

## **DECISION-MAKING IN DEFINITION OF KNOWLEDGE IN THE CONDITIONS OF UNCERTAINTY OF EDUCATIONAL PROCESS**

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### **Absrtact**

In this paper the way of application of intellectual technologies on the basis of the developed system of training and testing with application of the device of fuzzy logic is considered. Environment for application of the given system is an automatization of processes of teaching and the control of knowledge of students in higher educational institutions.

Quality of intellectual training system directly depends on accuracy of definition of knowledge's current level of the student, and also the decision of a choice problem of training strategy, it can be as transition to teaching of a new material, repetition passed or the training termination.

In the given paper the intellectual system of training and testing with using of the fuzzy logic device, with application of original algorithm of decision-making in the uncertain environment is described even at the limited set of the entrance data.

### **Introduction**

Application of intellectual information systems in formation creates the new environment into which modern methods of teaching are easily integrated, and also flexibility and individuality unachievable extends in traditional methods of training.

At absolute continuity of advantages in other ways of teaching, application of network technologies possesses side benefits as though training simultaneously can take place a considerable quantity of students, for any of them educational process and testing are individual. It allows to master better a material in comparison with a traditional method of training as allows to reveal real level of knowledge of teaching materials everyone students separately.

Other advantage is flexibility of system. Presented teaching material for students is a collection of materials in which experience and talent of the best teachers from every corner of the world is enclosed. It allows the student to choose from various training courses ways and intensity of training according to own preferences and abilities.

Each modern HIGHER SCHOOL itself solves for itself a problem about creation of educational information systems, and the problem of this work – harmoniously to integrate their information systems into complex intellectual, information, training system of a network of HIGHER SCHOOLS, having developed the universal automated ways of the control of knowledge and an individual approach to training of students.

At practical realization of intellectual information system, we solve more low listed problems:

- a problem of creation of system of unification, methods of storage and addressing of the distributed information materials in networks of difficult configurations;
- a problem of creation of flexible system of training and testing with a universal quality monitoring of knowledge of students.

### **Intellectual information system**

The structure of intellectual information system of learning and testing (IISLT) is represented in figure 1.

Let's consider structure IISLT more in detail. As the basic groups in databases are stored: an information material, programs, a teaching material, details of the student.

- All kinds of electronic resources concern an information material, for example, video collection, audio the information, laboratories of text materials, unabridged editions of various dictionaries and encyclopedias. All this large quantity of the information is on different servers of system and there is a possibility of addition new or editing of an existing material.

Multimedia courses, search programs concern group of programs on system resources, players of files of various formats (video, audio, images, etc.). It can be also test and training programs.

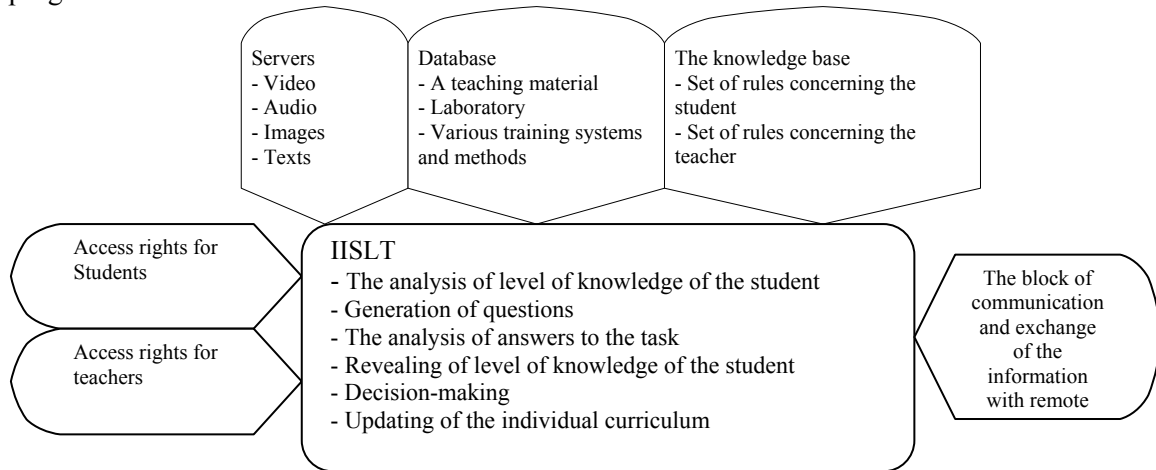


Figure 1. Structure IISLT

The teaching material can be divided into some groups on functional value: a preparatory material, the pedagogical materials and a training material.

The preparatory material contains a considerable quantity of a various teaching material on the most various themes of all areas of knowledge.

Pedagogical materials consist of courses of lectures, abstracts and the various questionnaires prepared by teachers for the practice. This material more purposefully and more religiously, also can different various methods of teaching.

The training material is intended for intermediate or definitive testing of knowledge of the student. Various ways and testing methods, for the purpose of definition of level of knowledge and abilities of the student are here too put.

Resources of information system are increased by a method of cross references at this way the new material is easily built in the information environment, a method of use of accompanying keywords as index elements. Keywords allow to be guided easily in extensive information resources of a similar orientation and subjects, without limiting teachers additional conventions in registration of learning materials.

Resources of intellectual system are increased by addition or improvement of algorithms of decision-making, and also expansion of library of rules of the knowledge base realized on a mathematical apparatus of the fuzzy logic and neural networks.

One of the main system resources is the Information folder of the student which stores all data on its abilities, the schedule of passage of training and testing, the statistician, etc. Except this data are stored in a folder comments and remarks of teachers.

**Decision-making in management of training and testing**

Feature of a method of testing is the mechanism of decision-making on a choice of level of question complexity which will be set to the student by the following on the basis of result of the answer to the previous questions.

The decision of this problem depends on a considerable quantity of parameters, the majority from which is not known to intellectual system (owing to complexity), however exact enough answer can be found by means of a mathematical apparatus of fuzzy logic [1,2].

The algorithm of decision-making leans against results of the decision of following problems:

- the preliminary analysis of knowledge of the student – is used for an estimation of level of student knowledge for decision-making on a choice of the first question (to the lagging behind student the question from group simple while the question more difficult will be asked to the prepared student in the beginning will be asked);

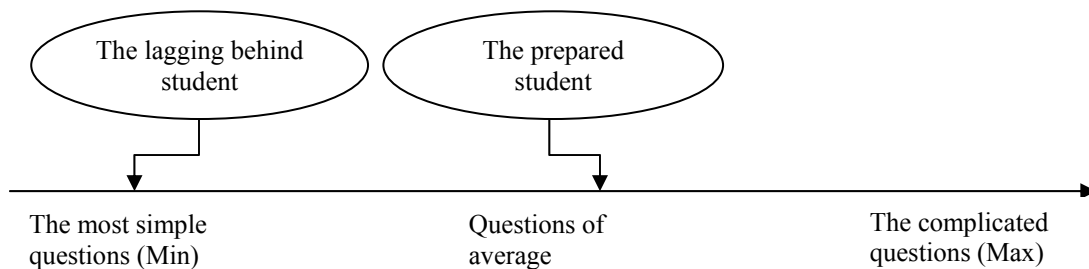


Figure 2. Strategy of a choice of the first question

- the student has answered the previous question correctly – in this case to the student the question of the raised complexity, simply is asked

$$Q = (\text{Max } (A +) + (\text{Max or Max } (A-))) / 2 \pm 2 \% \tag{1}$$

where, Q – the following question, (A +) – a right answer, (A-) – the wrong answer,  $\pm 2 \%$  are limits in which casually the following question gets out;

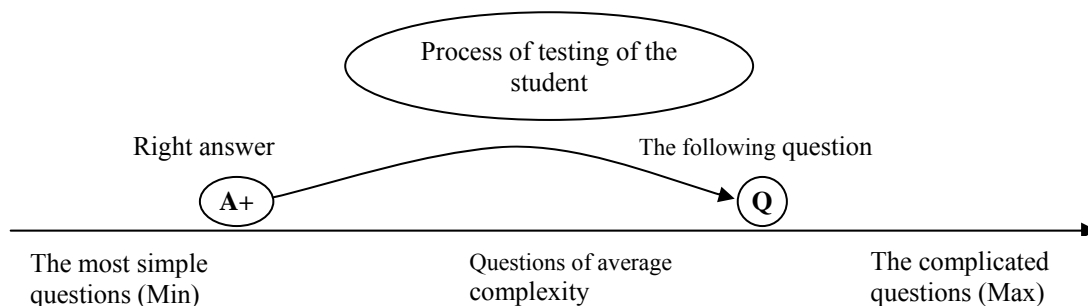


Figure 3. Strategy of a choice of a question owing to a right answer

- the student has answered the previous question not correctly – in this case to the student the question of the lowered complexity is asked

$$Q = (\text{Max } (A-) + (\text{Min or Min } (A +))) / 2 \pm 2 \% ; \tag{2}$$

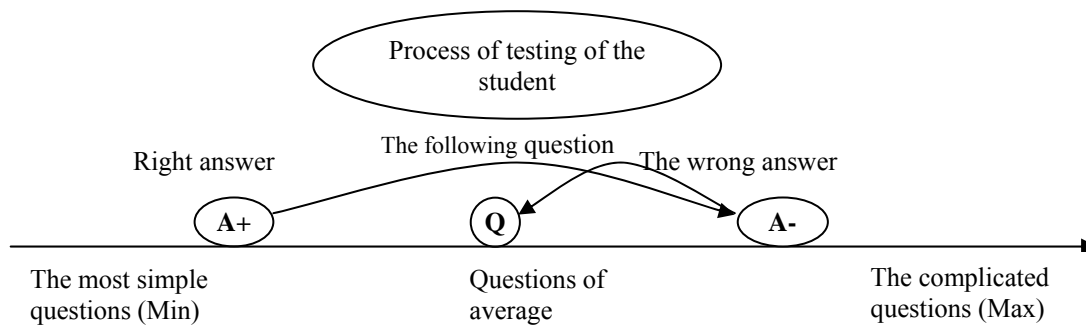


Figure 4. Strategy of a choice of a question owing to the wrong answer

- processing of results and decision-making on a definitive estimation or testing continuation – quantity of right answers multiplied by their complexity after the relation to errors, and set of correct and wrong answers move on an input to the subroutine of decision-making for estimation delivery or if there is a high probability of uncertainty, testing proceeds

$$\{Z, P\} = f(\sum (A+) \times (V+), \sum (A-) \times (V-), (A0+), (A1+) \dots, (A0-), (A1-) \dots) \quad (3)$$

where, Z – an estimation, P – uncertainty, f – the subroutine of decision-making, (Ai +) – set of right answers, (Ai-) – set of wrong answers, (V +) – weight of right answers, (V-) – weight of wrong answers.

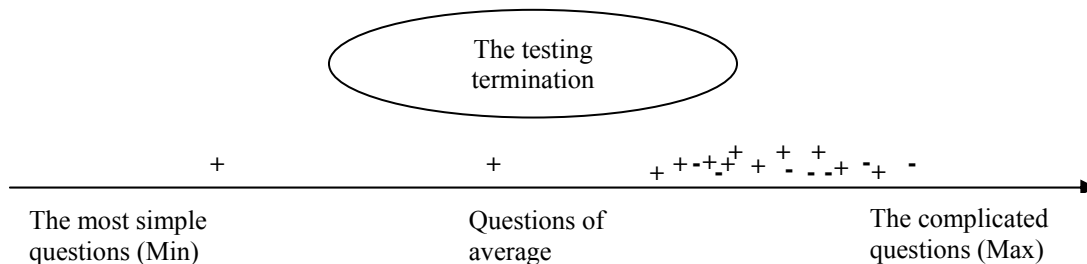


Figure 5. An example of distribution of answers upon termination of testing

One of functions of the block of decision-making, is, a choice of a following question which, most likely, corresponds to knowledge of the student. At the incorrect answer reevaluation of the data about the student is made and the following will set less a complicated question (2). At a right answer the program will choose more a complicated question (1).

As it has already been earlier told, because of a considerable quantity of external parameters the analysis and delivery of decisions is made by means of a mathematical apparatus of fuzzy logic. The question choice is carried out by performance of several calculations of a set of the fuzzy expressions [3,4] which ultimate goal is transfer to a subsystem of decision-making of the results.

The given way of decision-making on sequence of questions choice allows to make individually testing process and upon termination of to give out the most exact estimation of knowledge of the student.

With use of the previous results of the student (3) in the given subject the system makes the analysis of passage of the given test and takes out an estimation which is brought in the private affair of the student.

The estimation is represented in the form of a digital estimation and the diagram of passage of tests (Figure 6).

The decision of a question on value of an estimation for the executed test can be accepted both the program and the teacher or their joint decision. The given way of decision-making

allows carrying out training or testing of any level of complexity, from the individual test and before graduation examination.

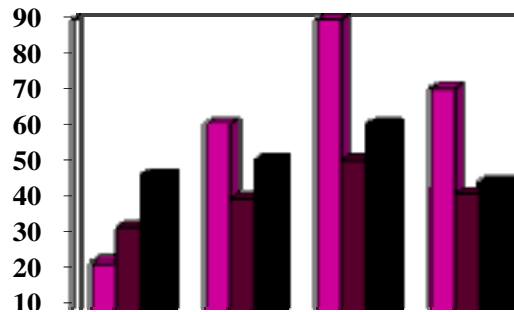


Figure 6. The generalized result of testing in the form of the diagram.

### **Learning process**

In the course of work, the student can not only test the knowledge, but also be trained. On reaching stable results in questions of a certain theme, the student can pass to following sections of a training course.

Gradualness in training will give necessary time for full mastering and material fastening, and then transition to new, more difficult material. Each transition is accompanied by the small test on the previous material with the analysis of its mastering.

### **Conclusions**

In this paper the intellectual system in which advantages of test system and algorithm of behavior of the teacher are combined at definition of knowledge of the trainee is described.

The developed algorithm of decision-making, is capable to define knowledge tested on the basis of interrogation of is minimum possible quantity of questions that allows to state in the shortest terms an estimation to knowledge with high level reliability in comparison with a traditional method of the interrogation, the spent teacher or at the sample test task.

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