

Computer-Based Educational Environment in NUST MISIS

Osadchy V.A.

National University of Science and Technology "MISIS"

Gorbatyuk S.M.

National University of Science and Technology "MISIS"

Zarapin A.Y.

National University of Science and Technology "MISIS"
e-mail: lncs@springer.com

Abstract—The educational environment Dist is described, allowing to provide students with educational materials, to realize training on trajectories, knowledge control, attendance of classes, rhythm of work, calculation of the current rating. During testing, various types of questions are used, including tasks with the formation of virtually non-recurring variants. The system includes a wide toolkit for administrative control of the educational process.

Keywords—words: distance learning, testing, trajectory training, rating, knowledge control.

I. INTRODUCTION

E-learning has recently been widely used both in our country and abroad. Its various forms are successfully applied both in correspondence and in intramural education, first of all, to enable and control students' individual work. Available software is mostly developed abroad and does not cater to the specific organization of the educational process in our country [1-5]. For this reason, all educational organizations are recommended to use their own approaches, including the development of an in-house educational portal.

In recent years National University of Science and Technology "MISIS" (NUST "MISIS") is working to improve the scientific and methodological aspects of teaching its students [6-9]. A computer-based educational environment has been developed and is accessed via the Internet (portal econom.misis.ru). It implements a scheme of blended learning, which combines classroom based and distance learning, and facilitates scientific work. The environment manages all aspects of distance learning (assessment, access to educational content, display of training programs, communication between students and teachers, etc.). The main aim of distance learning implementation is to improve the quality of specialists training, develop creative initiative, and ensure unbiased assessment.

The concern of this article applies mainly to NUST "MISIS" students, but students of any other university can find it of some use while mastering their courses. While organizing the educational process some goals were kept in mind such as to stimulate paced individual work of students, minimize teachers' overload, and provide user-friendly system together with sustainable data protection.

II. ACCESS TO EDUCATIONAL CONTENT

One of the main tasks of distance learning was to provide students with educational content.

The developed system provides an authorized student with an access to a list of courses scheduled for the current semester. If required, the student can choose their elective courses and look through general methodological and reference materials. What is more, the system also provides a list of course tasks with missed deadlines.

Having chosen a course, the student gets a full set of educational and methodological materials: course syllabus, presentation, textbooks, training aids, glossary, study guides, laboratory course, methodological guidelines, and some material for further reading (scanned resources). All of these saves the student from wasting time on searching required literature. All course materials are constantly updated and reviewed.

The system also lets the student start computer-based laboratory practice, get assigned tasks, choose a topic for academic papers and projects, and even have a test.

The teaching staff provides The Center of New Educational Technologies with all required course material (in the form of MS Office files) and The Center's staff uploads it using designated format at the University interactive educational portal.

Currently the system has 812 textbooks, 250 presentations, 663 trajectories, 9390 tests that account 554992 tasks and questions. Moreover, the system provides access to a collection of scanned textbooks and manuals (more than 6600 items) together with inventories of books, magazines and journals available in reading halls and study rooms of the University. A search system for uploaded educational materials has also been developed and implemented on the site.

III. EDUCATIONAL TRAJECTORIES

The aim of the models implemented in the educational process is to enable students use their potential, which means they should follow their individual educational trajectory that ensure personalized approach to educational process. The evidence from the past shows that if provided with an unlimited access to all educational resources with self-regulated deadlines, students tend not to work on a regular basis. For that

reason, NUST “MISiS” has implemented a rigid scheme that regulates term and conditions for taking any academic course.

Each student is offered an individual trajectory where educational content is provided as smaller steps of 6-10 page sections of material with follow-up tests. The steps become available on dates set previously. The overdue steps and tasks are penalized when assessed.

Students get sections of material with follow-up tests sequentially. A new section only becomes available if the previous one is successfully complete. If assessment by means of tests shows unsatisfactory level of acquired knowledge, the system sends students to revise relevant material from the previous sections.

The trajectory can contain some revision material from previous courses and sub-trajectories for students with different abilities.

Depending on the amount of learning material, each section or page of the course is provided with a minimum required time a student should spend on studying it. This serves to avoid mindless clicking. Course trajectories help students to understand what material they are supposed to cover before a lecture, a seminar or a lab class and what deadlines are set for it.

Teachers can edit the trajectories, for example they can change the deadlines for the course. Students get access to sections not long before the deadline. The system controls due dates and the time each student spent on fulfilling the task. As a result, the data on how successfully the course was learned is collected through available information about students’ grades and points. The penalty students get for missing deadlines or using extra attempts to accomplish the tasks promote paced learning process and deeper material understanding.

Teachers can see a visual representation on how each student is moving along the assigned trajectory. Detailed information on how a course topic is acquired can be shown together with the information on which tasks and questions caused students the most difficulty.

IV. ASSESSMENT

The system includes measuring tools to assess students’ knowledge in the form of different tests used to control learning process.

To ensure reliable test results 1 hour of lectures is followed with no less than 16 test questions. Even the staff of the Centre involved in the server maintenance does not have access to correct answers.

There are ten different types of questions including the ones with analysis and morphological text processing. Together with usual test questions, the system uses complex assignments with any number of digital and textual parameters, with given algorithms. Mentioned above features ensure generation of unique assignments and test with very low change of repetition.

What is more, in the beginning of each month independent testing assignments become available to the students. The results of this test are verified later during a class-based test. Alongside with test assignments obligatory for all the students,

teachers can provide additional tests for some students to perform further assessment.

The system can figure out the difficulty of a question based on statistical analysis of students’ performance (the more successful the students are with the tasks the lower is the difficulty). The system also analyses the quality of the tasks, marks poorly stated and simple questions so that the teacher could review them later. For every course statistical performance reports are available for all test assignments.

The questions that caused an individual student problem go to a course-specific pool and so-called make-up test assignment becomes available in the corresponding section of the course. If the student chooses the make-up test assignment, it motivates him to fill in the gaps in the course material.

Teachers can manage tests by controlling its accessibility, amount of tasks and questions, attempts, time; they can also make the tests accessible only for PCs with specific IP according to the classroom they are installed in.

V. LABORATORY CLASSES AND RESEARCH

Students can do laboratory assignments both in computer classes in The University buildings and at home using their own PCs. Students get access in form of a test assignment, accomplish it with further computer-assisted assessment and present the results to the teacher. The system automatically forms the assignment, calculates the points, and grades the assignment both at each step and in whole.

By now, the system contains 34 laboratory assignments on economics and 29 routine calculations provided as laboratory assignments for mathematical courses.

While conducting their research [10-17], both students and teachers can perform economic and process calculations as well as statistical analysis with the use of subsystems implemented in the educational environment.

VI. COMMUNICATIONS

Special consideration was given to online communications that were used to provide communication between teachers and students while working with various educational elements.

Students can sign up for academic courses and course paper topics based on their preferences with following approval from the teachers. The system eliminates the possibility for several students to choose the same topic. Administrators and teachers can carry out targeted mailing by means of the educational environment.

Students’ results on how they move along their trajectories, pass their tests and perform in laboratory assignments are recorded in an electronic gradebook and cannot be edited afterwards. Teachers add data about students’ attendance, in-term grades, credits and exam results to the system.

VII. POINT RATING SYSTEM

Point rating system approach requires a grade expressed in points to be assigned to a student after each individual assessed assignment (laboratory or home assignments, tests, seminars,

tutorials etc.); these grades are later summed up and characterize the student's course performance.

The rating (monthly and final) is counted as a sum of productions of earned points by the weighting factor of each assignment. While counting the rating all bonus and penalty points are taken into consideration.

At the final stage of educational process a computer-based subsystem forms individual university transcript based on the student's performance data.

Data security and results reliability

For any informational system data security and reliability of the obtained results are the key elements that largely define the success of its operation. For the system under consideration each student gets personal access code to download lectures, assignments, study books and so on. However, for the three first times students access the system they can use their student identification number to memorize the system-provided code and use it in the future. Individual passwords are provided to other users. The system has defined user categories and subcategories with personalized functions and permissions to access and edit data and content.

Access permissions depend on user's category and affiliation. For example, a teacher can view all course programs, but educational material is only available if developed by the corresponding department. The teachers only have access to students' performance in their groups and can only edit their course gradebook. Priority access and permissions are given to heads of departments and academic secretaries.

All information is stored on the server in an encrypted form.

All test questions are modified so that the wording never repeats itself, for that reason it is useless to clipboard the questions.

In addition to that the system analyses users work in order to identify cheating. Teacher can see the system's comments in the gradebook. Online assessment is supported by teacher-controlled in-class assessment.

VIII. CONCLUSION

Using computer-based educational environment improves learning process itself and clearly demonstrates teachers and students activity in various academic courses.

Independent testing allows quantifying correspondence between education programs and materials used by teacher and requirements set by regulatory institutions and standards.

Ability to perform administrative control is an important factor as heads of departments and faculty or university administration can easily check if educational materials corresponds to its course program and if assessment is credible. Implementation of computer-based educational environment allowed to ensure transparency of teachers' work, improved administration awareness of learning process and students activity starting very first days of semester, eased some of organizational issues solution (like issuing academic records and university transcripts). An opportunity to receive prompt integrated informa-

tion regarding academic performance of particular students or student groups was established.

Many teachers report more serious attitude towards studying among the students as well as overall improvement of academic performance. Conscientious students feel more confident during their exams, as most of the grade (70 %) is formed according to their prior work during the semester.

The system developed reflects conventional learning structure of higher education institutions using student groups, specialties and studying plans as well as applying contemporary tendencies of shifting towards distance learning, that is an opportunity to study no matter the time and place, using individual plans and schedules. It is also effective at pursuing a second university degree.

System-provided reports on available learning materials, students and teachers' activity, attendance and academic performance are regularly discussed during department briefings and meetings of the University Scientific Council. The educational environment is constantly improving. Subsystems for student group contests, extra scholarship appointments, enrollees, graduates and employers management are under testing.

The education portal can also operate in English and French, which can be extended with any others on demand. The Web-system is registered in Russia and the USA under the alias of Dist and is awarded numerous diplomas at International congress-exhibition "Education Without Borders", 11-th All Russian forum "Educational Equipments 2009", and VDNH diploma.

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