

communication with the teacher [4]. In addition, *e-learning* is less system-based, and focuses on the use of some elements of e-learning in Russia (for example, *testing programs*).

2.2. Experimental setup and study preparation

Testing is the most commonly used method in Russia for monitoring personnel's knowledge in various forms of training. If the current control is usually applied tests of one type (for example, *substitution tests or constructive tests*), then the final control combines tests of different types. The goals, scope and complexity of training are taken into account when determining the number of questions. Final control is carried out at the end of training, and includes questions on all modules (topics, sections). Developed professional tools for automating the process of testing and processing results now.

OAO «Novosibirskenergosbyt» is an electricity supplier in the Novosibirsk region and ranks 1-st in the rating of the best guaranteeing suppliers and energy sales companies of Russia in 2012-2017gg. Leadership in the ratings confirms that the company is stably at the highest level in the industry for such a time. The program of automated testing "INDIGO" is used to check the knowledge of the personnel at the enterprise (<https://www.indigotech.ru>). The program is the most in demand in many industries and organizations, such as «gazprom transgaz» Tomsk», network of gas stations "Top Line", GBU AO "Center for Monitoring in Education" and many others.

"INDIGO" is used to solve a wide range of tasks, starting from the survey "Satisfaction of work in the company" and ending with the organization of staff assessment, is carried out in accordance with the requirements of the International Standard ISO 9001:2015 in OAO «Novosibirskenergosbyt».

The module *DiTest v2.0* is developed - an *automated testing system* that supports the international specification Question & Test Interoperability (QTI) version 2.0 of the IMS consortium to ensure control of students' knowledge, as well as personnel of enterprises on human security issues in the technosphere without interrupting production activities in NSTU. The DiTest testing system is integrated into the general concept of LMS *DiSpace 2.0* and includes modules for assigning, passing testing and creating tests. The tests are created outside the *DiSpace 2.0* at http://ditest.edu.nstu.ru/editor/create_new_test.edu.

3. RESULTS

When comparing the two programs for automated testing, some fundamental differences were revealed. The main, and most important, is that *DiSpace 2.0* is a full-fledged learning management system (LMS) with the *testing module*, and the program "INDIGO" is only a *testing system*. Consequently, the programs were created

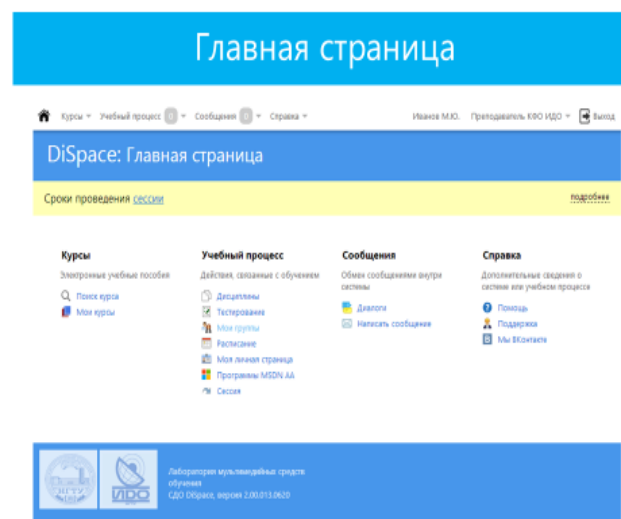
for different purposes and tasks, and have different possibilities.

Table 1. Possibilities two compared systems

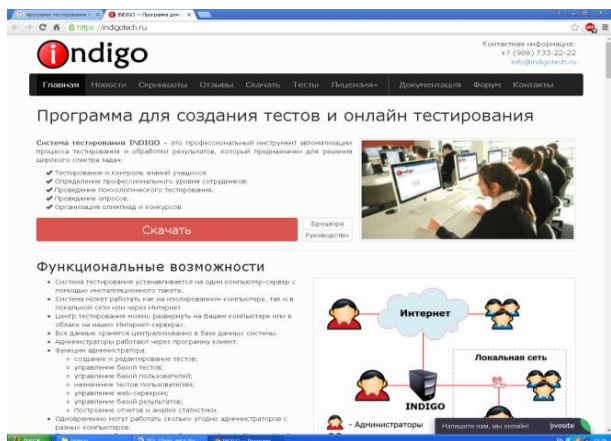
Possibilities	
LMS <i>DiSpace 2.0</i>	INDIGO
Testing and control of students' knowledge	Testing and control of students' knowledge
Definition of professional level of the personnel	Definition of professional level of the personnel
Carry out surveys	Carry out surveys
Organization of the educational process in LMS, including organization of olympiads and competitions	Organization of olympiads and competitions
Organization of video conferences, webinars	---
One- and two-channel communications (consultations, forums, chats)	---
Creation of the base of electronic educational resources	---

Accordingly, it can be concluded that the LMS *DiSpace 2.0*, which was developed at the NSTU by a group of authors-developers [5]. LMS *DiSpace 2.0* provides a new level of support of the e-learning process in the Lifelong Learning. The concept of workspaces allows you to enter the market of SAAS services.

Figure 1. LMS *DiSpace 2.0* and testing program INDIGO: home pages



COMPARATIVE ANALYSIS OF «INDIGO» AND «DISPACE 2.0» AUTOMATED TESTING SYSTEMS FOR THE CONTROL OF PERSONNEL KNOWLEDGE



We examined the advantages and disadvantages of two automated testing systems, summarized in the table.

Table 2. Analysis of testing systems INDIGO and DiSpace 2.0

INDIGO	DiSpace 2.0
Only, there are no public types, no support for multimedia data in answer options	8 types of questions are available
No formula support	Export of users
Import of Word in simplified form, no graphics, only text information	Sorting and selection of questions within topics
The editor of the questions is not modular	The possibility of providing access to the test at a specific time (minutes)-
The system itself is not support the introduction of new types of questions	Visual text editor WYSIWYG
The format of storage of questions has its own, closed	Assigning access to individual students and the entire group at once
The system has only functional testing, no other functions	The possibility of trial testing
The import format is your own	Developed formula editor
You need to configure access to the server each time you pass the test	Privacy settings
High hardware requirements to the server pass the test	The possibility of several attempts to pass the test
No stylistic monotony, non-standard fonts and color differences	User-friendly interface
More complex and accurate multistage assessment system	—
office-style interface (but requires the installation of additional software)	—

Export of users	—
Information module for the test (theoretical basis for testing) due to lack of ability to create the electronic educational resources	—
User-friendly interface	—

Thus, the study showed a wider and adapted functionality of the LMS *DiSpace 2.0* testing module compared to the INDIGO testing system. Not surprising, that when assessing the quality of *LMS DiSpace 2.0* and the testing module placed in it, a high level of student satisfaction, which allows to organize training in remote access and to recommend LMS NSTU for training of personnel of enterprises [6].

4. Conclusions

- LMS NSTU *DiSpace 2.0* can be used not only to control staff knowledge, implementing the testing function, but also to recommend LMS NSTU for training personnel of enterprises.

- It is shown that, in general, both systems implement a standard set of functionality when passing test tasks;

- It is revealed that in *DiSpace 2.0* there are more opportunities: you can configure the inclusion / deactivation of topics and didactic units, you can assign the number of attempts, the time of passing the tests.

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