

1. As the result of the carried-out regression analysis the received values of coefficient of multiple correlation (CMC) and coefficient of multiple determination (CMD) demonstrate, that **minimum 38,9%** (at the reduced set of predictors and the rough scale of estimation on the basis of the sum of the correct answers the questions) and **maximum 59,0%** (at the full set of predictors and the exact scale of estimation on the basis of the sum of the gained points) of dispersion of dependent variable Y (estimation of the LRKT) is defined by the variation of the values of the reduced and full set of independent variables of the linear regression model  $Y(K_i)$ .
2. As predictors in the received linear multiple regression model is accepted the reduced (Age,  $K_7$ ,  $K_8$ ,  $K_9$ ,  $K_{14}$ ,  $K_{15}$ ,  $K_{16}$ ,  $K_{17}$ ,  $K_{18}$ ,  $K_{19}$ ,  $K_{20}$ ,  $K_{21}$ ,  $K_{22}$ ,  $K_{23}$ ,  $K_{24}$ ,  $K_{25}$ ,  $K_{27}$ ,  $K_{28}$ ,  $K_{29}$ ,  $K_{45}$ ) and the full set (Age, RU, LIT, LG, HIS, GEO, BIO, ALG, GEOM, FIZ, CHE, SCH, AST,  $K_7$ ,  $K_8$ ,  $K_9$ ,  $K_{14}$ ,  $K_{15}$ ,  $K_{16}$ ,  $K_{17}$ ,  $K_{18}$ ,  $K_{19}$ ,  $K_{20}$ ,  $K_{21}$ ,  $K_{22}$ ,  $K_{23}$ ,  $K_{24}$ ,  $K_{25}$ ,  $K_{27}$ ,  $K_{28}$ ,  $K_{29}$ ,  $K_{45}$ ,  $L_{31N}$ ,  $L_{36N}$ ,  $L_{37}$ ,  $L_{38N}$ ) of independent variables (predictors), and as the factor (dependent variable) directly supports the resultativity of technological process of controlled formation of knowledge Y ( $Y_2$  – the estimation of LRKT on the rough scale on the basis of the sum of the correct answers the questions and  $Y_4$  – the estimation of LRKT on the exact scale on the basis of the sum of the gained points for each correct variant of answer the question).

During the regression analysis the equations of multiple regression are received:

$$Y_2 = 2,545 - 0,012 \text{Age} + 0,031 K_7 + 0,020 K_8 - 0,029 K_9 + 0,057 K_{14} - 0,017 K_{15} - 0,019 K_{16} - 0,017 K_{17} + 0,038 K_{18} + 0,012 K_{19} + 0,015 K_{20} + 0,030 K_{21} - 0,003 K_{22} - 0,031 K_{23} + 0,004 K_{24} - 0,005 K_{25} + 0,075 K_{27} - 0,035 K_{28} + 0,006 K_{29} + 0,037 K_{45}, \text{ CMC} = \mathbf{0,389}, \text{ CMD} = \mathbf{0,151}.$$

$$Y_4 = 4,924 - 0,108 \text{Age} + 0,028 K_7 + 0,005 K_8 - 0,025 K_9 + 0,016 K_{14} - 0,038 K_{15} - 0,016 K_{16} - 0,003 K_{17} + 0,038 K_{18} - 0,015 K_{19} + 0,021 K_{20} + 0,068 K_{21} - 0,019 K_{22} - 0,040 K_{23} - 0,015 K_{24} + 0,008 K_{25} + 0,090 K_{27} - 0,096 K_{28} + 0,020 K_{29} + 0,075 K_{45}, \text{ CMC} = \mathbf{0,509}, \text{ CMD} = \mathbf{0,259}.$$

$$Y_2 = 0,824 - 0,008 \text{Age} - 0,161 \text{RU} + 0,049 \text{LIT} + 0,147 \text{LG} + 0,244 \text{HIS} - 0,128 \text{GEO} - 0,008 \text{BIO} + 0,040 \text{ALG} + 0,120 \text{GEOM} - 0,100 \text{FIZ} - 0,077 \text{CHE} + 0,148 \text{SCH} + 0,041 \text{AST} + 0,030 K_7 + 0,021 K_8 - 0,035 K_9 + 0,067 K_{14} - 0,005 K_{15} - 0,034 K_{16} - 0,022 K_{17} + 0,040 K_{18} + 0,006 K_{19} + 0,007 K_{20} + 0,027 K_{21} + 0,000 K_{22} - 0,022 K_{23} - 0,003 K_{24} - 0,003 K_{25} + 0,062 K_{27} - 0,046 K_{28} + 0,008 K_{29} + 0,028 K_{45} + 0,087 L_{31N} - 0,020 L_{36N} + 0,025 L_{37} - 0,003 L_{38N}, \text{ CMC} = \mathbf{0,491}, \text{ CMD} = \mathbf{0,241}.$$

$$Y_4 = 3,035 - 0,098 \text{Age} - 0,106 \text{RU} + 0,034 \text{LIT} - 0,015 \text{LG} - 0,111 \text{HIS} - 0,077 \text{GEO} - 0,021 \text{BIO} + 0,259 \text{ALG} - 0,142 \text{GEOM} + 0,171 \text{FIZ} + 0,142 \text{CHE} + 0,024 \text{SCH} + 0,332 \text{AST} + 0,015 K_7 - 0,002 K_8 - 0,022 K_9 + 0,011 K_{14} - 0,035 K_{15} - 0,021 K_{16} + 0,003 K_{17} + 0,034 K_{18} - 0,021 K_{19} + 0,007 K_{20} + 0,055 K_{21} - 0,013 K_{22} - 0,050 K_{23} - 0,023 K_{24} + 0,011 K_{25} + 0,136 K_{27} - 0,089 K_{28} + 0,001 K_{29} + 0,097 K_{45} + 0,033 L_{31N} - 0,019 L_{36N} + 0,014 L_{37} + 0,005 L_{38N}, \text{ CMC} = \mathbf{0,590}, \text{ CMD} = \mathbf{0,348}.$$

In the equations of multiple regression the following designations are used (see the slide 3.1 – the CM of subject of training and see the slide 3.2 – the CM of means of training): Age – age, RU – estimation of LRKT in Russian language, LIT – estimation of LRKT in literature, LG – estimation of LRKT in foreign (English) language, HIS – estimation of LRKT in history, GEO – estimation of LRKT in geography, BIO – estimation of LRKT in biology, ALG – estimation of LRKT in algebra, GEOM – estimation of LRKT in geometry, FIZ – estimation of LRKT in physics, CHE – estimation of LRKT in chemistry, SCH – estimation of LRKT in drawing, AST – estimation of LRKT in astronomy,  $K_7 = \Pi_7^1$  – achromasia,  $K_8^1 = \Pi_8^1$  – protanopia,  $K_9^1 = \Pi_9^1$  – deuteranopia,  $K_{10}^1 = \Pi_{10}^1$  – tritanopia,  $K_{14}^1 = \Pi_{14}^1$  – verbalization (logical selection),  $K_{15}^1 = \Pi_{15}^1$  – deductive generalization (search of general signs),  $K_{16}^1 = \Pi_{16}^1$  – associative combinatory,  $K_{17}^1 = \Pi_{17}^1$  – classification and reasoning,  $K_{18}^1 = \Pi_{18}^1$  – the mathematical analysis (arithmetic abilities),  $K_{19}^1 = \Pi_{19}^1$  – numerical induction (recombining of numbers),  $K_{20}^1 = \Pi_{20}^1$  – mnemonics and memory (storing),  $K_{21}^1 = \Pi_{21}^1$  – plane thinking,  $K_{22}^1 = \Pi_{22}^1$  – volumetric imagination (volumetric thinking),  $K_{23}^1 = \Pi_{23}^1$  – verbal associativity,  $K_{24}^1 = \Pi_{24}^1$  – verbal originality,  $K_{25}^1 = \Pi_{25}^1$  – verbal uniqueness,  $K_{26}^1 = \Pi_{26}^1$  – verbal selectivity,  $K_{27}^1 = \Pi_{27}^1$  – figurative associativity,  $K_{28}^1 = \Pi_{28}^1$  – figurative originality,  $K_{29}^1 = \Pi_{29}^1$  – figurative uniqueness,  $K_{30}^1 = \Pi_{30}^1$  – figurative selectivity,  $K_{45}^1 = \Pi_{21}^1$  – level of proficiency in language of statement,  $L_{31N} = \Pi_2^2$  – color of background,  $L_{36N} = \Pi_4^2$  – set of font,  $L_{37} = \Pi_5^2$  – size of pointtype of symbol  $L_{38N} = \Pi_6^2$  – color of symbol (the specified and other parameters of the parametrical CM block are located in the database with a posteriori results of research of LRKT and IFPST).



The discriminant analysis allows to receive the own values of canonical functions and the chart of relative arrangement of the centroids of the classes, selected on the indicator of resultativity of the training, allowing to provide the evident interpretation of the differences between the classes of excellent, good, mediocre and poor pupils on the basis of a set of the values of parameters in the parametrical CM block (the CM of subject of training and the CM of means of training), which essential for the analysis of efficiency of a formation of knowledge of trainees in the IEE of the ART.

Table 2

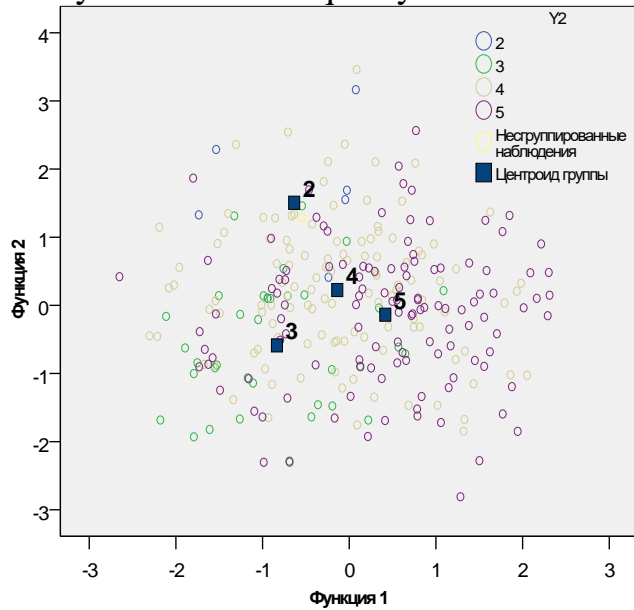
**The own values for the canonical functions (Eigenvalues)**

The reduced set of independent variables $K_i$ and dependent variable $Y_2$					The reduced set of independent variables $K_i$ and dependent variable $Y_4$				
Function	Own value	Share of dispersion	Saved-up dispersion	Correlation	Function	Own value	Share of dispersion	Saved-up dispersion	Correlation
1	0,183	51,6	51,6	0,393	1	0,414	76,6	76,6	0,541
2	0,131	37,2	88,8	0,341	2	0,082	15,3	91,9	0,276
3	0,040	11,2	100,0	0,196	3	0,044	8,1	100,0	0,205
The full set of independent variables $K_i$ and dependent variable $Y_2$					The full set of independent variables $K_i$ and dependent variable $Y_4$				
Function	Own value	Share of dispersion	Saved-up dispersion	Correlation	Function	Own value	Share of dispersion	Saved-up dispersion	Correlation
1	0,350	52,9	52,9	0,509	1	0,582	67,8	67,8	0,607
2	0,206	31,1	84,0	0,413	2	0,169	19,6	87,4	0,380
3	0,106	16,0	100,0	0,309	3	0,108	12,6	100,0	0,313

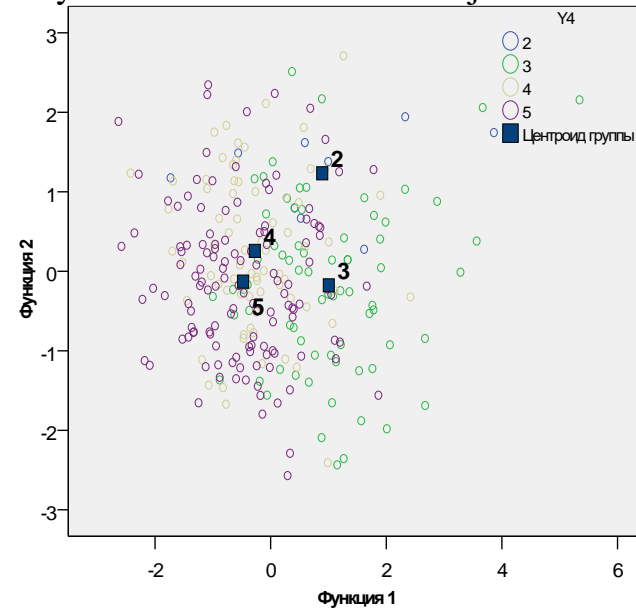
The informativity of the presented canonical functions is approximately equal.

# The results of the discriminant analysis (2 from 2): the position of centroids of classes in the space of two discriminant functions

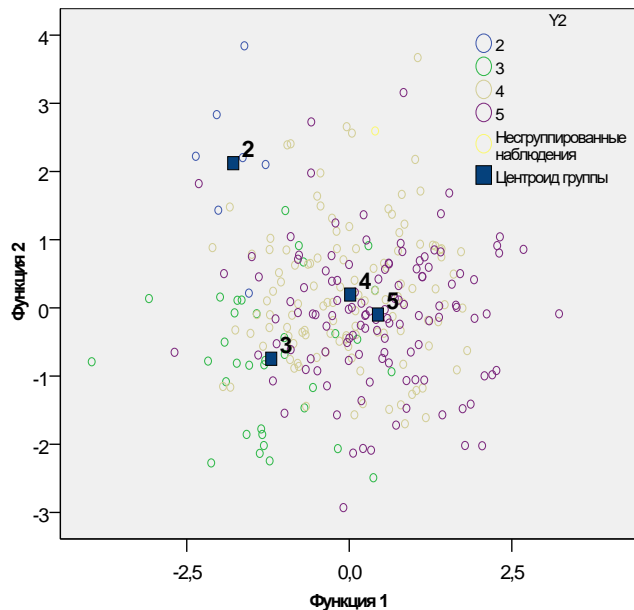
The graphical interpretation allows to analyze the received canonical functions and visually to estimate the quality of classification by the density of the distribution of the objects inside class.



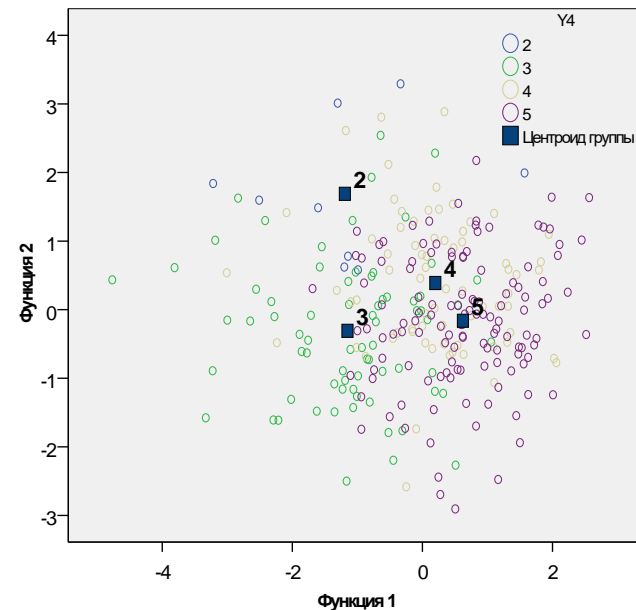
a



b



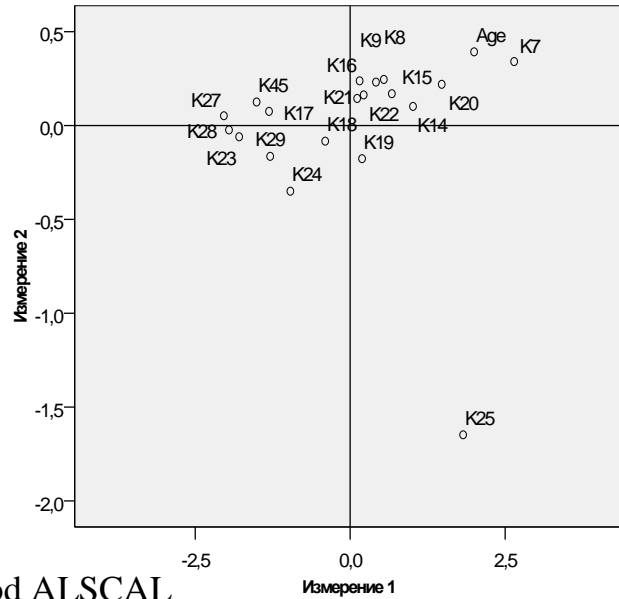
c



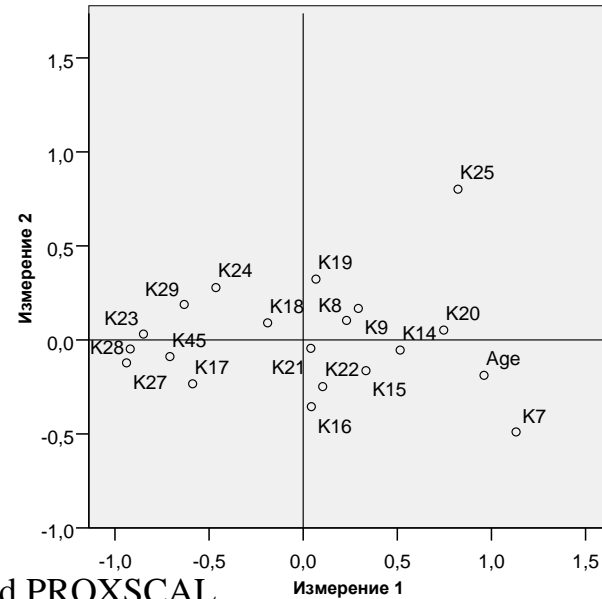
d

# The results of the multidimensional scaling

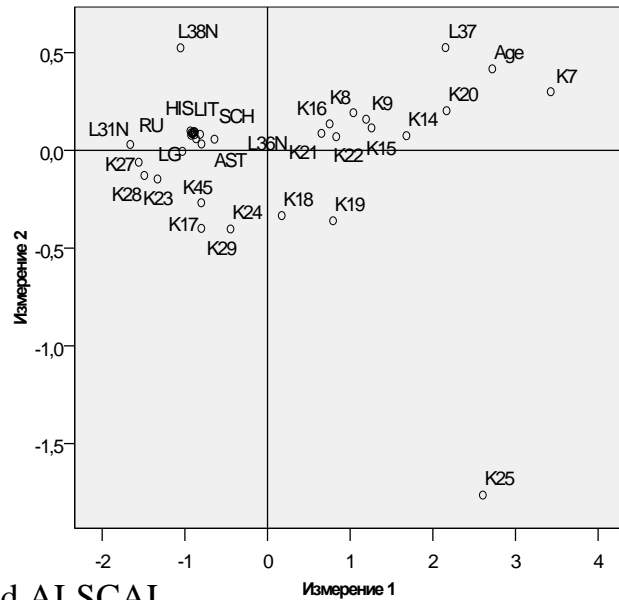
Multidimensional scaling allowed to reflect the geometrical place of points of the reduced (a – method ALSCAL, c – method PROXSCAL) and the full set (b – method ALSCAL, d – method PROXSCAL) of independent variables in space of two scales by means of two specified methods.



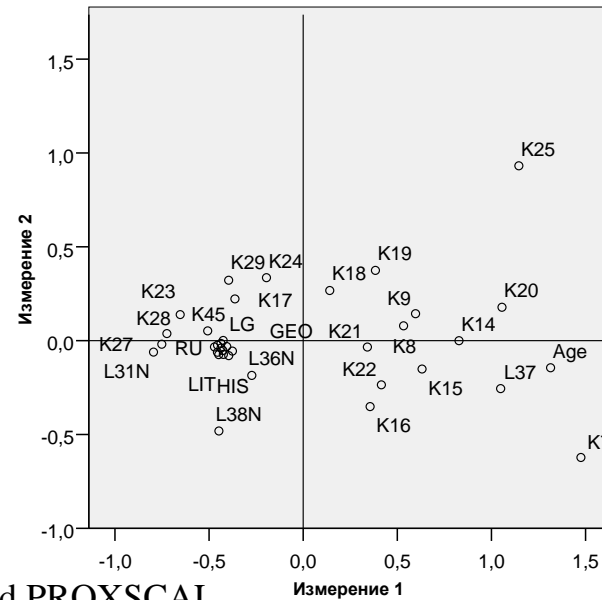
a



b

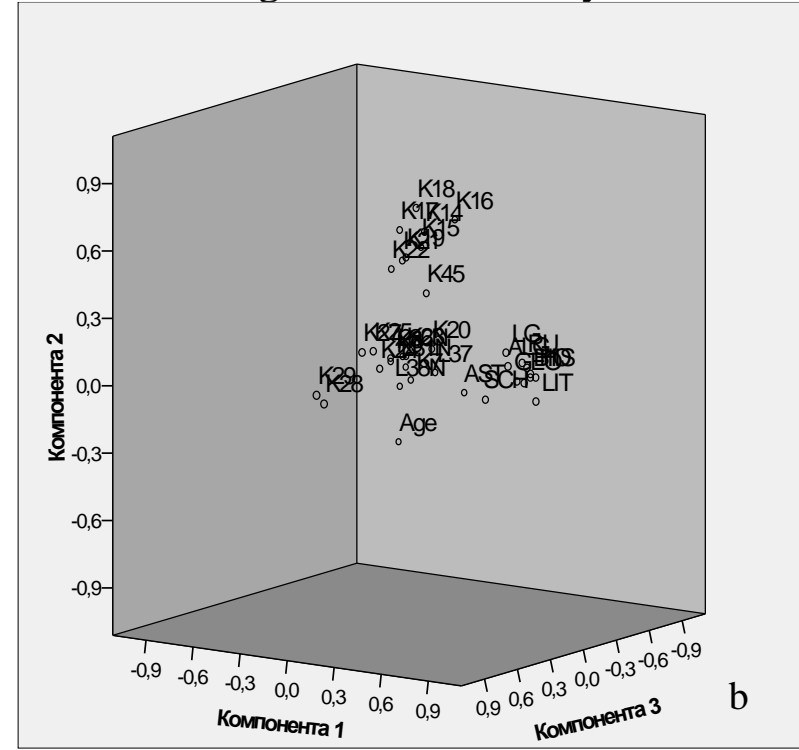
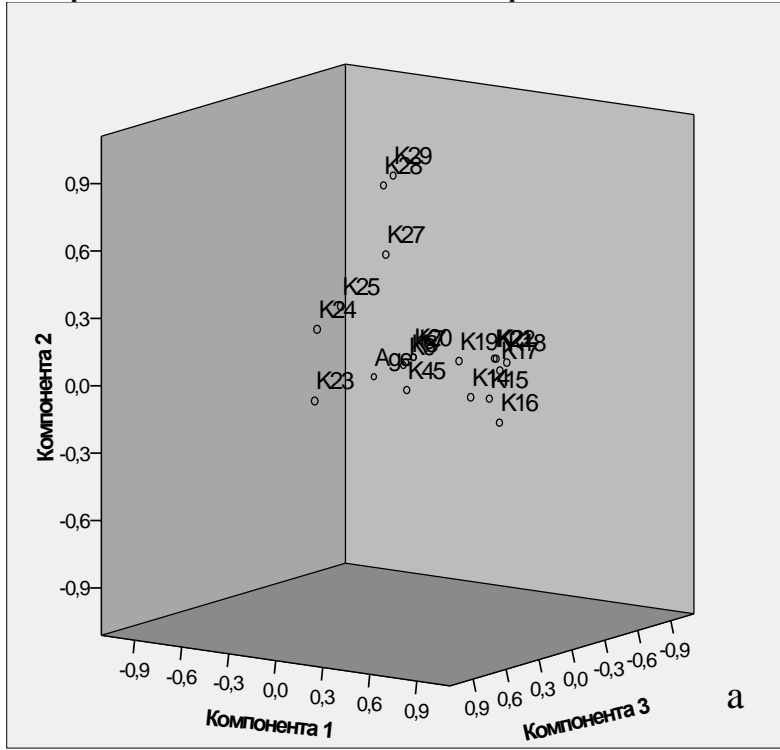


c



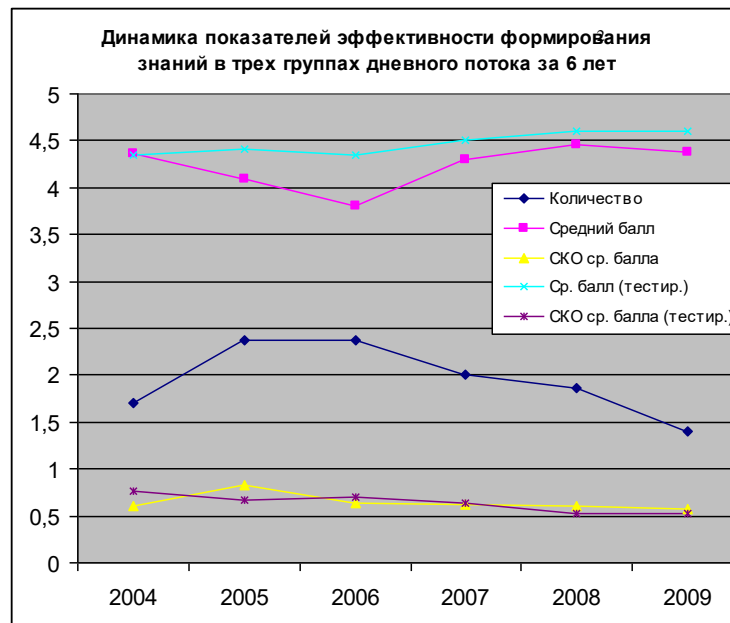
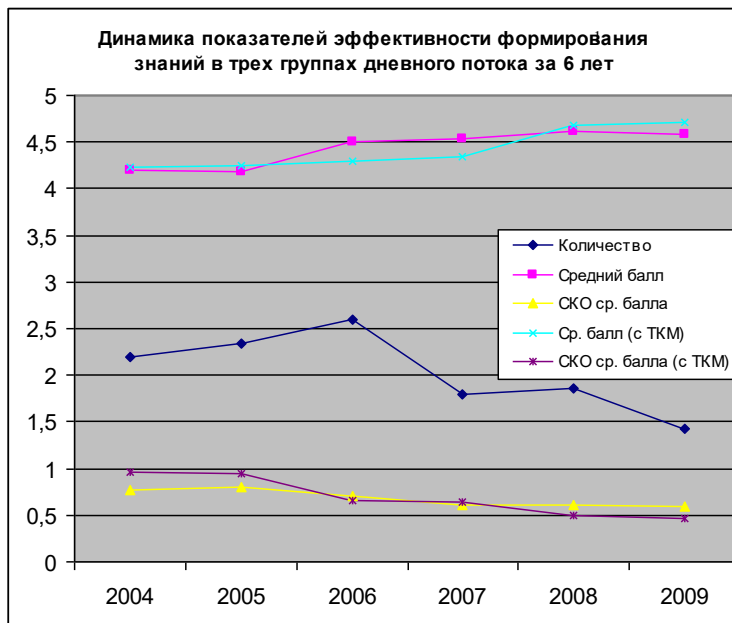
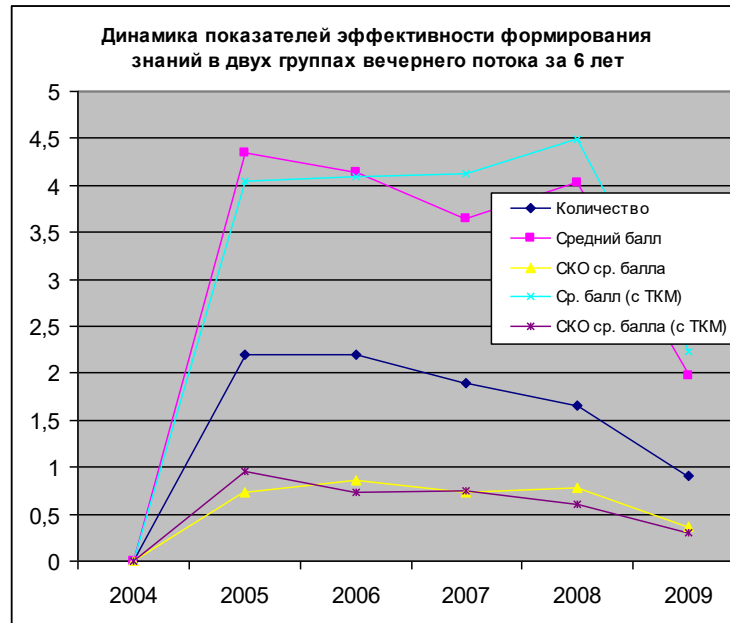
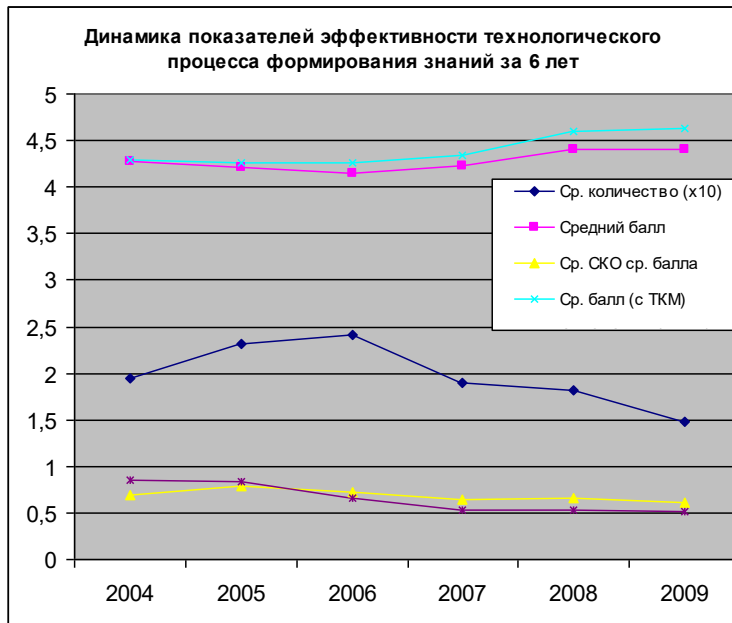
d

The geometrical location of the reduced set (a) and the full set (b) of independent variables in space of three components forming several locality is received.



# The dynamics of the indicators of efficiency (resultativity) of the technological process of controlled formation of knowledge of trainees (1 from 2)

The dynamics of indicators of resultativity of training for 6 years (2004-2009 y.) is presented.



The statistical analysis of a posteriori data received at the practical use of results of research in the learning process of “The Saint-Petersburg state electrotechnical university "LETI"” and “The international banking institute” allow to draw the following conclusions:

- the effective use of CMT in the automated IEE assumes the modification of the IEE of the ART and the modernization of electronic means of training and TMM of different appointment;
- the degree of influence of the parameters of CM on efficiency (resultativity) of process of training (formation of knowledge) depends on the contingent of trainees and has individual character;
- the increase of efficiency of formation of knowledge of trainees with the use of CMT is defined by the opportunities of means of IEE, the content of ET containing the structured information on the cycle of disciplines is adequate to the purposes of training, varied according to the algorithms in the basis of various components, techniques, learning plans and working programs.

In my scientific works and the next report on SRW “The research of the information environment of the automated training with properties of adaptation based on the cognitive models and the financial analysis of the organization by means of cognitive modeling technology” for 2006-2008 y., which is carried out in the process of writing of dissertation, on fact of the difficult theoretical and practical scientific-technical work:

- the CMT for the system analysis of IEE and the increase of efficiency of the system of ART is created – this dissertation;
- the aggregate of CMT for the financial analysis of organizational structure is developed – the dissertation on spec. 08.00.10 – “Finance, monetary circulation and credit” is formed.

“The Saint-Petersburg state university”  
faculty “Applied mathematics – control processes”  
chair “Information systems”

Part III. The answers the questions  
of the foreign and national  
of member of “The dissertation council”  
on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

Reporter (applicant): the author of the unique cognitive modeling technology  
for the system, financial and complex analysis *Vetrov Anatoly Nikolaevich.*

The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
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chair “Information systems”

The question of the foreign member  
of “The dissertation council” 1.1.  
*“The content of question”*

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The question of the foreign member  
of “The dissertation council” 2.1.  
*“The content of question”*

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The question of the national member  
of “The dissertation council” 3.1.  
*“The content of question”*

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The Russian Federation, Saint-Petersburg city, 2019 y.

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The question of the national member  
of “The dissertation council” 4.1.  
*“The content of question”*

The author of question:  
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The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
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Part IV. The performances  
of the members “The dissertation council”,  
the representative of opposing (leading) organization,  
the official opponents and the scientific supervisor  
on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

Applicant: the author of the unique cognitive modeling technology  
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The Russian Federation, Saint-Petersburg city, 2019 y.

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faculty “Applied mathematics – control processes”  
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Part IV.1. The performance  
of the members of “The dissertation council”  
on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

Applicant: the author of the unique cognitive modeling technology  
for the system, financial and complex analysis *Vetrov Anatoly Nikolaevich*.

The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
faculty “Applied mathematics – control processes”  
chair “Information systems”

## Part IV.2. The performance of the representative of opposing (leading) organization on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

The representative of opposing (leading) organization:

the head of chair “The name of chair”

of the faculty “The name of faculty”

of “The name of opposing (leading) organization”

(The country, city),

d.t.s., prof. *Ivanov Ivan Ivanovich*.

Applicant: the author of the unique cognitive modeling technology  
for the system, financial and complex analysis *Vetrov Anatoly Nikolaevich*.

“The Saint-Petersburg state university”  
faculty “Applied mathematics – control processes”  
chair “Information systems”

Part IV.3. The performances of official opponents  
on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

The first official opponent:

the head of chair “The name of chair”  
of the faculty “The name of faculty”  
of “The opposing (leading) organization”  
(The country, city),  
d.t.s., prof. *Ivanov Ivan Ivanovich*.

The second official opponent:

the head of chair “The name of chair”  
of the faculty “The name of faculty”  
of “The opposing (leading) organization”  
(The country, city),  
d.t.s., prof. *Ivanov Ivan Ivanovich*.

The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
faculty “Applied mathematics – control processes”  
chair “Information systems”

## Part IV.4. The performance of scientific supervisor on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

The scientific supervisor: the prof. of chair “Information system” of “The SPbSU”,  
the member of “The American mathematical society”,  
d.ph.-m.s., prof. *Kvitko Alexander Nikolaevich*.

Applicant: the author of the unique cognitive modeling technology  
for the system, financial and complex analysis *Vetrov Anatoly Nikolaevich*.



“The Saint-Petersburg state university”  
faculty “Applied mathematics – control processes”  
chair “Information systems”

Part V. The vote  
of the members of “The dissertation council”  
on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

Applicant: the author of the unique cognitive modeling technology  
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The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
faculty “Applied mathematics – control processes”  
chair “Information systems”

The results of vote  
of the members of “The dissertation council”  
on the question of assignment of scientific degree:  
“Yes” – 00, “No” – 00 and “Refrained” – 00.

The chairman of “The dissertation council” (scientific consultant):  
the head of chair “Modeling of electromechanical and computer system”,  
“The honorary professor of “The SPbSU””, d.ph.-m.s., prof. *Egorov Nikolay Vasilyevich*.

The scientific supervisor: the prof. of chair “Information system” of “The SPbSU”,  
the member of “The American mathematical society”,  
d.ph.-m.s., prof. *Kvitko Alexander Nikolaevich*.

Applicant: the author of the unique cognitive modeling technology  
for the system, financial and complex analysis *Vetrov Anatoly Nikolaevich*.

The Russian Federation, Saint-Petersburg city, 2019 y.

“The Saint-Petersburg state university”  
faculty “Applied mathematics – control processes”  
chair “Information systems”

Part VI. The concluding remarks  
of the chairman and the members  
of “The dissertation council”  
on dissertation

*“The environment of automated training with properties  
of adaptation based on cognitive models”*

on the competition of scientific degree of the candidate technical sciences  
on spec. 05.13.01 – “The system analysis, control and information processing”

Applicant: the author of the unique cognitive modeling technology  
for the system, financial and complex analysis *Vetrov Anatoly Nikolaevich*.

The Russian Federation, Saint-Petersburg city, 2019 y.