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INTELLIGENT SYSTEMS FOR TESTING KNOWLEDGE IN DISTANCE EDUCATION

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Abstract:-

The article reviews the issues of testing student knowledge related to the possibility of choosing the correct answer from among several options, and the intelligent knowledge testing systems (ITS), that use open-ended questions for examining student knowledge, i.e., when students are asked to independently construct an answer rather than choose from among various options that are presented to them.

INTRODUCTION

The increase in the capabilities of computer and networked communication technologies leads to the increasing of possibilities to use pedagogical arsenal in distance education. A teacher of any discipline can independently create and modify tests, manage student access to them, and analyze information about the student work.

The proposed tests are created in a form of a closed-type dialogue, i.e., doing the tests that require selected-response, a student is usually asked to select one or more answers from among the suggested ones.

Due to simplicity of technical implementation, this type of dialogue sometimes is almost the only tool for identifying the level of student knowledge in electronic testing systems. It is also known that it has a number of significant drawbacks: a modern teacher simply can not tolerate the following shortcomings, namely: high level of the hint; complexity of selecting distractors; limitation of application on a row of educational fragments; a possibility of "computation" of the correct answer in a logical way without solid knowledge of learning material; implementation of the mass of incorrect expressions in distractors in student minds; cultivation of specific thought process of guessing responses, and many other things.

The way out can be found in the application of open-ended questions, i.e., questions, to which the learner must formulate an answer by himself/ herself without any syntactic restrictions.

Further the article presents two intelligent systems for testing knowledge: an intelligent system for comparing and testing a response of an examinee in the form of phrase in a natural language, created by Viktor Nozhnov [3] and an intelligent system for comparing and testing a response of an examinee in the form of phrase in a natural language, created at the International Banking Institute of St. Petersburg.

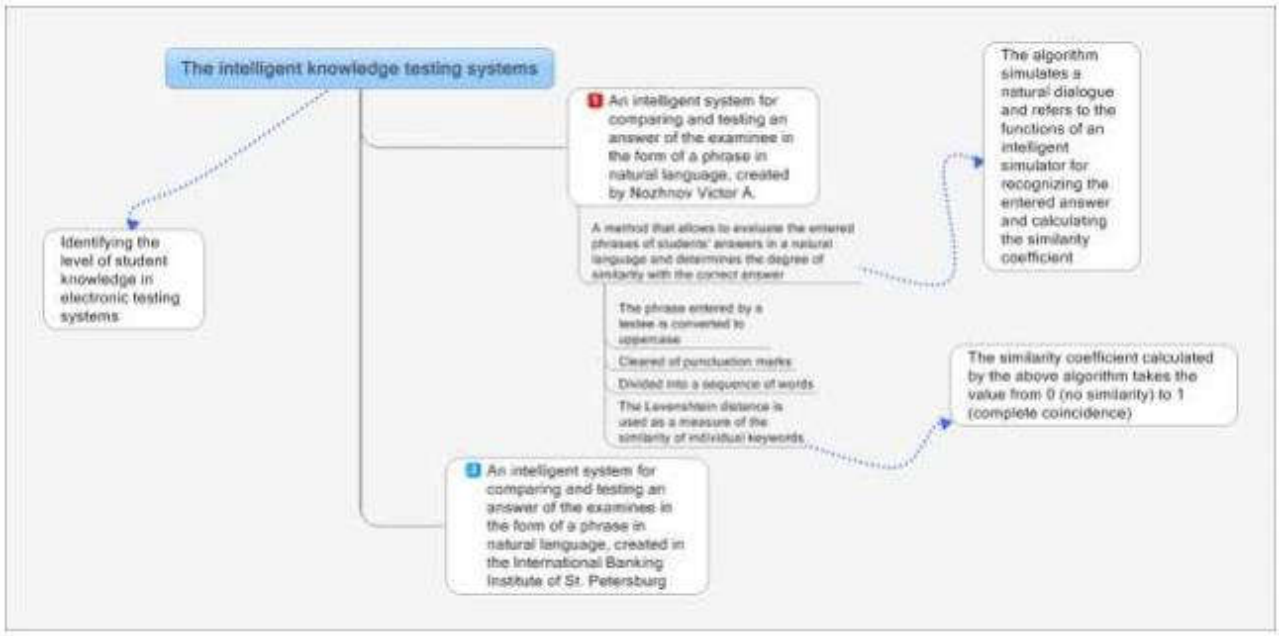


Fig. 1.Concept map ofintelligent system for comparing and testing

(Using MindjetMindManagerProTMtool)

The intelligent knowledge testing system developed by Viktor Nozhnov applies the method that allows to assess entered phrases of answers given by students in a natural language and determines the degree of similarity to the correct answer. According to the functionality, the described algorithm simulates a natural dialogue and refers to the functions of an

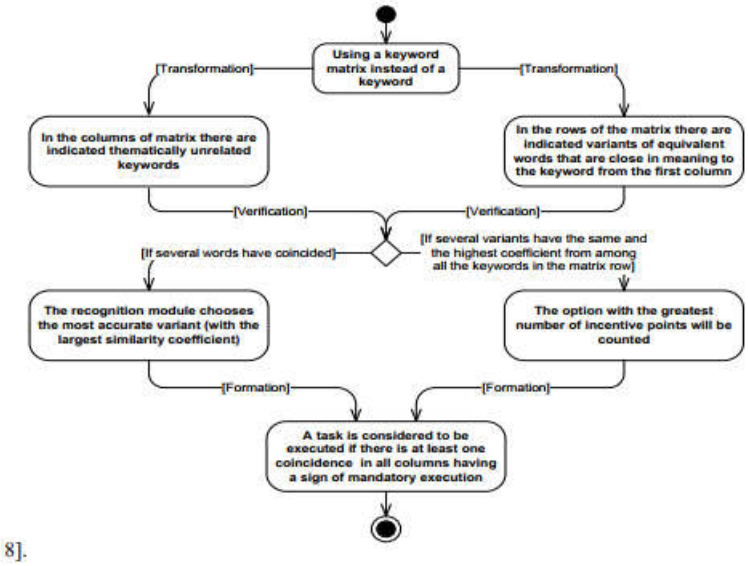
intelligent simulator for recognizing the entered response and measuring the similarity coefficient [3].

At the initial stage the phrase entered by an examinee is converted to uppercase, cleared of punctuation marks, and divided into a word sequence. To ensure that minor typos, as well as changes in endings do not affect the authenticity of recognition, the Levenshtein distance is used as a measure of similarity between individual keywords [7].

The similarity coefficient measured by the above-presented algorithm assumes the values in the interval 0,1. Values close to 0 represent very dissimilar words while values close to 1 represent very similar words. The author of Intelligent Knowledge Testing System found out, that the words with a similarity coefficient below 0.77 should be excluded from further processing. As a result, the words that are most similar to keywords in the keyword matrix are selected from the entered phrase [3].

Usage of a keyword matrix instead of a keyword list allows to take into account the variants of the mandatory keywords that affect task performance, and the options for additional keywords that affect only the incentive points. The matrix columns indicate thematically unrelated keywords (for example, "control", "project"). The matrix rows indicate variants of equivalent words that are close in meaning to the keyword from the first column (so, for the word "management", the

variants "managing", "governance") are possible. Check is carried out on a condition OR (Fig. 2). If several words have coincided, the recognition module chooses the most accurate variant (with the largest similarity coefficient). If several variants have identical and the highest coefficient among all the keywords in a matrix row, the option with the greatest number of incentive points will be accounted. A task is considered to be executed if there is at least one coincidence in all columns having a sign of mandatory execution [3,7, .



8].

Fig. 2. Algorithm of intelligent system for comparing and testing the answer given by an examinee in the form of a phrase in natural language

The keyword matrix for the task "Specify the properties of a secure information" with three mandatory keywords and the presence of up to 3 variants of each of them can be graphically represented as follows (Table 1):

Table 1 Variants of equivalent keywords [3]

M	Variants of equivalent keywords			Keywords
*	Confidentiality?			
*	Accessibility?			
*	Integrity?: 1	Consistency?	Non-distortion?	

Where M – an attribute of mandatory keyword The results of testing are presented in Table 2:

Table 2 The results of testing [3]

Answers given by examinees	Result of test performance	Incentive points
"Confidentiality, integrity, accessibility"	100%	1
"Confidentiality, non-distortion, accessibility"	100%	0
"Secure information is notable for its confidentiality, accessibility, integrity, and consistency"	100%	1
"1.Confidentiality 2. Accessibility" (the text of the original for recognition illustration with errors or misprints is saved)	66.67%	0
"I do not know"	0%	0
"lawanda13" (user ID is entered instead of an answer)	0%	0

In the example considered (Table 2), the system allows the use of keywords of the third line as correct, but for a more precise term "integrity", 1 insentive point is awarded. The system of incentives and penalties allows to simulate the intellectual process in case of assessment judgments: to give objective and not importunate assessment judgments instead of the standard "yes / no", and also to use accumulated penalty or incentive points for educational purposes [3].

Intelligent knowledge testing system developed at the International Banking Institute of St. Petersburg

The system makes a partial language analysis of an expression in a context-sensitive situation, in this case it is enough to have the partial or simplified base of keywords and mutual arrangement of the sign characters which are presumably expected in the expression defining a response quality [1, 2].
The intelligent knowledge testing system checks for the presence of keywords and wordcombinations which shall be in the text in compliance with a given mask and in a certain sequence, then draws a conclusion about semantic compliance of the entered expression. [1, 5].
The process of user string analysis is carried out automatically by a specific analyzer on the basis of algorithm inherent in the analyzer structure. The process of constructing the analyzer structure is not automated [1, 2, 5].

Table 3. Example of intelligent system operation [6]

Question	Answer given by a student
"*Formulate the fundamental question of philosophy as it was formulated by Frederick Engels in the second chapter of his work, "Ludwig Feuerbach and the End of Classical German Philosophy"*	1. **Answer given by a student:** *"Tra-la-la"* **Comment of system:** The answer is wrong, you should study the theory.
	2. **Answer given by a student:** *"IS MATTER PRIMARY REGARDING CONSCIOUSNESS? THAT IS THE FUNDAMENTAL QUESTION OF PHILOSOPHY".* **Comment of system:** *"YOU ARE ALMOST RIGHT! But the answer is INCOMPLETE. ALAS. But You COULD NOT GIVE a COMPLETE answer to this question, even after additional detailed explanations".* *"You CORRECTLY formulated the first part of the fundamental question of philosophy – "WHAT COMES FIRST, MATTER OR CONSCIOUSNESS?" But F. Engels has also the second part of the formulation – epistemological. Refresh your memory and enter the formulation in a response line as accurately as possible".*
	3. **Answer given by a student:** *"IS IT POSSIBLE TO KNOW OUR WORLD?"* **Comment of system:** *"ABSOLUTELY RIGHT! The second epistemological part of formulation of the fundamental question of philosophy by F. Engels is as follows: "WHETHER THE WORLD IS KNOWABLE?"* (hereinafter a detailed explanation is given).

On the basis of carried-out analysis of intelligent systems, the article authors created a concept map which allows to systematize advantages and disadvantages of the examined system (Fig. 3).

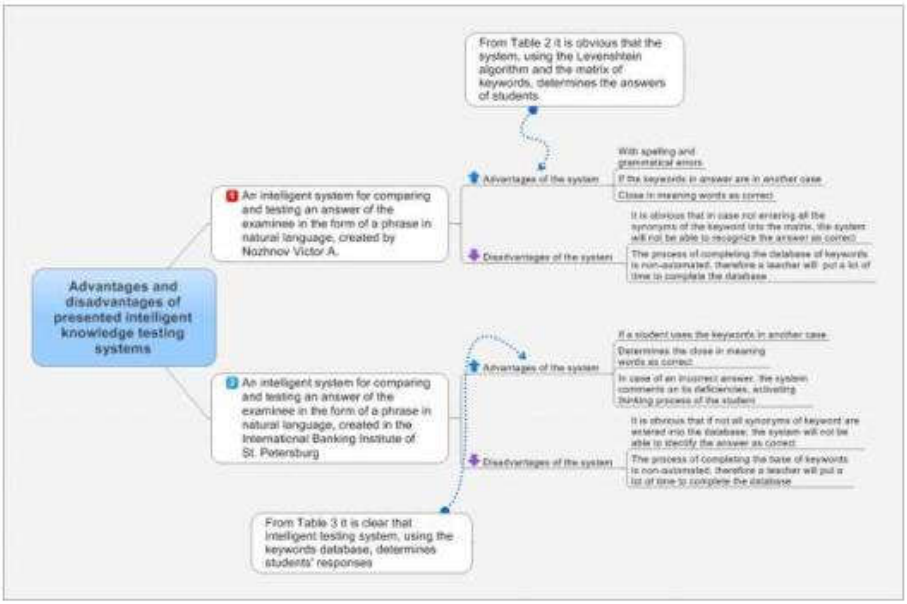


Fig. 3.Concept map of advantages and disadvantages of presented intelligent knowledge testing systems *(using MindjetMindManagerProTMtool)*

Conclusions

Implantation of the intelligent knowledge testing systems with open-ended questions into a distance education would allow to eliminate the possibility of "computation" of the correct answer in a logical way without a solid knowledge of learning material and the possibility of cultivation of a specific thought process of guessing responses, and much more. The main drawbacks of considered intelligent knowledge testing systems with open-type questions are as follows: non-automated filling the keyword database on a given subject topic, therefore a teacher has to spend his/her time for filling it out.

For a possible solution to these problems there could be used a technique using latentsemantic analysis, which with the help of a thematic dictionary could determine dependence of keywords of a given topic, and a teacher would have to check the database filled by means of this method and, if necessary, make correction [10, 11, 12]. The thematic dictionary can be used as a synonym database, i.e., a teacher would not have to fill the database of keywords that are close in meaning.

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