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Evaluation of Knowledge Quality in the E -Learning System

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Abstract

Introduction: The most important properties of the proposed concept in the quality of information and evaluation it is procedure is universality, significantly expanding the class of problems to be solved information analysis. The intensification of the development of the national economy directly affects high education as one of the links in the systems of personnel training. To the number of the important direction of restricting the system of higher education, and the main direction of the restricting of higher and secondary special education in the Jordan refers to the non-improving the quality of training specialties, their scientific potential, and skills of the organization work. **Metric and Methods:** The analysis of using information systems in the evaluation process indicates a small scale of the using of information technology in the operational information support system. In this paper, the methodology of students work with the computer knowledge measurement system outlined, and explains the principals of the operation of the system in an off-line mode. In this case, it seems relevant to the search for a method of effective information support for the problem area which allows to significantly reducing the time and other resources of the decision maker. **Results:** This paper proposed an effective optimization algorithms for information support, based on the concept of information quality, a semantic full model of information and its central measurement of information quality. **Discussion:** The proposed quality criteria afford it the formation of a model in the form of the hierarchical and set of consumer information properties.

Keywords: Factor, Evaluation, properties, Support system, Information, Optimization, Decision making.

I. INTRODUCTION

One of the important properties of the proposed concept in the quality of information and evaluation it is procedure is universality, significantly expanding the class of problems to be solved information analysis. In this application are very important that it is possible to set the quality of important for different classes in the corresponding sets of characteristics features. And the classification of information can be carried out depending on the set of quality characteristics. The selection of the most characteristics properties makes is possible to simplify the structure of the quality function and accordingly, the evaluation procedure. Existing opportunities can show for class educational information, possessing a number of features and the difference between scientific and technical information [1]–[3].

II. PROPERTIES OF THE EDUCATION INFORMATION

The intensification of the development of the national economy directly affects high education as one of the links in the systems of personnel training. To the number of the important direction of restricting the system of higher education, and the main direction of the restricting of higher and secondary special education in the Jordan refers to the non-improving the quality of training specialties, their scientific potential, and skills of the organization work. In light of its implementation, one of the leading factors is the solution of the tasks of deeper individualization of instructions. In these conditions of limitations (labor, tangible), with which universities, collide, the adaptations of leaner can be carried out only through the wide introduction education into the educational process of computer technology, and first of all Computerized Learning Systems (CLS).

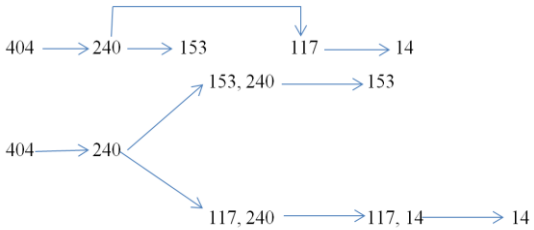
Another factor: application of the computer in the organization, accounting, planning of the educational process. Such a comprehensive use of computer technology it is connected with the solution of the number of rather complex scientific problems in the field of psychology of teaching, pedagogy, informatics, cybernetics and artificial intelligence systems and a number of other related scientific areas. In general, CLS is a specialized Information System (IS). The main attention in the development of the IS is eliminated by methods of organizing to educational material, the form of issuing a piece of information to the student, optimum distribution of material during training, and so on. With this acquisition intermediate and the fringe control of knowledge does not correspond to the achieved level of the CLS. Control of knowledge acquisition is conducted on the basis of quantitative counting of correct answers, which in turn are tightly related to the text of acquisition application of and control methods reduces the effectiveness of student feedback – CLS, as a result, there is a decrease in efficiency of the systems – CLS [4]–[6]. To increase the prestige and efficiency of the CLS, it is necessary to expand the didactic capabilities of the system in the field of control, and knowledge evaluation, mastered by students. The name is used to develop a method for evaluating the quality of information, which allows entering control training in CLS based on the quality of mastering students' knowledge [7].

In this paper, the CLS represent some specialized information systems, working with the classroom training information. It is the difference is that the input comes in advance of selected systemized and orderly information. Each frame of the training information is inherently semantic finished and

corresponds to the concept (single information). In this connection, the task of finding the types of information (τ, Q, Θ, ρ) can be reformulated by the dual task of evaluating the level (quality) of acquired knowledge. Suppose that the known selection rule refer as ρ and quality criteria Q which on τ specifies a subject Θ evaluations υ. Then, in the aggregate, the information presented $m^* \subset \tau$ we need to determine the quality of the system m, assimilated to students. Quality of students' knowledge $(\dots, i, \dots) \in m$ can be determined by the quality criterion. To obtain an evaluation requires synthetics and semantics analysis of response. The synthetic analysis involves the selection of elements of the standards answers from input characteristics. Semantics analysis of answers is understood as search operations, marking and sorting of the corresponding types of semantics units and dependences among the response elements, on the basis of which these or other characteristics of the quality of knowledge are calculated. The measurement of each characteristic and obtaining consolidated evaluation is made relative to the standard of the response by means of the interaction operation [8].

The comparison of this method with others, in particular, with the methods of taxonomic classification, applying the criteria of taxonomic similarity, showed that the proposed approach seems more complete and more in line with the task of knowledge control those others. For evaluation information, intended for training, the most convenient from presentation natural language [9]. But, given the complexity of designing communication in artificial intelligence systems, using constraints E^{th} or artificial language, close to the user for the introduction in knowledge management systems, the appropriate application of problem-oriented E^{th} (thesaurus, compiled for each individual course) [10]. The existing set of terms and with the possibility of extension of the nomenclature, and the synonyms allows the avoidance and ambiguity of the expression in the presented information and answers. The advantage of the language of this type is its use in training without prior preparation. Limit the number of terminology in the structure of the thesaurus for each section based on the characteristics of the subject, depths, completeness of studying the course and experience of the teacher himself [7]. As shown in Table 1, the fragment of this thesaurus for the course of electrical measurements.

As one of the polled variants of the semantic analysis for revealing the mental phrases of the answer, it is proposed to establish binary relation of terms on the basis of analytic continuation of type (subject-predicate, predicate – determination) and others. Received binary relations taking into account the meaning of terms and their role in the suggestions of the answer, in essence, are semantic concepts, determined the content of the phrase. Formalize the response, presented as a set of directed graphs, fixing, structure, and the content of each phrase, made with a digital code for semantic dependence and several digital codes introduced throughout written for semantic dependence. Example: magneto electric measuring mechanism consists of permanent magnet and current frame recourse to the thesaurus: magneto electric measuring mechanism – 406; consist – 240; permanent magnet – 153; frame -117; current -14. Phrase coding semantic dependence and semantic units in the digital code has the form Input codes in the completion of the management task, the system defines a type graph.



If the answer contains expression in the form of formulas, dependencies on numeric data and other actions, then the arithmetic or algebraic operation, the expression in parentheses is defined in the codes as the arrow of drop with the code of the corresponding action in its entirety and the code element in expression fractional.

Example: formula $P = I * R$. Recourse to the thesaurus – power P – 16, current I – 14, resistance R – 17, equal "=" – 249; Exponentiation (square) 205; multiplication operation "X" – 243. Coding formula gives a record 16, 249; 249,243; 243, 14; 14, 205; 243, 17. If the answer can be represented as shown in Figure 1, the structure diagram of the voltmeter, then sequential can also be represented as a cade entry.

Example: reinforced flowchart of the electronic voltmeter of an alternating current

Table 1: Fragment of the thesaurus of (Electrical Measurements)

Section	Section name	Name of terms	Code
0	Physical quantities	Electricity Voltage Electro-motive force	014 015 091
2	Dependency	Interaction Converts Minus	201 229 250
8	Measurements of electrical quantities	Noncontact method Sample source brightness Thermistor	800 823 843

Figure 1: structure diagram of the voltmeter.

Recourse to the thesaurus: divider – 195; rectifier - 403; amplifier -174; constant -67; current -14 measuring mechanism – 405. The code entry for the flowchart is as follows:

195; 403; 174; 67; 14; 405;

195, 403; 403 , 174; 14 , 174; 14 , 67; 174 ,405.

A more perfect option is the creation of an analysis program in a programming language, have the ability to analysis character information, like Visual Basic, in this case of using the thesaurus, it is not necessary. In addition, the natural or automatic coding procedure is eliminated.

III. A COMPUTERIZED SYSTEM FOR MEASURING THE QUALITY OF KNOWLEDGE:

In this paper, the methodology of students work with the computer knowledge measurement system s outlined, and also explains the principals of the operation of the system in an off-line mode [11]. There are several classes of systems with different modes of interaction with the computer [12]. A system of measuring knowledge designed to analyze and evaluate student responses having an idea in the form of freely constructed phrases on natural language, numeric data, flowcharts, or schematic diagram of various devices [13]. In the language of communication with the system, the words, terms, a notion (or their synonyms) how is the entered dictionary or thesaurus, which is stored in computer memory and used in the learning process, and not included in it. Thesaurus is oriented to the specific subject area, e.g. electrical engineering, metrology and so on [14]. The teacher gives the task by code, simultaneously from the knowledge base for the same code, the reference standard is sent to the measuring system. Previously prepared and laid the memory of the computer by the teacher. Trainee using thesaurus from the answer and enter it into the computer. At the end, the entering and access to the system for the evaluation of the answer, an estimate, and errors of knowledge on a given question. Strength algorithm for measuring the quality of knowledge, consisting of terms of input language is shown in Figure 3. Before starting the measurements in the computer memory, enter the arrays: A_1: the terms of the standard answer; A_2: the meaning of the terms of the standards; A_3: semantic links with the standard answer; A_4: the meaning of semantic links. Furthermore, In the process of answers, arrays are formed as shown below:

A_5: answer terms; A_6: semantic communications of the answer.

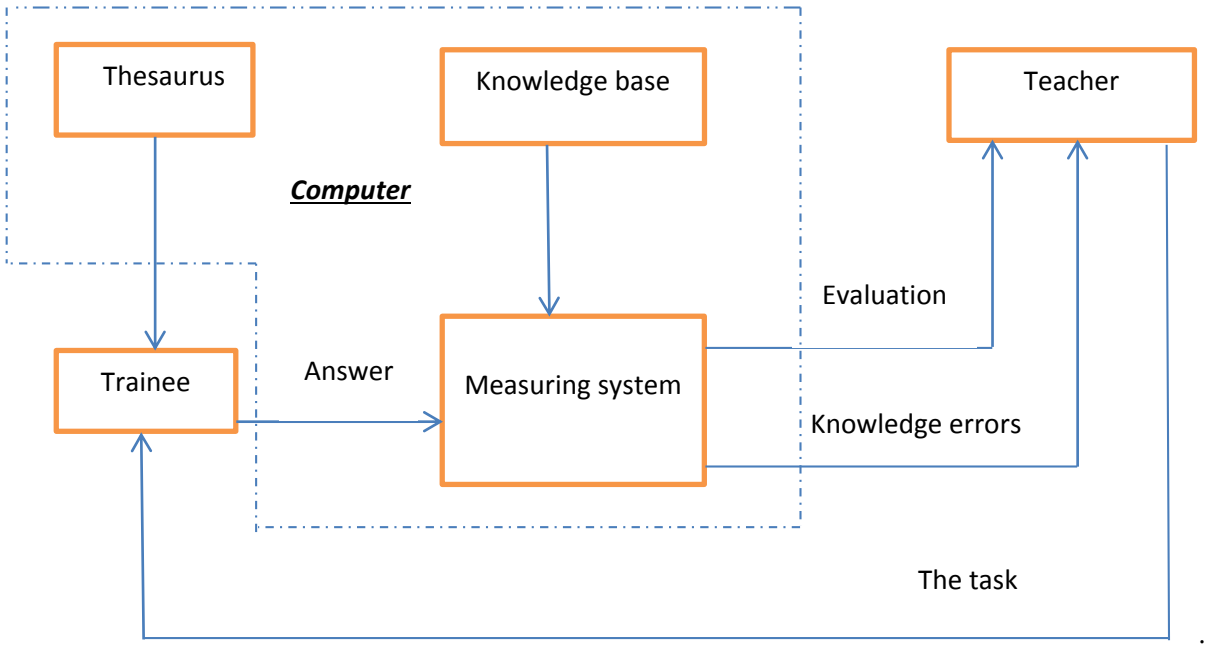


Figure 2: Block diagram of the organization of measuring the quality of knowledge.

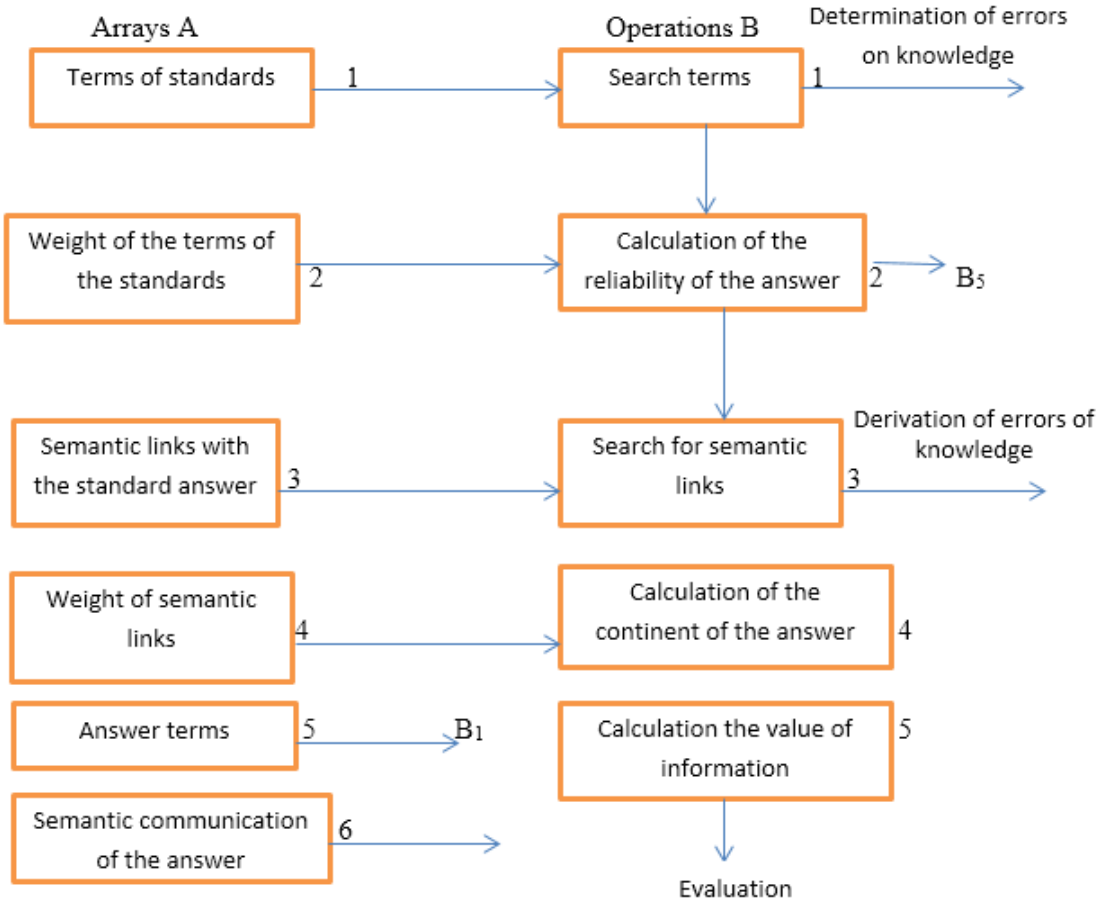


Figure 3: The algorithm of measuring the quality of knowledge in the computer

In the process of measuring the quality of knowledge, occurs in comparing the graph in the standard and the answer. Search for matching terms, as well as a synonym, used in the standard and answers, carried out by block B_1. The process of finding terms terminates the calculation of the reliability of the answer in B_2. Searching for terms in arrays A_3 and A_6 is implemented by B_3. The result of the analysis is the meaning of the answer content relative standard received in B_4. Based on measurements of the confidence value and the content of the answer are calculated a value of the value of information in the B_5 and the derivation of the error on knowledge based on the results of the searched operations B_1 and B_2.

Accordingly note that the process of knowledge evaluation in the system, is modeling by the teacher, any stage of this process can be analyzed as relative, so together with the teacher. The proposed methodology is implemented in the form of a block of computerized measurement of knowledge in computer [15]. An analysis of the result of the application of the method has been shown the increased interest of students in the studied subject and computer technology, improving the quality of the computerized management process and as a consequence increases of effectiveness of the learning system as a whole [16]. Let's consider some methodical question of the organization measurement. The use of computers in learning system requires a number of preparatory works, the creation of various types of support. To them include a number of pedagogical, information, and programming supports, and also the choice and preparation of the actual technical means. For offline evaluation system, the orientation is effective on the computer with a different interface. The most labor –intensive of types of support should be recognized as pedagogic, for it, preparation is necessary to conduct a thorough analysis of the academic discipline, mutual linkage of different sections allocation of the fundamental moments, ranking items by importance [17].

As a part of the knowledge evaluation by the computer, pedagogical support includes:

- The system of the question, tasks, and set of preliminary answers, an array of weighting factors;
- Variants of the application of the system for both the routine and current knowledge evaluation;
- Method of using the computer for independent work of students in the self- control mod;
- Controlling influence on the basis of the analysis of revealed errors in the learning composition.

It is important to note that, this support is fundamental to the evaluation and shouldn't be formed depending on the specific type of computer users and other factors. Information support system includes [18]:

1. Input system language;
2. Information arrays, providing storage in the computer memory of reference knowledge and additional information;
3. Thesaurus course (dictionary);

4. Evaluation results.

In this paper, proposed some information about the thesaurus formation, and the choice of the input system language. There are other options for approaches and preparation of information support [8]. The programming support is a set of programs, realizing input of answers, the process of measurement, the output of results, correction of information arrays and thesaurus [16].

Let's consider more detailed preparation of pedagogical support of evaluation of knowledge, and some methodical of the organization of measurement. When creating systems, the standers of answers and questions, and the teacher should well represent the capabilities of the computer and developed system as a whole; it is also necessary to determine the approximate amount of time for the assignment in the calculation of the average of the student [19]. In the practice of teaching, the same subject for different specialties, different depth and degree of detail of individual sections of the course are required. These circumstances need to be taken into account in the preparation of pedagogical support at the stage of drawing up the standards of answers and question. Here it is also necessary to take into account the designed level of assimilations of the material [20]. Psychology distinguishes several levels, for the learning system the following are distinguished:

1. Recognition;
2. Reproduction;
3. Skills;

Therefore, when preparing the material, methodical correct decisions should be worked out on the necessary levels of mastering the individual sections of the course proceeding from this, the construction of teaching and preparation of standard answers and questions, and in a number of cases, many levels have options for educational material, in particular, many reference replies (answers). The possibility of evaluation overall standards should be provided, and the system should issue ratings [4]. The teacher using computers in the educational process needs careful organizational – methodological preparation of evaluations. First of all, this is the creation of conditions, facilitating dialogue with the machine. Explanation of the algorithm of operation and the monitoring system, the fact the computer is only a means of increasing the effectiveness of training and evaluation. It is interesting to draw an analogy between the proposed computerized technique and knowledge evaluation of teachers [7], [10], [11], [21].

Important explain that this process is managed, any stage can be verified. Based on the measurement standard, can be conducted by the teacher or by the student himself, only with a great deal of time. Mastery of methodology of analyzing the components of knowledge errors, fixed at the computer output, is a methodical feature of the system. An indication of the nature and significance of the error, effective recommendation for their removal and further improvement of knowledge are an integral part of the teacher's creative activity. Undoubtedly, that the combination of computer evaluation and creative analysis of the results increases the effectiveness of the learning system as a whole the important stage of learning evaluation results if it doesn't agree with the computer estimate. Referring to the issue of information support, we note, when analyzing the error, knowledge is most convenient for obtaining a hard copy, which allows analyzing the mistaken terms and links. Creation of pedagogic support – a long process, requiring a collective decision – making on the specific issues of one or more course, however, its improvement is possible only with the systematic use of knowledge evaluation in the practice of the learning system. The levels of mastering the knowledge are checked how in the exam session, and the process of training on specific issues, on laboratory and practical exercises, in a period of intermediate credits. On all listed stages, it is possible to organize various evaluations in accordance with the composition of the technical means used. During the current evaluation and the presence of a network of terminals after the issuance of task and after the time limit is expired, it is necessary to output the results sequentially to the teacher's evaluation panel. If there are not terminals, answer in natural language can be fixed and publish to the teacher with an indication of specialty, group, family. The training and support staff introduces this data to the computer with the subsequent reception of the listing, containing the results of measuring the quality of knowledge. Individual knowledge evaluation allows students to work with a computer without a terminal network. There is an opportunity to organize the independent work of students during the year. For this measurement, the program and the database with references, answers should be protected, results of independent work to register. The forthcoming extensive introduction of a personal computer which related the development of work to increase the effectiveness of software and didactic computer support an integral part of the modern stages of improving the educational process. Using in the development of this provision of elements of a pedagogical keyboard will exist to enhance the effectiveness of the learning process and reliability of estimation of its results [8], [20], [22], [23].

VI. CONCLUSION AND DISCUSSION:

The analysis of using information systems in the evaluation process indicates a small scale of the user of information technology in the operational information support system. In this case, it seems relevant to the search for a method of effective information support for the problem area which allows to significantly reducing the time and other resources of a decision maker. To solve this problem, we propose effective optimization algorithms for information support, based on the concept of information quality, a semantic full model of information and its central measurement of information quality. The proposed quality criteria afford it the formation of a model in the form of the hierarchical and set of consumer information properties. Examples of the functioning of the system are given in the autonomy mod and it combines with a model of computerized information retrieval system. In the latter case, the system also works as an input stream preprocess. The extension of the criteria scope to the class of educational informational system, make it possible to develop a number of algorithms for testing the quality of learning assimilation by the student.

Using of quality evaluation procedure, the answer analysis subsystem of the type of computerized training systems showed the effectiveness of the application of this concept.

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