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## EVALUATION AND ANALYSIS OF COMPUTER-BASED TEST SYSTEMS

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**Mazmunnom:** Hozirgi kunda komyuterga asoslangan imtihonlar vaqtni qisqartiribgina qolmay insonlarning baholash jarayoniga aralashishining oldini oladi. Kompyuterdan foydalanish bilan imtihon sifati oshadi, bu esa talabalarga imtihonlarda erkinlikni, shaffoflikni va ochiqlikni his qilishlariga yordam beradi [1]. Ushbu maqolada zamonaviy kompyuterga asoslangan imtihon tizimlarining qiyosiy tahlili keltirilgan va yangi sinov tizimi taklif qilingan.

**Kalit so'zlar:** kompyuterlashtirilgan, imtihonlar, haqiqiyliги, ta'lim sifati, talablar.

**Аннотация:** В настоящее время компьютеризированные тесты не только решают проблемы времени, но и предотвращают вмешательство человека в процесс оценки. Кроме того, тесты, собранные в базе данных, будут обновляться с годами и улучшаться в качестве. На письменных экзаменах существует множество проблем, таких как сложные экзаменационные процедуры и подверженные ошибкам. С быстрым развитием эпохи компьютерных приложений сетевые технологии становятся более зрелыми и улучшают качество экзаменов, что позволяет студентам участвовать в экзаменах и чувствовать справедливость, нотариальное заверение и открытость [1]. В статье описывается сравнительный анализ современных систем тестирования и предлагается новая система тестирования.

**Ключевые слова:** компьютеризированный, экзамены, достоверность, качество образования, требования.

**Abstract:** Nowadays computerized tests not only solve time problems, but also prevent human interference in the assessment process. In addition, the tests collected in the database will be updated over the years and improve in quality. There exist many problems in written examinations, such as complex exam procedures and prone errors. With the rapid development of the era of computer application, network technology becomes more mature and improve examination quality, which facilitates students to participate in exams and feel the justice, notarization and openness [1]. This paper is described a comparative analysis of modern testing systems is presented and a new testing system is proposed.

**Key words:** computerized, examinations, authenticity, quality of education, requirements

**Introduction.** Currently, there is a tendency in the education system to use modern technologies to assess the quality of student achievement and in the world practice of monitoring the quality of education; there are no uniform models or established forms. Each country, when selecting applicants, is guided by its own criteria and motives, educational and cultural traditions and legislative norms. Recently, computer testing has become especially popular, which has a number of advantages over traditional blank testing: obtaining an instant result, eliminating bias, ease of processing results, etc. [2], [3].

Computerized testing technology should have the following characteristics: the presence of an interactive instrumental environment;

✚ multidisciplinary application; full reflection of the constructed domain model;

✚ the ability to choose a testing algorithm;

✚ integrality into various educational technologies;

✚ profiling;

✚ scalability;

✚ availability;

✚ user interface friendliness; maintaining a database of test multilevel tasks;

✚ custom planning and management; achieving better results and increased motivation.

Computer based testing is carried out in various forms, differing in the technology of combining tasks into a test (Fig. 1). Some of them have not yet received a special name in the literature on test problems.

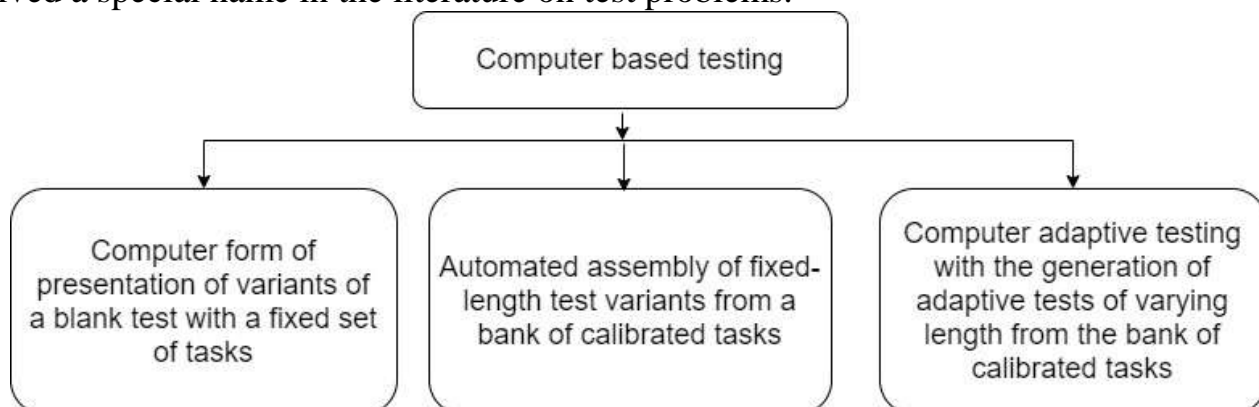


Figure 1. Forms of computer testing

The first form, when a ready-made test intended for current control, is entered into a special shell, the functions of which may differ in the degree of completeness. During the final testing, the shell allows you to present tasks on the screen, evaluate the results of their implementation, form a matrix of test results, process it and scale the primary scores of the test subjects by transferring it to one of the standard scales for giving each subject a test score and a protocol of his assessments for test items.

The second form of computer testing is the automated generation of test cases using tools. Variants are created before or during the exam from a bank of calibrated

test items with stable statistical characteristics. Calibration is achieved by preliminary work on the formation of a bank, the parameters of the tasks of which are obtained on a representative sample of students, for 3 - 4 years from using blank tests. Content validity and parallelism of variants are ensured through a certain selection of tasks for each variant in accordance with the test specification [15].

The third form - computer adaptive testing - is based on special adaptive tests. They are based on considerations that the student does not need to be given test assignments that he will perform correctly without difficulty or is guaranteed to fail due to high difficulty [4], [5], [6], and [7]

### **Analysis And Comparison Of Computer Based Testing Systems.**

MyTestXPro - a comprehensive software solution that provides the ability to conduct testing. Contains in the arsenal a large set of tests on computer topics. Automatically collects the results, allows you to analyze them. It can work with tasks of nine different types; the parameters of each lend themselves to fine-tuning. A simple text editor is included.

This software can be used in educational institutions and enterprises. It will help organize and conduct a test, an exam for schoolchildren, students. Suitable for attestation, certification among employees [8], [9] and [16].

Minimum requirements, capabilities, features:

- ✓ License: Free
- ✓ Languages: Russian, Belorussian, Ukrainian, English, Armenian, Romanian, Latvian, Uzbek.
- ✓ Devices: pc, netbook, laptop (Acer, ASUS, DELL, Lenovo, Samsung, Toshiba, HP, MSI)
- ✓ OS: Windows 10 Home, Professional, Enterprise, PRO, Enterprise, Education, Home Edition (updates 1507, 1511, 1607, 1703, 1709, 1803, 1809)
- ✓ Bit depth: 32 bit, 64 bit, x86
- ✓ Version: latest 2020, no virus

*x-TLS*. Instrumental system for creating automated training programs and knowledge control programs based on multimedia test tasks. It is a cross-platform fully client-server solution written in java 6 and C ++ with MySQL. *x-Tls* is a program for creating test items. *x-LS* is a modern instrumental environment for creating automated teaching and monitoring systems based on advanced multimedia test tasks. The system allows you to create tests and conduct them with an unlimited number of questions. The system is free, is in the public domain [10], and provides many functions that allow you to qualitatively test knowledge.

Minimum requirements, capabilities, features:

- ✓ Operating system: Windows 2000 / XP / Vista / Server 2003/ Server 2008/7
- ✓ Language interface: Russian
- ✓ Type of license: Free Ware
- ✓ Bit depth: 32 bit, 64 bit
- ✓ Size: 28.3 MB

Features of the *x-Tls* program:

- setting a certain score for each question;



- unlimited number of questions and answers;
- the ability to ask several correct answers;
- time limitation of the test (total time / time for each question);
- the ability to create a scenario;
- optional ability to view correct answers;
- the ability to store test data on the controlling side.

The INDIGO testing system is a professional tool for automating the testing process and processing results, which is designed to solve a wide range of tasks:

- Testing, control of pupils and students' knowledge.
- Determination of the professional level of employees, personnel assessment (HR).
- Preparation for exams and certifications.
- Psychological testing.
- Organization and conduct of surveys, Olympiads, competitions.

Minimum requirements, capabilities, features:

- ✓ Operating system: Windows XP / Vista / Server (2003, 2008, 2012, 2016, 2019) / 7/8/10;
- ✓ Size: 135.3 MB
- ✓ Type of license: Freeware

Recommended minimum configuration for Windows Server 2016:

- up to 50 concurrent users: 2x2.2 GHz, 2 GB of RAM, HDD 20 GB;
- up to 200 concurrent users: 2x2.2 GHz, 3 GB RAM, HDD / SSD 20 GB;
- up to 3000 concurrent users: 4x3.3 GHz, 5 GB RAM, SSD 20 GB or more.

*Moodle.* Using Moodle to organize electronic testing, we get a powerful toolkit for creating tests, along with a good analyzer of the quality of the test and its components - test tasks. Test questions in Moodle are managed through the Question Bank. Tests can solve the problems of incoming control, current, final control, or it can be simulator tests. At the same time, test questions can be common for some tests, as well as selected at random from a certain set of questions - both of these conditions can be implemented thanks to the "Question Bank". In addition, using the "Question Bank", it is easy to organize joint work on creating test questions and quickly find the right question for the test [11], [12]. Testing is proposed to be carried out according to the following procedure:

- The teacher develops and places tests on the page of his course, indicating in their parameters the dates when the tests will be available for passing, the time allotted to complete one attempt, the number of attempts provided to each student and the assessment method.

- The teacher informs the students about the content of the test, the place, date and time of the Test.

- After testing, the teacher analyzes its result.

Open Test is a free and open source functional test automation framework for web applications, mobile apps and APIs, built for scalability and extensibility, with a focus on enabling the mainstream test automation practices. Open Test is a feature-rich tool that requires little to no coding skills and can handle virtually any type of functional test automation project [13].

OpenTest consists of three components:

The OpenTest server - a Node.js application that orchestrates the test execution, implements the OpenTest web UI and exposes an API that can be used to integrate with external systems (CI/CD, advanced reporting, test management, etc.).

The test actor - a Java application that executes test steps, as instructed by the OpenTest server. There can be multiple actors participating in the same test and actors can be deployed on any machine in any network, or in the cloud. The test actor communicates with the OpenTest server through the server's HTTP API. The communication is always initiated by the actor, which greatly simplifies the setup in scenarios where the actors are running behind a firewall or in a network that is not accessible from the machine running the sync server (which is the case for many labs and test environments).

The test repository - a directory with a predefined structure, typically under source control, containing the various test assets (test files, data files, scripts, test session templates, etc.).

The proposal design of the testing system under development is as follows: In terms of design, it is divided it into two parts. Test preparation phase and test section. Exam preparation also requires a separate methodology, as there are several shortcomings in assessing what we know through testing today, the test taker may not be able to cover all topics completely, and the test taker may accept questions of the same difficulty or ease. We will consider such questions from a methodological point of view in the next article. Now let us talk about the testing process, if the test is usually conducted online, there will be more attempts to break it in some way, to falsify the test. The following solution is proposed to solve such problems. Three-step authentication for testing can be incorporated into test systems. To ensure this security in the system, we use super admin, administrator and monitors. Super admin confirms the authenticity of the computers being tested before testing, thereby ensuring that test participants are divided into groups. For example, test items can be divided into 2, 10, 100 subgroups. This creates passwords for one-time test participants that can only be used by the administrator. Proposed testing system requirement:

- ✓ License: Free and commercial
- ✓ Languages: Russian, English, Uzbek.
- ✓ Devices: pc, netbook, laptop, mobile device and tablet
- ✓ OS: windows, iOS, android
- ✓ Version: latest 2019, no virus
- ✓ Browser: chrome, Mozilla, opera, safari

Table 1. Comparison of the capabilities of computer based testing programs

Possibilities and functionality	Computer based testing program					
	My TestXPro	x-TLS	IND IGO	Modle	Open Test	Proposed testing systems
Additional types of test questions, except for the main ones	✓			✓		✓

The ability to customize the rating scale	✓	✓	✓	✓	✓	✓
Importing questions	✓	✓	✓	✓	✓	✓
Ability to export tables with results	✓		✓	✓	✓	✓
Protecting test keys and user data		✓	✓	✓	✓	✓
Ability to modify program modules, integrate your own blocks	✓	✓				
Ability to change the interface design of the program under test	✓	✓	✓			✓
Setting up a test schedule				✓	✓	✓
Establishment of additional questionnaires during testing				✓	✓	✓
Existence of security mechanism (three step authentication)	✓		✓			✓
Ability to change the examination methodology and evaluation criteria	✓	✓		✓	✓	✓
Support cross platform		✓		✓	✓	✓
<b>Sum</b>	9	7	7	9	8	10

**Discussion.** An computer based testing system is a web-based software package that is designed to plan, implement and evaluate learning, facilitate student interaction, and manage students’ rating. Several types of computer testing have been discussed above, computer-specific test systems, client-server technology-based testing systems, and cloud-based testing systems.

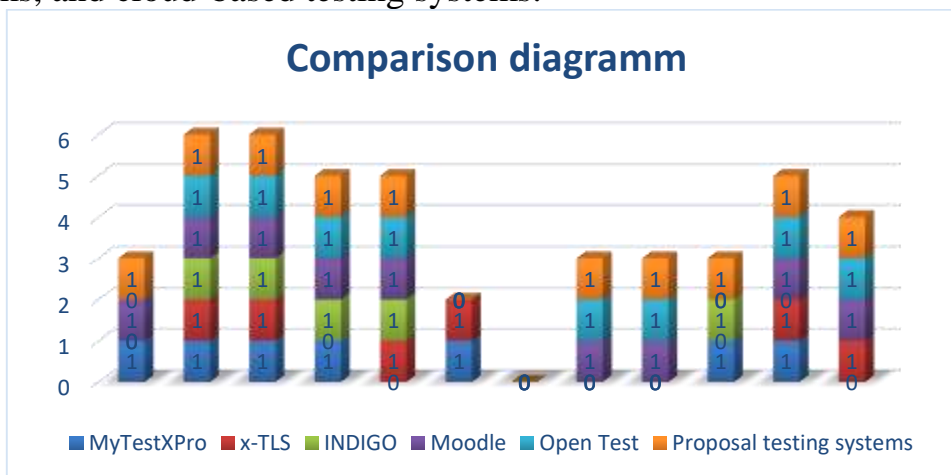


Figure 2. Comparison diagram of computer based testing systems.

The crucial factor that influences student satisfaction is that the features available in testing systems meet their needs and facilitate its use. In the future, it will be expedient for us to use widely available and flexible testing systems. Open source

testing system are becoming a choice for every institution, as they are beneficial to users in allowing platforms to be modified according to user requirements, and because of the low costs charged to get a better service. The comparison diagram above shows its advantages of proposal testing system.

**Conclusion.** In the selection process, it is also necessary to compare mobility of systems and other indicators: for example, the minimum technical characteristics of a computer, operating system, quality of the user interface, price, etc. Tests as a form of control of students' knowledge are widely used at all stages of various forms of education, and a single exam and organization. In general, continuity in learning cannot be imagined without testing. Therefore, the modern education system pays special attention to the organization of the testing process and the development of banks of test items. As a special innovative type of tests, computer tests are the most effective form of control, testing and self-examination of students' knowledge. Therefore, it is important that in the process of organizing computer tests there is a well-designed and implemented information support system.

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