

Testing information system at Vladivostok State University of Economics

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1. Architecture of testing system

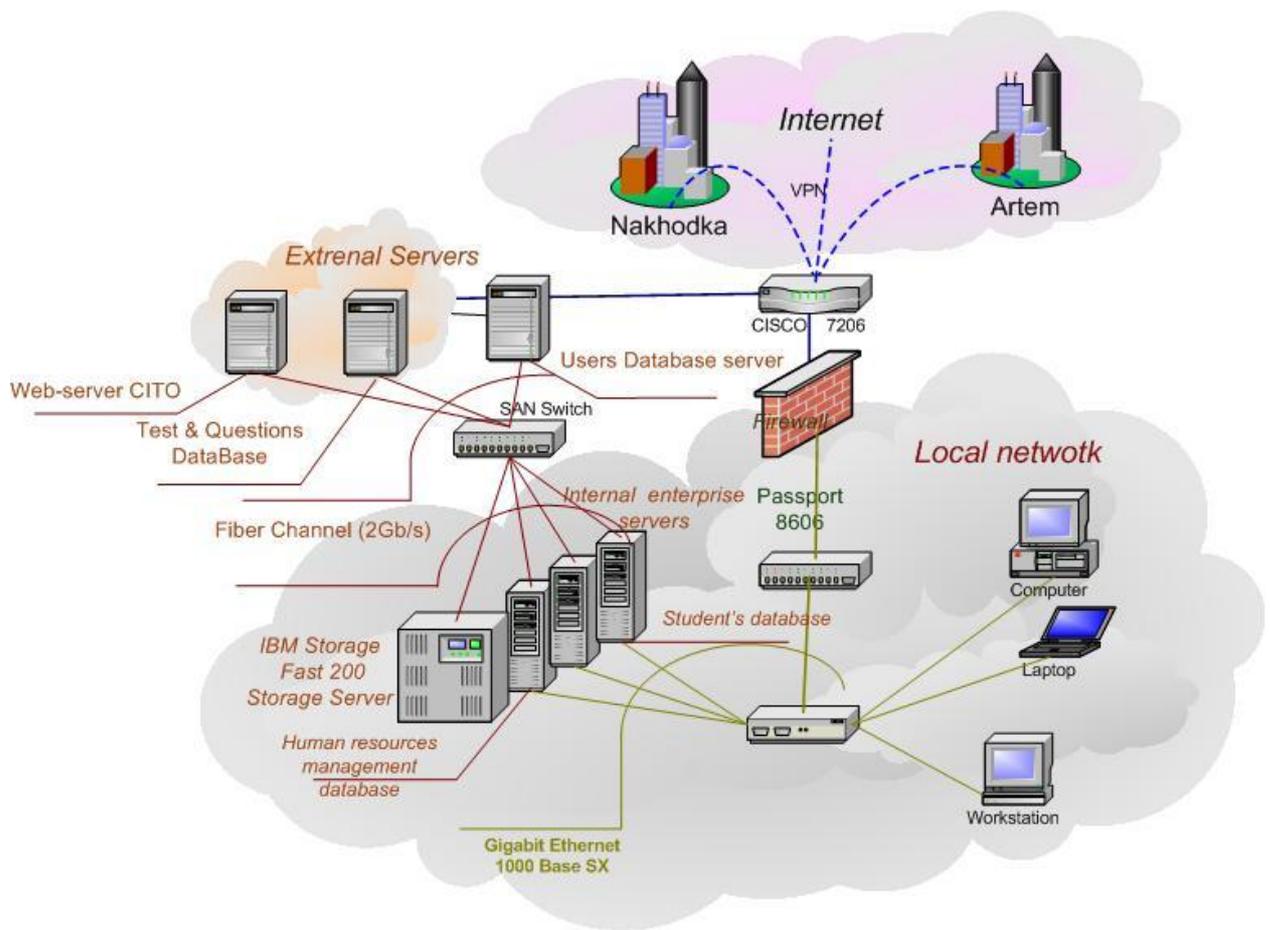
Testing at the Vladivostok State University of Economics (VSUE) is used for various goals and in the different forms of education. Internal students take some tests as the exams. Testing is used for intermediate attestation, verification of residual knowledge, and self-examination. Testing through Internet is especially useful for distance-learning students.

Information testing system CITO (<http://cito.vvsu.ru>) was developed at VSUE in 2002. It has widely been deployed at VSUE from 2004. The main demands of the system are

1. to support testing of all users: students of VSUE and it's branches (in Artem and Nakhodka), employees of VSUE, scholars, and others;
2. to support testing both through Internet and Intranet;
3. to satisfy specification IMS Question and Test Interoperability v1.2;
4. to be integrated into University's information environment.

Architecture of CITO is shown at pic.1. CITO is web-application developed using Java and Oracle Application Server. It has the tests, questions, and testing results database located on Oracle Server. It uses the enterprise database containing the information about the organizational structure, the students, the courses, and the students groups. CITO uses accounts database of VSUE's information environment.

All users of VSUE's local network have access to CITO. They get access as soon as they have registered in VSUE's information environment. The registration is open for all people both the students, staff and external users. CITO is used at VSUE's branches in Artem and Nahodka. The students of the branches take the same tests as the students VSUE. External users may also pass tests if the tests were assigned on the users.



Pic.1. Architecture of CITO

CITO has the courses. The course may have topics. Topics may have theoretical material. The material is available for all users of the course. According to IMS QTI specification CITO supports creation of questions (items), sections, and assessments. Every question may belong to a topic but it may not belong to any topics. The sections select the questions according to a rule. The sections may contain the questions and other sections. Assessment is integration of sections.

CITO allows

1. creating and editing the topics and the theoretical materials containing text, graphics, audio, video, applets, etc.;
2. creating and editing 16 types of questions;
3. creating and editing the sections and the assessments;
4. assigning roles to the users and assessments to the students;
5. testing of the CITO's users;
6. storing results of testing and getting reports of progress;
7. analyzing quality of the questions and the assessments;
8. importing and exporting questions, sections, and assessments using IMS QTI formats to exchange content with other testing systems.

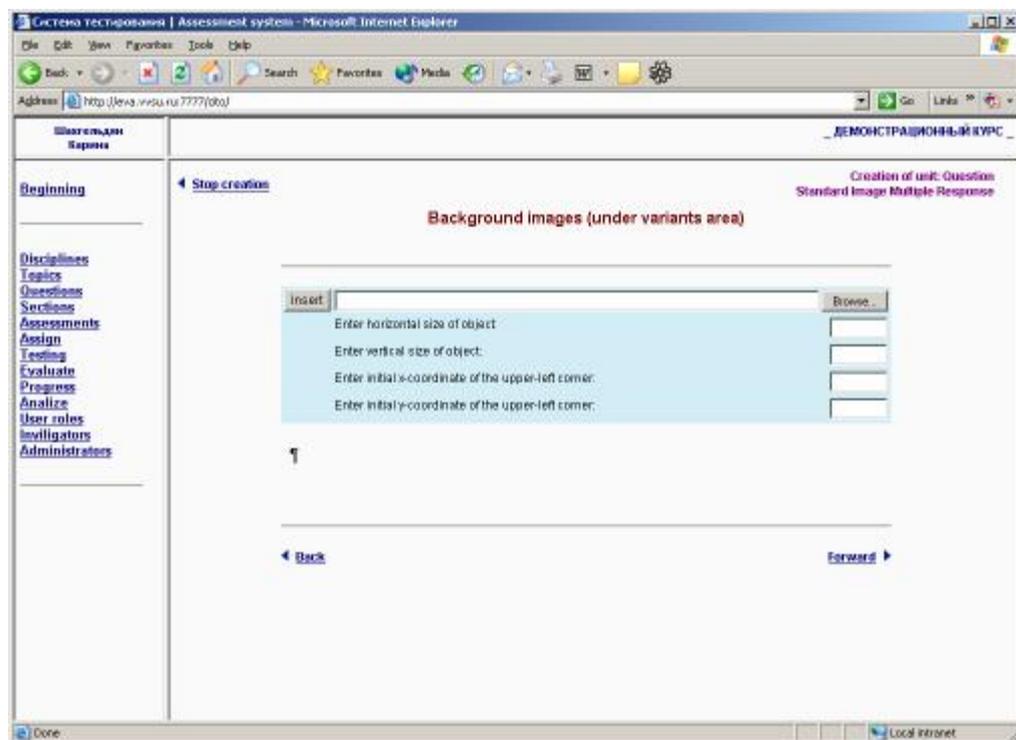
The questions of CITO have several parameters: title, maximum and minimum points, time limits, presentation, content, processing, objectives, rubrics, and feedbacks. For simplicity CITO has 16 types of questions which were selected from different presentations and contents:

1. Multiple Choice including true/false;
2. Multiple Response;
3. Image Multiple Choice;
4. Image Multiple Response;
5. Image Hot Spot;
6. Matching;
7. Order text objects and Order image objects;
8. Connect-the-points –select;
9. Connect-the-points – graphics;
10. Drag and Drop the objects;
11. Single Fill-in-the-blank ;
12. Short Answer (Essay);
13. Numeric fill-in-the-blank;
14. Multiple Choice with Slider;
15. Numerical Entry with Slider;
16. Compound questions.

The content of CITO's questions may have different parts: text, html, rtf, images, applets, programs, audio, and video. The objectives of the questions are defined by authors and they can be differed for various users' roles. The rubrics can have methodical help to answer the questions. The feedbacks contain promptings, solutions, and messages after acceptance of answers.

Conception "right response" is absent in CITO. Every response can cost some points, between minimum and maximum points of the questions. There are two algorithms of response processing. The first one requires determination of all possible variants responses. The second algorithm assumes accumulation points obtained for every selection. Sometimes point can be negative. Therefore users may take negative point for the question.

CITO has wizard for the questions creation. It simplifies creation the questions. The wizard may be used by untrained authors (pic.2). Advanced users can use power of CITO in full measure.



Pic.2. CITO's wizard for question creation

CITO supports four types of assessments:

1. self-examination;
2. training test;
3. exam;
4. intermediate control (survey test).

The assessment has title, time limit, return permission, and sections. Solutions and promptings are available to look through in self-examination and training test.

CITO's section is a set of the questions and other sections. The questions and the sections can be selected into the section according to some rules:

1. randomly from permanent set questions;
2. randomly from changeable set questions;
3. up to some total point;
4. up to some quality of questions;
5. step by step selection;
6. increase of complexity (maximum point);
7. range of maximum points;
8. exception of the questions from self-examination and training test;
9. from some topic.

2. Steps of work with CITO

Human resources managers of VSUE enter information about organizational structure (including departments) and employees (including teachers) into human resource management system. Education managers enter information about courses, students into student's database and link theirs to some departments. They assign a teacher on a course and student groups. The teacher gets opportunity to create the questions and the tests into CITO. They have author role for the course.

Course author can create questions, sections, and assessments. When the assessment is ready the users having admin authority role assign the students on the assessment. Instructor is appointed for every students group. The students take the assessment into limited date range. The mark obtaining during the testing may be exported into progress information system of VSUE. Instructor can check essay questions.

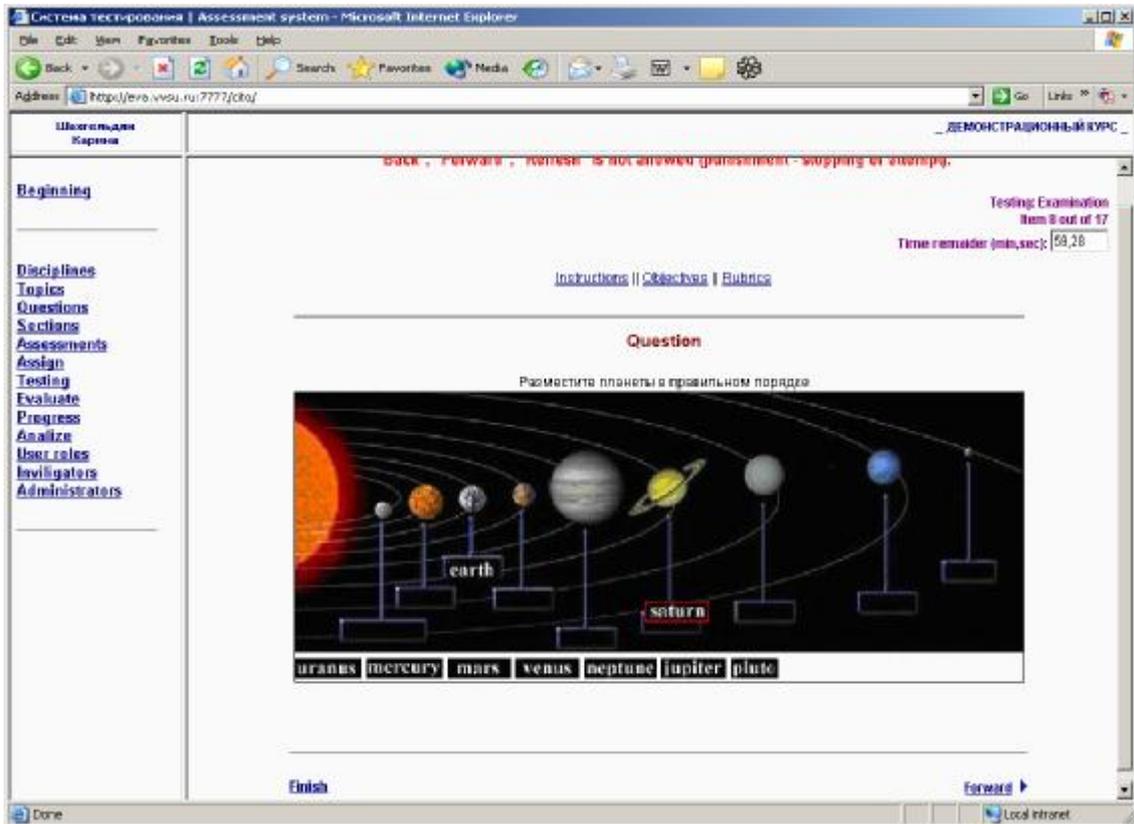
Quality of the assessments and the questions can be estimated by author and psychometrician.

3. Testing

Testing is available through Internet and Intranet (pic.3). The self-examination and training tests may be passed by the students at any time. But the exams and the survey tests have to be passed only within limited date (time) range. CITO generates the questions according to assessment's rules. If user misses a question he gets minimum point of the question.

A mark of testing is obtained as sum of all question points of the assessment. The mark of the assessment may be both points and grade. The author matches between points and grades.

The results of testing are stored into database. They can be exported into progress database and some users have access to look the results.



Pic.3. CITO's testing

4. Quality analysis

High-quality education is serious problem for distance learning. Great demands of test's quality are made at VSUE. Automatic techniques are necessary for the support of the quality. There are two approaches: semantic interpretation and statistic analysis.

Semantic interpretation allows analyzing contents of the questions. There are a lot of rules for questions semantic. For example, the word "every" is undesirable for the questions as too long question. CITO has the tool allowing automatically looking for such cases. Authors may add new rules. Statistical analysis processes testing results and gives some recommendations. The analysis includes calculation of mean, variance, correlation, median, mode, and other statistical parameters.

The parameters can be used to define complexity of the questions, necessary of the questions. For example, if normalized mean of a question is 1 it means all students obtained maximum point of the question. Therefore the question should be changed or excluded. As opposed if normalized mean of a question is 0 it means all students obtained minimum point of the question. Therefore the question should be changed or excluded also. If normalized mean of a question tends to 1 it means that the question is simple and the question should have little maximum point. If normalized mean of a question tends to 0 it means that the question is complex, it should have great point.

5. Conclusion

CITO is success project at VSUE. 5000 students take tests in CITO every semester. 400 courses with 2-4 assessments for every course are stored in CITO. Only 3 managers control the process of testing for all University. That is possible due to there is strong connection between CITO and other parts of information environment of VSUE.

CITO is used for distance and blended learning. It is used at VSUE's branches. About 4000 distance learning students take assessments in CITO.