MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY STATE UNIVERSITY
UKRAINIAN FEDERATION OF INFORMATICS

PROCEEDINGS

OF THE IV INTERNATIONAL SCIENTIFIC CONFERENCE

ADVANCED INFORMATION SYSTEMS AND TECHNOLOGIES

AIST-2016

May 25 –27, 2016
Sumy, Ukraine

Information System of Test Monitoring of Students' Knowledge

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Abstract. The work is dedicated to the improvement of the test control technology of mastering the educational material by the students. To achieve this the information system of tests formation has been worked out. The increasing of the variability of tasks is provided by the use of linear congruent method of pseudo-random numbers generating.

Keywords. Effectiveness of Studies, Testing, Model of Information Technology of Test Control, Information Systems of Testing, Pseudo-Random Number Generator, Linear Congruent Method.

INTRODUCTION

The formation of the unified European education and research area requires the improvement of the existing educational technologies. The teaching process may have a sufficient level of quality only if it is equipped with the tools of results control. The best approach to ensure impartiality of the attestation measures is the use of written tests. The control of learning results using test technologies is one of the most important stages of the learning process, because it provides check on the quality of education, providing input information to improve the training and methodological support.

The testing process should be provided by a special information technology (IT) for the formation of which it is necessary to analyze the test technology of the knowledge control (Figure 1). The important attribute of the testing system is the possibility of a computer knowledge control (e-tests), and the ability to print test items for written test control and their saving in the archive. The test system of a high quality should provide a high level of variability of tasks. To simplify and accelerate the results check the test system should generate not only the key to the answers but be capable of automated inspection of paper tests.

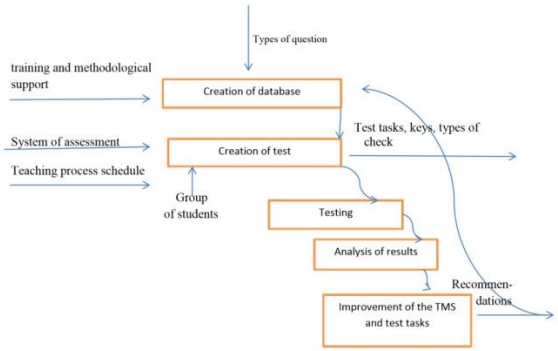

Figure 1 – Conceptual model of the test control

DESIGNING OF INFORMATION SYSTEM

Conceptual model of information system Testing Information System (IS) is a combination of:

$$IS = <DB, GPRN, UI, ID> \quad (1)$$

where DB - a database;

GPRN - generating module of random numbers;

UI - user interface;

ID – input data.

In turn, the database is a set of questions (SQ) formed from a plurality of created options (CO):

$$DB = <SQ, CO> \quad (2)$$

The set of questions consists of a range of disciplines (R d), topics (Rt) in the subjects and questions (Rq) in the subject.

The input data to the system are the discipline, list of necessary topics, quantity of options for the formation and the number of questions in the variant.

The user (teacher) collects database of questions that are divided into the disciplines

and topics within the discipline, and sets the input data to form necessary test task. According to the information received from a plurality of questions the sample of all numbers is created that match the criteria. GPRN module creates a sequence of random numbers obtained from the sample. Then from the set of questions the user (teacher) selects such questions that correspond to the data of generated sequence and a test task variant is created in accordance with the input data.

GENERATION OF RANDOM VARIABLES

The search of a necessary method has been performed among the three main methods: linear congruent method (LCM), Blum-Blum-Shub algorithm (BBSH), Fibonacci method of delays (MFD). For this test software in Visual C # language has been created. Additionally the built in the programming language method GRN (Random) has been considered. The model of the system of testing has been worked out for choosing of the method of generation. The base of questions consisted of 30 questions. Using each of these methods the blocks of 15 options have been created.

The effectiveness of the method was evaluated by comparison to a standard case. The case is considered to be standard when each question in the block occurs the same number of times. After the experiment the analysis of the received samples has been conducted. For every experimental method according to the formula (3) the score is calculated:

$$K = \sum ki \quad (3)$$

where K - resulting score

ki – the score of the experiment, which was calculated according to the formula:

$$ki = \sum(nj - ne) \quad (4)$$

where nj- frequency of the j-th question in the created block; ne – standard frequency of question repetition.

The analysis of the received data showed that in all the experiments linear congruent method showed the best results. That is the allocation of the sequence generated by the algorithm LCM is more uniform compared to other sequences in each series of experiments. Based on this, for the creation of the test options linear congruent method has been selected.

CONCLUTIONS

The paper solved the relevant problem of improving the current testing technologies of the control of mastering of the educational material with the help of the developed information system of test items creation for attestation measures in schools. The models of IS have been created, its software implementation, based on which the system itself has been designed as software. The use of such information system by the teachers can significantly save time during the formation of variants of the tasks. The use of the linear congruent method provides a higher level of variability compared to most similar software products. For the analysis of the effectiveness of the developed information system two samples assignments have been compared, obtained with the help of the standard RNG and linear congruent methods. The study found that the linear congruent method showed a 35% better result. The next stage of the development of the IS is the addition of the electronic testing module with the archiving of results which will provide the teacher with the analysis tools of the test results to improve the teaching, preparation and monitoring of the level of the students' knowledge.

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