

Distance Learning Environment and Interactive Educational Process Management

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Abstract

This study is devoted to the urgent problem of improving the curriculum management technology. The article proposes an approach to the use of information and communication technologies in the educational field. To achieve an improvement in the quality of assimilation of knowledge by students, a software product has been developed and tested that provides automatic control of the learning process. The computer system that implements the scheme of general classroom and distance learning in order to motivate and stimulate students' independent work is studied. The advantages that are revealed when using this form of training specialists are shown. The proposed system provides automatic control of the learning process, starting with time planning, tracking and closing knowledge gaps and changing the learning path depending on the individual preparation and abilities of each student. The model developed by the authors includes a set of educational tools such as: providing educational materials; students step-by-step control; assessment of knowledge; the use of active teaching methods; introduction of various forms of communication into the educational process; analysis and improvement of the educational process; teacher process

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I. INTRODUCTION

The educational sphere differs from all others in that the improvement of the curriculum management technology is always relevant in it. Therefore, the innovative work in this type of activity never stops, and at present, with the development of computer technology, it has also intensified. In addition, the amount of knowledge that a student needs to learn in order to meet professional standards is also increasing. Therefore, in the educational system, scientific and technological research is carried out in

the methodology of mastering knowledge and evaluating its effectiveness.

The problem of distance learning using the Internet (E-learning) has recently received much attention in the world [1,2]. This is explained by the advantages that are opened when using this form of training of specialists; first of all, there is no need for students to move for a long time to the location of the university. This makes it possible to obtain the necessary knowledge for those who, for example, cannot leave their jobs or leave for any

other reasons. In addition, teachers from leading universities can teach students around the world that Western countries have been actively practicing in recent years.

The developed standard of distance interactive learning SCORM defines the general requirements for software [3].

This direction is recognized as progressive among educational projects [4,5]. It must be developed so that residents of small towns and rural areas, as well as in large cities where there is no necessary specialty at a local university, can receive vocational training that meets educational standards.

Currently available distance learning systems are actually limited either to the provision of training materials, or, in extreme cases, provide the possibility of testing. At the same time, “intelligent” training systems have not yet been sufficiently developed. Such systems should provide automatic control of the learning process, starting with planning over time, tracking and filling knowledge gaps and then changing the learning path depending on the individual preparation and abilities of each student.

The independent work of students in the study of any disciplines is a very important component of the educational process, since it affects the level of knowledge acquired by students. Therefore, improving the organization of this area of the educational process is the goal of this work.

The work is carried out in the following areas:

- provision of educational materials;
- automatic formation and delivery of tasks;
- organization and control of rhythm and independent work of students;
- assessment of knowledge and rating;
- the use of active teaching methods;
- introduction of various forms of communication into the educational process;
- analysis and improvement of the educational process;
- transparency of the work of teachers;
- obtaining operational information on the state of the educational process and the

issuance of documentation and personal docs;

- performing calculations and research.

The development of computers and the Internet can be of great improvements in the development of these areas. Students spend a lot of time online and we need to use this for educational purposes.

II. THE SYSTEM DESCRIPTION

The system provides for several categories of users - teachers, students, registered users, guests and administrators (methodologists, managers, observers and system administrators) with their rights, capabilities and responsibilities.

Between students, teachers and administration, the system is equipped with communication tools: built-in E-mail; files can be sent either attached to E-mail messages, or directly to or from individual folders; the ability to transmit announcements (messages); when working where it makes sense, the user sees a photo of the intended interlocutor.

The teacher’s function is reduced to the preparation of training materials, tracking students’ work (obtained grades for testing, the date and duration of work of students) and, if necessary, communication with students.

The student receives educational materials (course program, electronic textbook, subject and name index, etc.), as well as assignments, the ability to be tested in three modes (training, with and without prompts), test results with analysis of answers, communication tools (e-mail, Skype), including - in the online mode.

Administrators (each group in their field) ensure the filling of the system, its work, can monitor the activities of individual users.

In addition to these categories of users, the system can be visited by registered users and outsiders (guests). Registered users can use certain information resources in accordance with the agreement (in addition to educational material, the system includes quite sophisticated applied developments), and guests have very limited educational opportunities.

The usage of a high-level language, as opposed to writing, for example, Java scripts or PHP programs, allowed, on the one hand, to protect information and the program itself from unauthorized copying and hacking at a higher level, and on the other hand, to facilitate the creation of settlement programs of any complexity, which is especially important when training technical specialists. The use of calculation modules with a graphical representation of the results facilitates the perception and assimilation of educational material.

We are using multimedia training tools, including video clips.

The system has an intuitive and convenient interface and does not require any special knowledge from users when working with the system. The program is constantly being improved and the description often lags behind the real state (Fig. 1).

The additional software has been created for the initial processing and data entry, as well as the automatic tracking and adjustment of information, made it possible to minimize the number of staff -

only one person is enough to enter information and maintain the system

III. ORGANIZATION OF THE WORK IN THE SYSTEM

After authorization on the site (Fig. 2), the student selects the academic discipline of the current semester and receives a complete set of educational and methodological materials. In addition, the system has additional materials - a library of scanned textbooks and manuals (over 3,000 items) with a table of contents navigation, which eliminates the need to spend time searching for literature agreed with the teacher. Readable to students and teachers, as well as a catalog of books and magazines in the reading rooms of the institute. All training material to speed up page loading is divided into small fragments with hyperlinks to go to the previous and next pages, to the table of contents. In addition, there are also hyperlinks to go to other sections of the electronic textbook.

The administration has up-to-date information on the availability of training materials in the system and can check and control it, as well as the duration of students' work in each academic discipline.

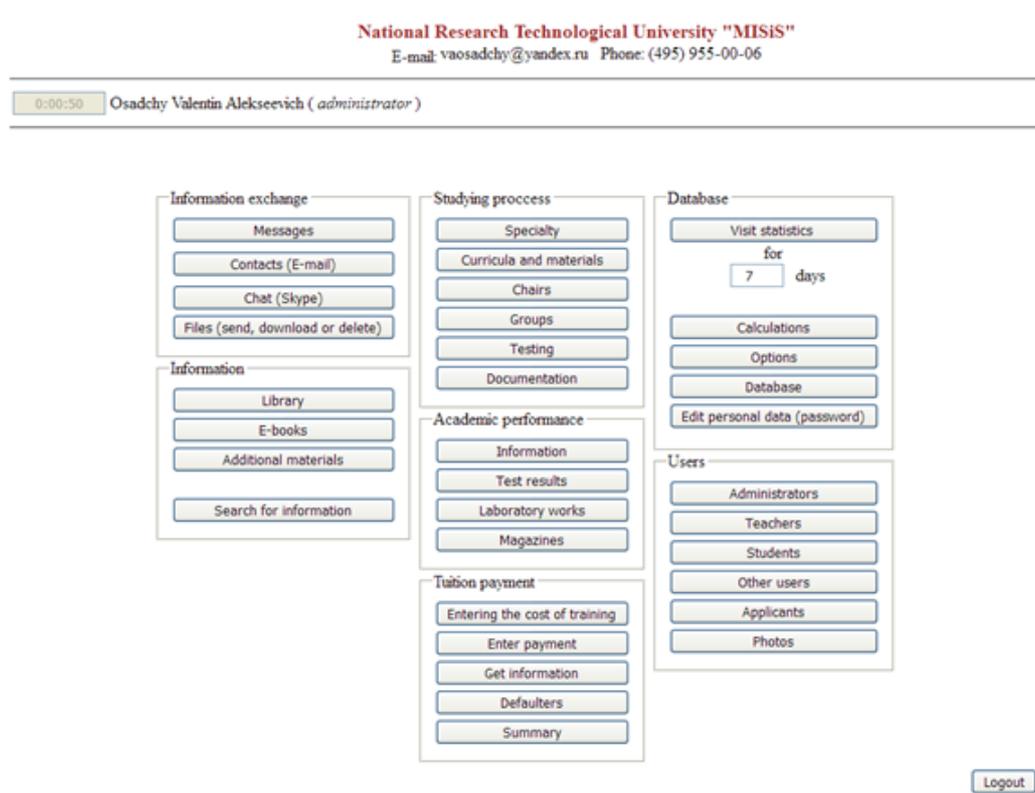


Figure 1. Administrator's home page

The screenshot shows the login interface for the National Research Technological University 'MISIS'. At the top, it identifies the institution as 'Remote Education (Dist)' and provides contact information: 'E-mail: pep@disto.misis.ru Phone: (499) 236-03-54'. Several accreditation certificates are displayed in a row. The main area features a 'Good day!' greeting, a language selector set to 'English', and a prompt to 'Enter your name and password'. Below this are input fields for 'Surname' and 'Password', followed by 'Enter' and 'Forgot password' buttons, and a 'help' icon. A note at the bottom explains that a student ID can be used on the first visit, but a password is required for subsequent logins. A footer section contains instructions to avoid frequent failures by not rushing, to use the back and forward browser buttons, and to use the 'Help' button for issues. It also provides an email address vaosadchy@yandex.ru and notes that the Yandex browser is not recommended due to performance issues.

Figure 2. Student's login form

Practice has shown that the liberal scheme for the supply of educational materials, when the student is given full access to educational materials, and he himself determines the sequence and timing of activities, weakly stimulates systematic work. Therefore, a “rigid” scheme was developed and introduced that governs the conditions for studying each discipline, training along the so-called “trajectory”.

Training along trajectories provides stimulation of students' work during the semester and timely application of organizational measures.

The student sequentially receives portions of educational material and tests to verify the acquisition of knowledge. If the test is unsatisfactory, the system returns to re-study the relevant sections of the course.

In order to exclude formal page turning, the minimum time for studying a fragment (page) is set.

Other control measures can also be included in the trajectory, for example, sending the completed homework to the teacher.

The teacher has the ability to adjust the trajectory (for example, the dates of the work). Students have access to the individual steps of the trajectory about a week before the deadline.

Timelines, time spent are monitored. As a result, information is accumulated on the degree of assimilation of the material (grades and scores). Penalty points for untimely performance of work and the use of additional attempts stimulate regularity of work and careful study of the material.

The teacher in visual form in graphical form at any time can see the progress of each student of the group along the trajectory (Fig. 3). He can get information about the assimilation of material on each topic, as well as questions to which the student could not give the correct answer for the interview, which actually allows eliminating knowledge gaps.

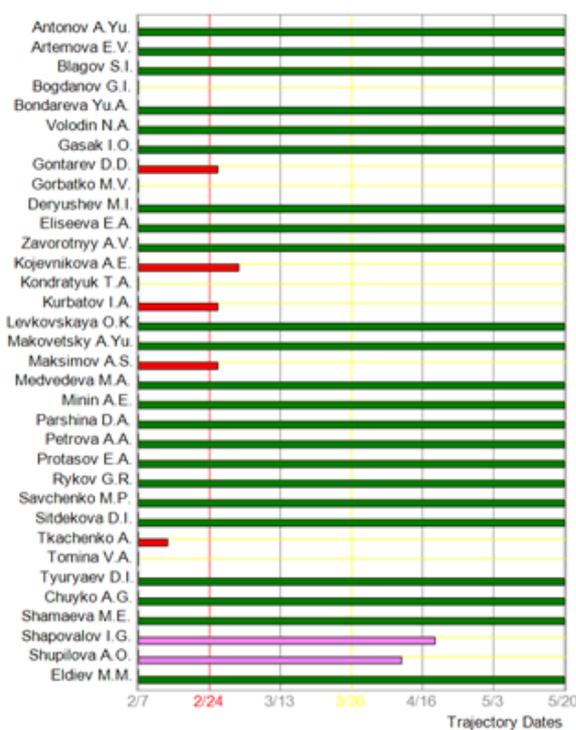


Figure 3. Student's trajectory scores

Currently, more than 4,000 man-trajectories and more than 120 academic disciplines have been implemented.

When teaching students, this scheme was used by about 100 teachers from various universities and more than 2000 students.

In accordance with the requirements, the trajectories require at least one test per month, but the weekly supply of training material and verification of mastery with the test was preferable. In addition, it also provides for confirmation (taking place in the audience, with the teacher) of testing and independent monthly mandatory testing on issues based on existing educational standards.

To ensure the objectivity of the test results included at least 16 questions per 1 hour of lectures. Along with the usual types of test questions, complex problems are widely used with an arbitrary number of verifiable numerical and text parameters, with a given algorithm. During testing, questions of various types can be used, including, along with simple yes/no questions, choosing the right answer, sequence, questions of a more complex kind can be used - with an analysis (so far very simple) of textual answer, as well as tasks with the answer in

the form of one or more (up to 3) numbers. Questions can be provided with links to a guide and explanatory material. It is possible to use the difficulty factor of the question, set the rating scale and time: the program determines the difficulty of the question, highlights dubious and too easy questions.

Teachers and the administration have the ability to open and close the availability of the test, set the test conditions (number of questions asked, number of attempts, test time).

The system was successfully tested at in-line conducting routine exams and state exam at the same time in 4 computer classes (120 seats).

The presence of testing protocols with the student data and the correct answers reduces the risk of conflict situations.

Grades for tests and laboratory work fall into the journals automatically and cannot be changed. Class attendance and grades exhibited by teachers in practical and seminar classes for tests, homework, essays, term papers, as well as further tests and examinations are entered by teachers into the system.

Massive continuous testing (67947 tests in 127 academic disciplines) ensured the availability of a sufficient number of grades and points for each discipline per student, made it possible to increase the reliability of knowledge assessment and to implement rating calculation.

The calculation of the rating takes into account all types of control activities (practical and seminar exercises, tests, homework, essays, laboratory work, independent testing, audience testing, attendance, rhythm) with weighting factors. In this case, the last score is taken into account, but the number of attempts is limited and the score is reduced by 5% for each attempt. This encourages the student to study the material before testing, rather than trying to achieve a result through additional attempts.

The current rating can be calculated at any time, which allows identifying lagging students.

In accordance with the requirements of the point-rating system, the credit and examination records for academic disciplines for bachelors and specialists of

the institute of all full-time courses were issued with ratings, the use of which is mandatory.

A sufficiently large number of assessments, a shift in emphasis on regularity of work increase the objectivity of knowledge assessment.

Given that people remember better from what they see, hear and do, much attention is paid to creating a laboratory workshop.

Students can perform laboratory work, including simulators, both in the computer classes of the institute and from home computers. At the same time, in almost all laboratory work a tolerance in the form of a test is provided. The grades obtained are automatically recorded in the teacher's electronic journal.

The description of the laboratory work, like other educational materials, may contain video fragments.

In the educational process, films can be used, which are sometimes shown in the audience, but more often the task is given to students to watch them at home in the system for subsequent discussion in the lesson.

The student sends the completed tasks to the teacher from the page of the discipline, and the teacher sees them and receives them on the page of the journal.

Automatic registration of attendance at lectures in streaming classrooms where computers are installed has also been implemented. There you can conduct a blitz test.

Students reserve disciplines of choice and topics of term papers, followed by approval by the teacher. This excludes the choice of one topic by various students of the course.

The distance learning system makes it possible to make an analysis in order to improve the educational process, as it provides a number of additional features. Namely, it is possible to evaluate the time spent by students on the study of individual academic disciplines, evaluate the mastery of individual topics according to the results of testing, as well as the load per semester.

Independent testing allows you to evaluate the compliance of the programs used with the requirements of the standards.

Along with improving the organization of the educational process, the use of a computer system clearly shows the work of teachers - the availability of teaching materials, tests, the availability of assessments, exactingness, activity in the system, both of teachers and students in a particular discipline.

The sufficiently successful use of computer control of student's independent work in many ways was made possible due to the fact that they practically did not increase the load of teachers except their direct responsibility - to prepare training materials and control tools, as well as to monitor work of students.

An important factor is administrative control; you can easily check the compliance of the training material with the tests and the course program.

In addition, this system can be used not only by participants in the educational process, but also by researchers who need to calculate and analyze the results on the topics provided for by the developed program (for example, a database of mechanical and technological characteristics of stainless steels and heat-resistant alloys, statistical data processing and construction regression equations, calculation of the parameters of the rolling process; assessment of the economic efficiency of enterprises, banks and other tasks). The list of these tasks is presented in Fig. 4.



Figure 4. Logging into the anonymous user system and a list of programs for performing settlement tasks

IV. CONCLUSIONS

The distance learning system allows us to implement a model of blended learning (full-time and part-time), as well as individual training increases motivation and stimulates the independent work of students.

The developed system reflects both the traditional structure of education in higher educational institutions using groups of students, specialties and curricula, as well as current trends in the transition to distance learning, i.e. the ability to learn anytime, anywhere, according to individual plans and schedules.

It has been possible to use the system by various categories of users to ensure the organization of the educational process both using groups and curricula, and individual learning using various schemes: with the issuance of individual tasks; testing; training on individual trajectories; the issuance of training materials in portions; the use of multimedia dia; the use of computing modules with a graphical representation of the results; definition of rating, etc.

The created system offers users access to versatile information of an educational nature (curriculum disciplines, manuals, additional course materials, assignments, tests, and general nature (regulatory documents), as well as a software package for performing calculations and scientific research.

In the future, work is planned on modules that help to track the formation of not only knowledge, but also competencies in the framework of educational programs of undergraduate and graduate programs.

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