

UDC 378.146**Development of the typical algorithm for the adaptive testing of the level of students' knowledge****Sergei N. Larin**

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Abstract

In modern conditions the need for the preparation of qualified experts grows more than ever. This circumstance causes the mainstreaming of the systemic control of students' knowledge level. The use of modern information technologies can considerably facilitate and accelerate this

process. The achievement of mentioned targets is promoted by the development of methods of the adaptive computer testing, which nowadays is possessing by most modern instruments for the control and assessment of students' knowledge level. The article describes main peculiarities and advantages of the application of adaptive testing methods, as well as defines key characteristics, which have been used for the development of the typical algorithm for the adaptive testing of students' knowledge level.

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Keywords

Students' knowledge level, control and assessment, information technologies, adaptive testing.

Introduction

The rapid implementation of modern information technologies in the field of education stipulates the buildup of its use practice not only for the maintenance of electronic educational resources, but also as effective instruments for the assessment of students' knowledge level. Nowadays, in order to achieve this target, the most part of educational establishments uses computer testing methods more and more actively, and for the development of electronic educational resources it becomes mandatory to have a special block and more often – several blocks (pro rata the number of sections of the subject domain of a certain educational discipline) for the test control of students' knowledge level. With that the computer testing can be used, on the hand, as instruments for the student's knowledge assessment, and on the other hand its results become the efficient motivation for the checking of the quality of digestion of the didactic content by students in the course of the organization of their studies on the basis of modern pedagogic information technologies [Stebenyaeva, Baranov, Larina, 2014, 32].

Module educational technologies (MET) as most popular amongst modern pedagogic information technologies, allowing to develop electronic educational resources by means of consolidation of several education modules (EM), corresponding, as a rule, to sections of the subject field of a certain educational discipline. The important peculiarity of MET is that each EM has got the block for the control of students' knowledge level, usually representing certain computer testing technologies [Larin, Lazareva, Hudoley, 2018, 49].

As we know, computer testing technologies are mainly orientated to the increase of efficiency and reduction of time for the assessment of students' knowledge level. Nowadays these goals are mostly met by adaptive testing (AT) technologies, which principal peculiarity is the dependence of the sequence of tasks generation directly in the course of testing from each student's knowledge level. Accordingly, at the AT organization the consequence and the quantity of test tasks can be different for each student. For the purpose of practical implementation of AT technologies nowadays are developed different algorithms for the adaptive testing [Ustinova, Lazareva, 2014; Papanastasiou, www].

Target of studies

The main target of the article hereunder is the substantiation of the approach to the development of the typical algorithm for the adaptive testing of students' knowledge level. The key feature of the typical algorithm is that it can be used in relation to the didactic content of the subject field of the whole

educational discipline, as well as to its several sections, topics and EM.

Materials of studies

In comparison with traditional testing technologies AT have got principal differences and peculiarities in its practical implementation. It is as follows:

- in order to assess the each student's knowledge level is generated the individual algorithm for AT passing, differing by the quantity of incorporated tasks, its content and volume, as well as is limited by the testing time;

- the individual algorithm of AT passing by each student assumes the generation of the consequence and quantity of tasks in the test in conformity with his/her knowledge level in the automatic mode, depending on the task complexity and correctness of replies [Avanesov, www; Larin, Gerasimova, Gerasimova, 2016, 65].

Mentioned principal distinctions and peculiarities have determined main advantages of AT technologies [Stebeyeva, Baranov, Hudoley, 2015, 20]:

- possibility to assess each student's knowledge level with more precision at minimal time expenditures;

- more efficient time use for the control of students' knowledge, what, according to the opinion of many practicing pedagogues, stipulates the increase of objectiveness of its results due to the decrease of the impact of such unfavorable factors as tiredness, worrying, lack of attention etc.;

- establishment of the direct communication and feedback between the student and pedagogue not only in the process of education, but also at the control of students' knowledge level.

Notwithstanding the fact that computer testing technologies are the more modern form for the control of students' knowledge level in comparison with traditional approaches, the organization of the computer testing usually causes two kinds of problems according to its influence character – methodical ones and technical ones. Methodical problems are:

- order of selection of test tasks and the determination of its consequence for the control of each student's knowledge level;

- need for the development of computer testing plans, which terms are referred to the studies of certain volumes of the didactic content of the subject field of certain EM, sections or educational discipline in whole;

- determination of the content of requirements for the development of individual AT algorithms, as well as of the number of tasks and its complexity, depending on the level of each student's knowledge.

Technical problems comprise:

- consequence of the submitting of selected tasks in the test;
- definition and application of testing parameters depending on certain volumes of didactic content of the subject area of individual MO, sections or educational discipline as a whole;

- formation of the AT algorithm to control the level of knowledge of students.

Therefore, for the practical implementation of the AT are necessary not only sound methodological approaches, but also implementing methods of monitoring and assessing of the level of knowledge of students, as well as the appropriate software developed on the basis of modern information technologies. Since the methodological approaches and methods of control and assessment of the level of knowledge of students will be covered in more detail in another article, the further research will focus on the formation of algorithms for the implementation of at. This will be based on a standard algorithm that meets most of the requirements for the organization of AT.

Research methods

It is obvious that for the formation of a typical AT algorithm, we will need to determine a number of fundamental characteristics that have a direct impact on its practical implementation. These characteristics include the following: the purpose of the AT, the rationale for approaches to the formation of the composition of test items, the rationale for the choice of methods of at, especially the at and obtain its results, as well as the basic requirements for its completion.

The most important characteristic of the AT performance is its objectives, as they determine all the requirements and features, as well as the content of this process. As a rule, the objectives of the AT vary depending on the control of the level of knowledge of students in the context of the volume of didactic content of the subject field of EM, individual topics and sections or a specific educational discipline as a whole. Definition of the purposes of carrying out the AT involves need of preparation and representation of didactic content of subject area of educational discipline in the established volumes and in methods, convenient for carrying out testing [Uglev, Ustinov, Dobronets, 2008, 83]. In this case, two approaches to the choice of ways to represent didactic content are usually used:

- thematic approach, according to which the didactic content of the subject area of the educational discipline includes several thematic sections that are interrelated, and at the same time for the purpose of control of the level of knowledge of students in each section there are individual test items;

- the task approach, according to which the didactic content of the subject field of the educational discipline is presented in the form of a certain set of tests of different complexity in relation to a particular EM, topic, section or specific educational discipline as a whole.

As a matter of fact, the justification of approaches to the formation of the composition of test items assumes the choice of one of these ways of presenting didactic content.

Methods of AT can be divided by the building of its trajectory and the choice of the first test task. Building of the AT trajectory represents features of creating a composition of test tasks based on the feedback from the student. This approach allows to organize an individual control of the level of knowledge for each tested student, offering the optimal level of difficulty for him/her of tasks, included in the test and developing individual trajectories to assess the level of his/her knowledge.

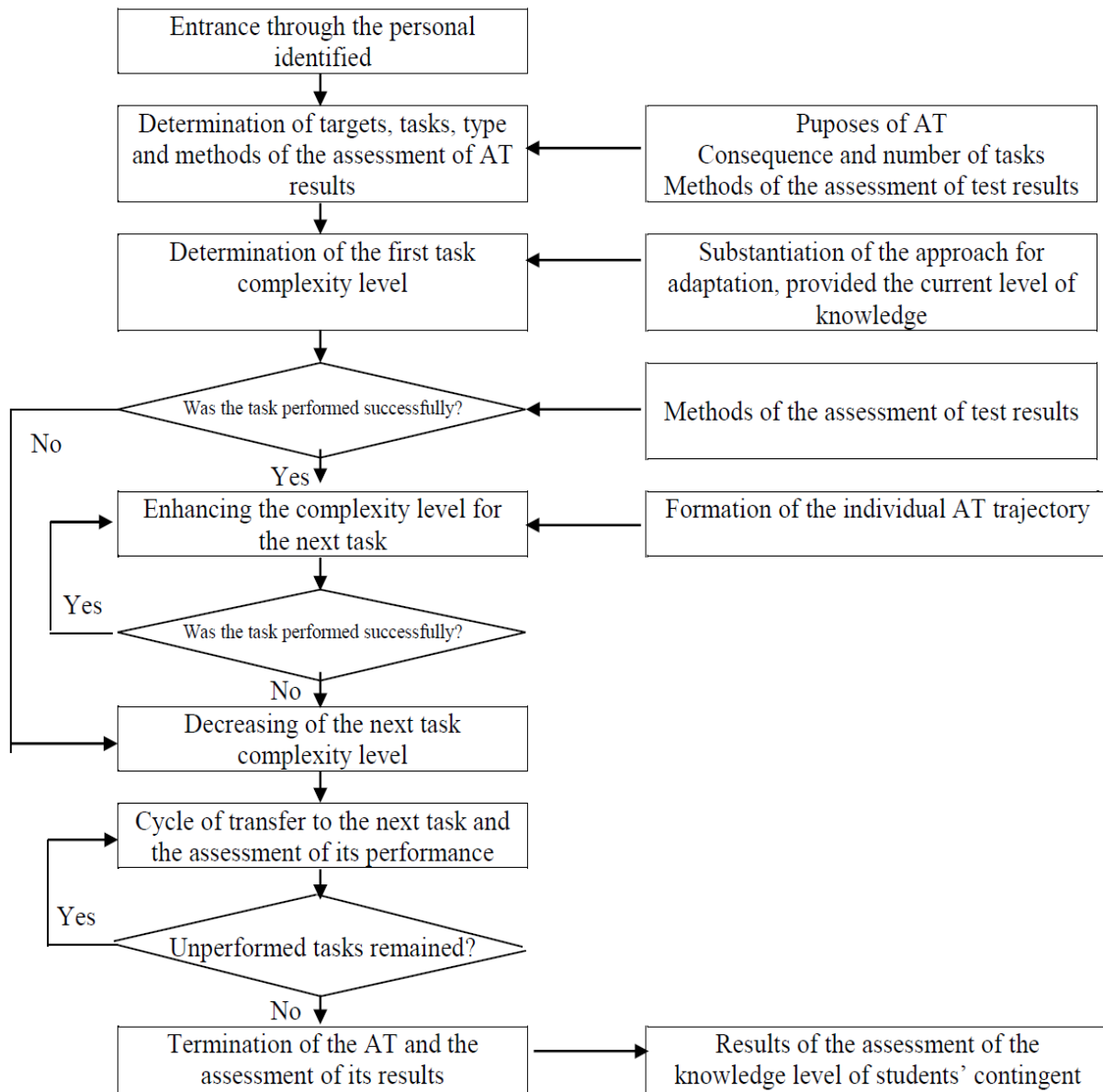
The choice of the first task of the test sets its level of complexity, which can be set by default at the middle level or set for each student (group of trainees) individually based on the results of the current control of their level of knowledge.

Features of the at and obtain its results are identified on the basis of methods of evaluation of test results [Lavrukhina, Abasova, 2010]. They determine the sequence of passing the test tasks during the AT. Methods of evaluation of test results allow for continuous monitoring of the level of knowledge of students and evaluate it on the results of the AT and the performance of its tasks, both in the learning process and at its end.

To complete the process of AT, certain rules are established that determine the conditions for the end of this process. These conditions may include a fixed time of AT, a fixed number of tasks in the text, a set level of complexity of the test and the required level of knowledge of students for successful completion of adaptive testing. The conditions for the completion of the AT process can be varied and thus create new conditions for its completion.

Results and discussion

On the basis of the analysis of approaches to the choice of ways of representation of didactic content the standard algorithm of the AT for determination of level of knowledge of trainees has been developed. It is shown in the picture.



Picture 1 - The scheme of the typical algorithm of the AT performance.

As the initial data at the development of the typical algorithm for the AT performance where used indices, which:

- characterize key dimensions of the performance of a certain test task, namely: its purpose; type selection; normative continuity of its performance; actual continuity of its performance etc.;
- characterize the key settings used to develop the algorithm of the AT, namely: targets of the AT; the number of tasks included in a particular test; the maximum allowable duration of the AT; determination of methods for assessing the results of the test; taking into account the current level of knowledge of the contingent of students, etc.

Determination of the sequence of operations of the standard algorithm of the AT is carried out by its developer, who must take into account the totality of the above source data. Naturally, when developing more complex algorithms for at, it is necessary to take into account a large set of initial data.

Opinions

Following opinions have been derived on the basis of obtained results:

1. It is established that in the conditions of rapidly developing informatization of the educational sphere, the practice of using of modern information technologies is expanding from the development of electronic educational resources to their use as an effective tool for assessing the level of knowledge of students. To achieve this goal, the methodology of computer adaptive testing is increasingly used in most educational institutions today.

2. It is established that the control and assessment of the level of knowledge of students are an integral part of each MET and included EM. In the organization of control of the level of knowledge of students, the main focus of computer testing technologies is to improve the efficiency and reduce the time of obtaining its estimates.

3. To the greatest extent these goals today correspond to the technology of AT, the principal feature of which is the dependence of the sequence of generating tasks directly in the course of testing on the level of knowledge of each student. Accordingly, during the AT the sequence and the number of tasks in the test for each student may be different. For the practical implementation of at technologies, various algorithms for adaptive testing are currently being developed.

4. A standard algorithm of AT, which can be used to test the level of knowledge of different contingents of students has been developed. Was determined a number of fundamental characteristics that have a direct impact on the practical development of a standard algorithm for AT.

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Разработка типового алгоритма для проведения адаптивного тестирования уровня знаний обучаемых

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Аннотация

В современных условиях как никогда возрастает потребность в подготовке квалифицированных специалистов. Данное обстоятельство влечет за собой повышение значимости организации системного контроля уровня знаний обучаемых. Использование современных информационных технологий может значительно облегчить и ускорить этот процесс. Достижению указанных целей способствует развитие методологии компьютерного адаптивного тестирования, которая сегодня обладает наиболее совершенным

инструментарием для контроля и оценки уровня знаний обучаемых. В статье изложены основные особенности и преимущества применения методологии адаптивного тестирования, а также определены ключевые характеристики, которые были использованы при разработке типового алгоритма для проведения адаптивного тестирования уровня знаний обучаемых.

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Ключевые слова

Уровень знаний обучаемых, контроль и оценка, информационные технологии, адаптивное тестирование.

Библиография

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