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MANAGEMENT OF EDUCATIONAL ROUTE LEARNING USING INTELLIGENT DECISION SUPPORT TECHNOLOGY

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Abstract. This article deals with the modeling of decision support systems in the management of OM using intelligent technologies

Keywords: hierarchical situational model; conceptual model; educational route; models of knowledge representation; reasoning based on case law; rules of inference.

INTRODUCTION

Among the problems that contemporary Russian society have to solve, one of the most important is the problem of training qualified specialists with higher education and scientific training at a level corresponding to international standards, the needs of society and the individual. Essential to improving the effectiveness of the educational process, the quality of training and their competitiveness is to implement innovative programs, including programs for the organization and development of international academic mobility for educational integration of the conservation and development of Russia's innovation potential.

The focus of current research in the field of education and research process is paid to improving the quality and competitiveness of education on the basis of compliance with international and Russian educational standards, the use of modern information technology in the development of teaching materials, optimization of resource management of educational institutions, closer to European educational systems. The relevance and prospects of the research confirmed the requirement for the quality of training in the universities on the basis of the introduction and development of innovative programs of the educational process for consumers of educational services.

As a part of the Bologna process prioritized higher education by 2020, among which are highlighted employment-based student learning and mobility. According to the National Information Center for Academic Recognition and Mobility in 2005, half of the total members participating in the programs of international academic mobility accounts for some of the leading universities in the second half of the remaining Russian universities. Currently, there is the growth of academic mobility in many universities.

Analysis of the promising trends in higher education led to the conclusion that in order to meet the demands of consumers of educational services can be developed educational routes. An approach to the problems of management of the educational route, which is defined as a structured program of action learning at some stage of training, providing him the opportunity to have the competencies (knowledge, abilities, skills) provided for educational standards.

Modern conditions of educational management (and educational route) are characterized by a number of problems: ensuring competitiveness, improve the quality of software, accounting requirements of consumers of educational services, accounting and resource constraints, especially the higher professional education system in Russia, increasing the efficiency of management, etc. Analysis of these features, performed using a systematic approach, allows us to conclude the following: the problem of managing the educational route is a complex because of the many influencing factors, problems arising in the administration, as well as changes in goals over time. This requires decomposition of tasks management educational route.

To account for these key factors in the management of educational route as accounting requirements of employers and participation in the programs of academic mobility, the necessary documentary base of professional and educational standards, the analysis of which revealed the following features: a large proportion of weakly formalized information, a large amount of information, the information is varied, the information is distributed. The special features of the educational route management to meet the requirements of the labor market are a variety of educational programs, a set of

professional standards to which students can be oriented universities, the development of new professional standards (eg in IT), one standard may be oriented the same direction and on the contrary, the account special requirements of regional employers, restrictions imposed by the federal state educational standards (GEF), a number of international educational standards (ISO) in the field of IT; dynamic and innovative IT-sphere. The special features of management of educational route with the development of the processes of academic mobility are a lot of programs of academic mobility, many types of academic mobility, the set of host universities, many areas of knowledge, many educational programs of basic and host universities, a wide variety of situations in the management of academic mobility and significant impact of the "human factor"- a member of the academic mobility problems of implementation of academic mobility in Russia (the language of instruction, the different periods of training).

These features of information resources and problems of management educational route on the basis of experience allow us to conclude on the use of intelligent technology to address tasks management of educational route.

DEVELOPMENT OF A CONCEPTUAL MODEL

A system domain analysis has revealed the semantic structure of concepts and relationships between them. A set of conceptual model in the management of the educational route has been developed. The developed conceptual model educational management route to the standards, the profile direction and professional educational needs of the students (Fig. 1), is qualified to the basic requirement for an adequate conceptual model mapping domain itself; reflection of the views and needs of all users; owning property easy extensibility providing input new information.

A developed conceptual model to decision making support in the management of educational route based on common semantic information and cognitive domain combines the following elements: process models of educational activities; hierarchical situational models, system models of educational management route, models of knowledge representation in the form of production rules and precedents in the decision-making problem situations, thus accounting for the integrated model.

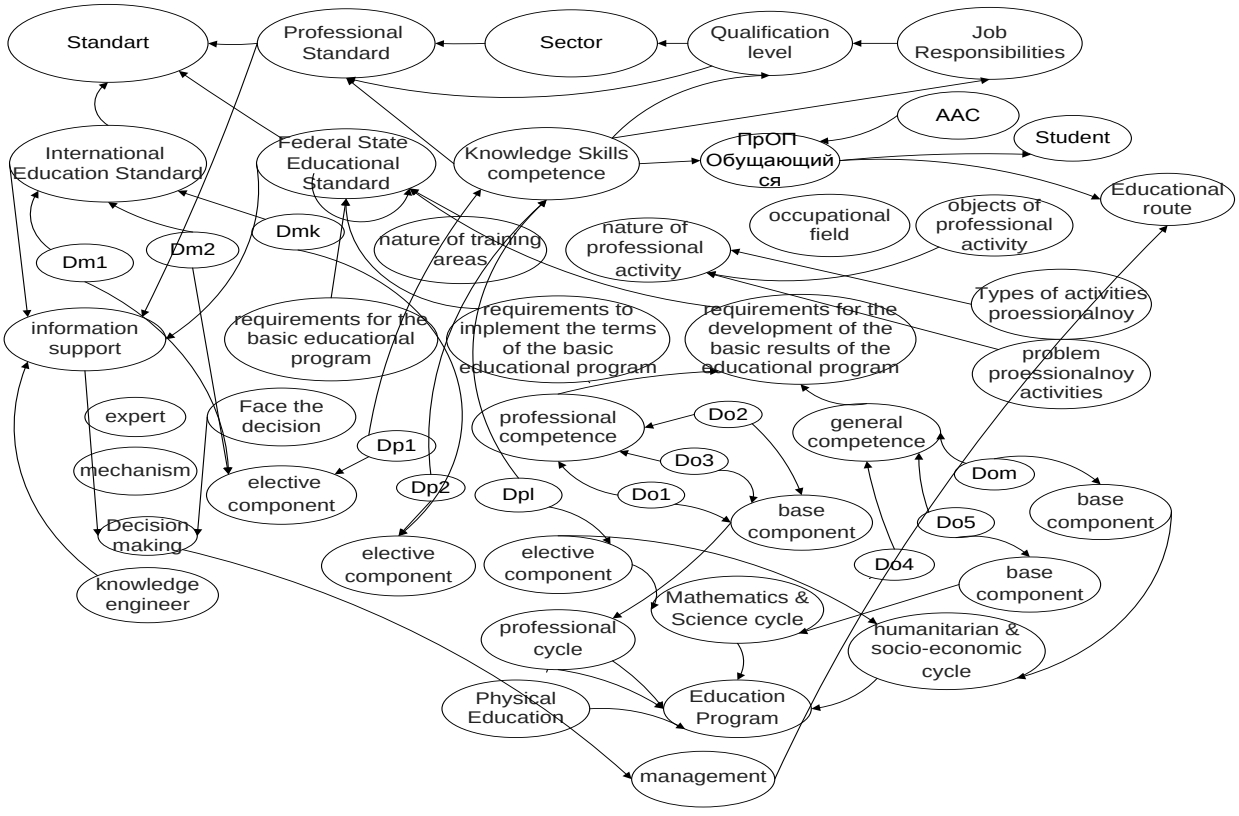

Fig. 1. A fragment of a conceptual model of management education route to the standards, the profile direction and professional educational needs of the students

A scheme of management of the educational route based on a conceptual model developed; it consists of the decision support system with an expert and knowledge engineer (Fig. 2).

DEVELOPMENT OF A HIERARCHICAL SITUATIONAL MODEL

Management is provided with the situational approach as a discrete-event model selected hierarchical situational model.

The use of the situational approach is to consider a finite set of situations, the occurrence of which account management system, the situation can be linked together different relations (relations of transition when one situation may move to another management; relations of hierarchy when one situation is a general situation), and the set situations and relationships between them is a situational model, situational model developed during the design of the control system, "embedded" in it and is used for the process of situational control. To do this, the control system provides an interpreter situational model (its monitoring function of the current state of the model, loan management decisions associated with the current state).

Initial hierarchical situational model, which is based on an object-oriented approach, is a network of objects: the situation, the transition, the immersion, the action (external procedure to perform an action – implementation of management decisions). Arc-object – can be linked to the activity of the predicate, the value of which determines the activity of the arc at the moment. Interpreter is a method of processing hierarchical situational models, resulting in the current model is constructed. Predicates activity are the function- procedure, producing a logical result of the current values of the control parameters - the presence or absence of a transition.

For the full range of classes of objects designed by the composition of their attributes and pointers that are used to link objects in a single model. The structure of such relationships, allowing recursively the current state of the model in the interpretation process with access to the objects of the original model. In this case, the object instances of the current state of the interpreter are placed on the heap of the current state. Relationship model with the outside world is implemented using objects - actions done by calling external procedures, which in turn may issue commands, change management strategy, and execute other types of managerial decisions. Developed algorithmic support hierarchical interpretation of the situational model allows you to build the current hierarchical situational model.

Hierarchical representation of the original model of situational management of the educational route includes a model simulation, the model controller and detectors. Hierarchical description of objects situational model allows further develop the software (Fig. 3).

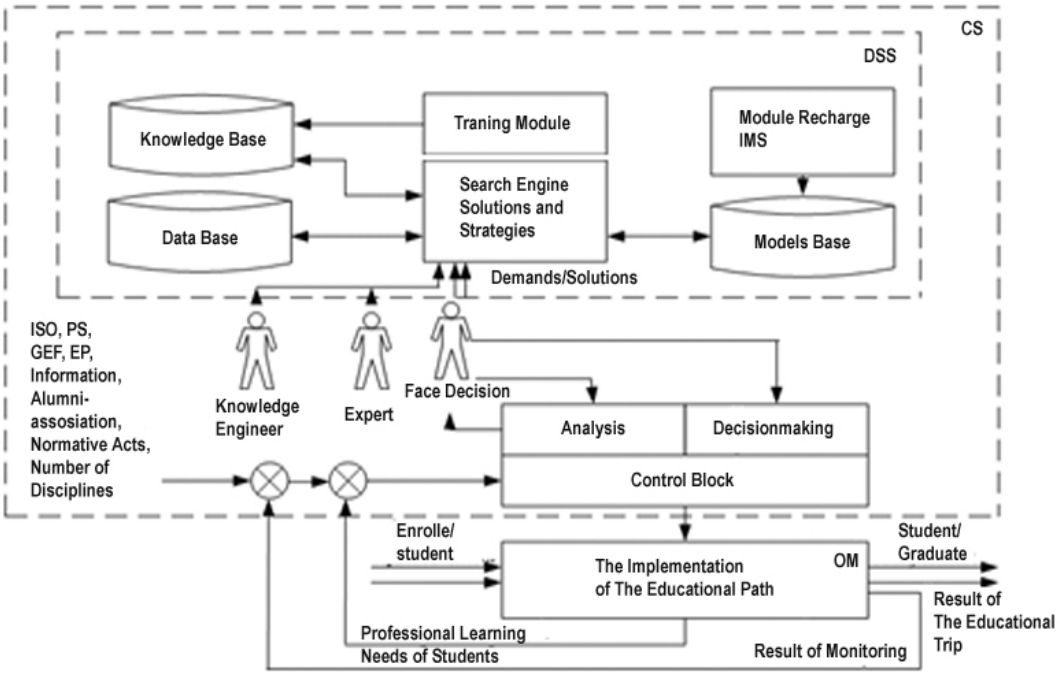

Fig. 2. Management scheme of educational route

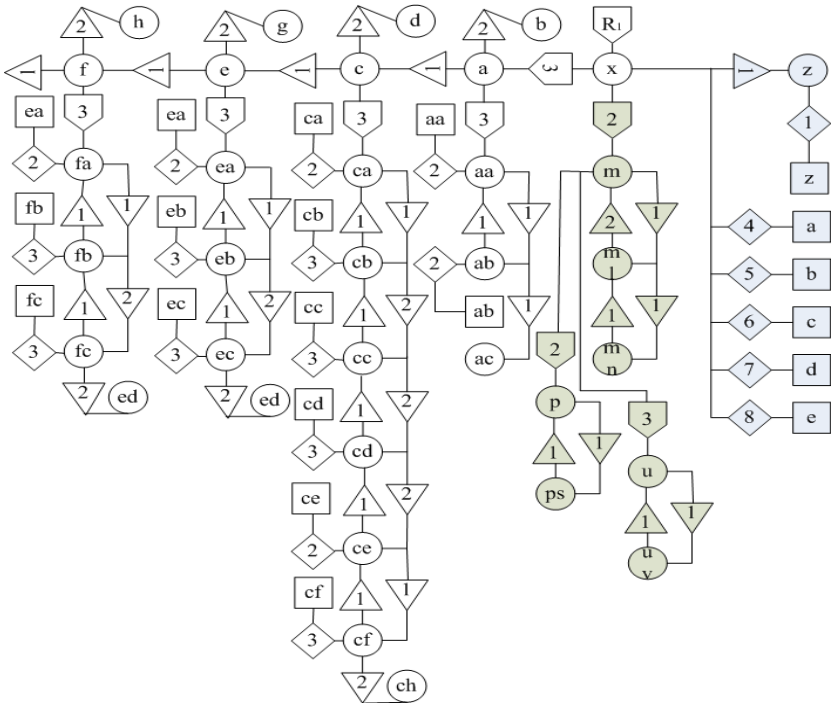

Fig. 3. Initial hierarchical situational model of management educational route

DEVELOPMENT OF DECISION-MAKING MODELS

The precedent is represented in objects <Casep, P_z, P_s, R_u, E>: $Case_p$ – name, P_z – precedents set of classes of problem situations, P_s – variety of signs case description in the class, R_u – the set of control solutions contained in precedent and E – set assessments of the effectiveness of decisions.

Approach to finding solutions on the basis of precedents include procedures such as searching for a solution in the database of precedents based on the principle of analogy, adapting previous decisions, evaluate the effectiveness of the solution and training.

For the model based on rules, characteristic description Rule_i: Q; P; C; $A \rightarrow B$; N, where Rule_i is rule name; Q is the scope of the rules; P is precondition (for example, priority); C is predicate (relation) and $A \rightarrow B$ – core products (allows to present knowledge in the form of a rule "IF A1, A2, ..., AN THEN B"). The constructed fact tables are the basis of the logical inference. The rule base is represented as a set of proposals

$$\{ A_1, \ldots, A_n, A_1 \rightarrow B_i, \ldots, A_1 \wedge A_i \rightarrow B_j \}.$$

The control structure of loops through the rules consistently.

The solutions searching for planning educational itinerary including key factors based on the assessment of similarity of class instances-disciplines, selected for inclusion in the student's educational path and instances of classes, courses of professional standard (changing requirements of the labor market), pre-structured with hierarchical clustering methods.

The decision-making support scheme is based on the following apparatus of decision making: expert analysis or evaluation of similarity when comparing objects by attributes based on similarity measures Jaccard:

$$C(S_j, S_k)_1 = \frac{m(S_j \cap S_k)}{m(S_j \cup S_k)}.$$

Calculating the values of measure of similarity of two compared objects by attributes is based on a binary matrix, which in terms of set theory is defined as follows:

$$S = \{S_j \mid j \in J\}, J = \{j \mid j - \text{int}\,eger, j = \overline{1,2}\}$$

$$S_j = \{x_{ij} \mid i \in I, j \in J\};$$

$$Z = \{Z_i \mid i \in I\}, I = \{i \mid i - \text{int}\,eger, 1 \le i \le p\};$$

$$Z_i = \{x_{ij} \mid i \in I, j \in J\};\ x_{ij} \in \{0,1\},$$

where S is indexed set with elements S_j (alphabet descriptions), S_j is j description; Z is indexed set with elements Z_i (alphabet signs or attribute values); Z_i is i-th feature (the feature); x_{iy} is one of the two values {0, 1} i-th trait y j-th object (x_{ij} = 1 if the i-th feature is a j-th object, otherwise x_{ij} = 0); J and I is index sets.

Binary matrix to calculate the measure of similarity between two objects is as follows:

$$B = \left\| x_{ij} \right\|_{\substack{i=\overline{1,p} \\ j=\overline{1,2}}}.$$

In this case, the output is a result of the analysis as a detailed explanation of the absence/presence of the disciplines in the educational program of the host institution regarding the educational program of basic school.

Scenarios presented current models, which are built by the interpreter can determine the current situation and make an appropriate decision on this situation of the management of educational route.

The basic functional unit of the semantic web G (O, R) is the structure represented by the components of vertices $o_i \in O$ (objects (concepts) domain) and arcs $r_j \in R$ (relationships between them), $O \neq \varnothing$, $R = \varnothing$. A semantic network based on the analysis of academic mobility programs has been constructed (Fig. 4). It is based on the concepts of the type hierarchy, partitioning, semantic distance. This semantic network includes the following categories such peaks: the concepts, features, value.

For decision-making by using intelligent technologies offered to use arguments based on case law, rules of inference (see Table 1).

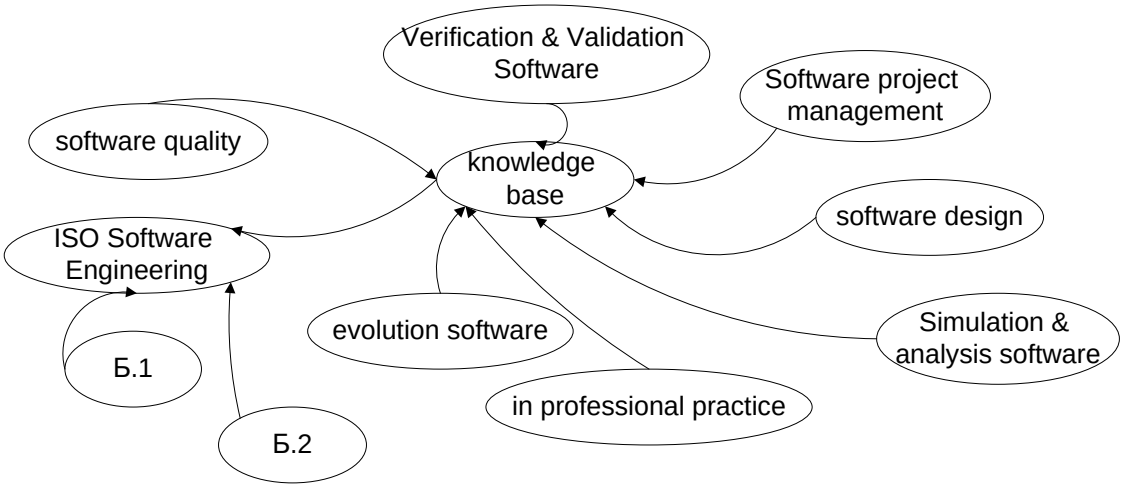

Fig. 4. A fragment of a semantic network of international educational standards

Table 1

Fragment of the table rules of inference

No	Rules of inference
RULE1	IF THE DISCIPLINE_R =AREA O1 AND DISCIPLINE_Z = AREA O1, THE SIMILARITY = YES, KD = 1/9
…	…
RULE21	IF A COINCIDENCE IS > 80%, THE COINCIDENCE = COMPLETE KD = 100%

4. CONCLUSION

Targeted educational routes have been tested in the process of participation of students in academic mobility program Erasmus Mundus (universities of Germany, Italy, Portugal, Poland, Austria), and confirmed the validity of the study. The results of the analysis to assess the effectiveness of intelligent information support in the management of educational route with the development of the processes of academic mobility, including the use of links with Alumni, received at the Department of Computer Science and Robotics USATU from 2006 to 2011 years. Participation in programs of academic mobility of students has increased from 6 to 37 per semester, the amount raised scholarships increased from 0.4032 million rubles to 18.774 million rubles per year.

Social benefits from the inclusion of an educational training course in the host universities is a successful procedure for recognition of the results, improving the language skills of participants, the development of relations between the universities, the creation of a positive image USATU with foreign partners, the development of the university Alumni-association.

The obtained results of the evaluation of the effectiveness of intelligent information management support educational route using a software implementation of the proposed methodology have showed varying degrees of efficiency in time of 1.5–2 times when advising students to 10–20 times in monitoring the implementation of the educational route.

The results of studies of the similarity of educational routes Bachelor Informatics in Russia and the leading IT universities in Belgium, France, Luxembourg, the U.S., France, Switzerland, Japan have been considered.

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