

Innovative Technologies for Learning in Moscow University of Geodesy and Cartography (MIIGAiK) (4210)

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The innovative e-learning methods have already shown its efficiency in educational process. Consequently many universities worldwide adopt of such new technologies. These technologies include training and testing programs (i.e. testing system), training with use of electronic textbooks, slide films, video lectures, educational video films, the programs modeling any processes, Internet technologies etc. In addition the automated system for training is becoming increasingly important.

In our opinion, the further development of such systems should be complex. E-technologies should be used in a integrated complex. This issue is an attempt to introduce you some developments that have been implemented at the Moscow State University of Geodesy and Cartography (MIIGAiK).

Certainly, the development of such funds is time-consuming and also requires financial cost, highly skilled professionals. However such technologies allow students to better assimilate the material spending less time. In addition, these technologies can reduce the duration of training while maintaining the quality of education.

If consider such technologies in detail they should split into two parts:

- Innovative technologies for learning
- Innovative technologies for management of education process

MIIGAiK adopts an integrated approach, both in learning and management of education process. Widely used electronic boards for learning at university.

Currently, Economics and Land management Faculty has five electronic boards used in the lecture rooms and electronic panels that are used in computer classrooms.

Interactive boards are not only combine the advantages of a large screen projector and whiteboards, but also allow you to save all the notes and changes made during the discussion and even control computer applications, without departing from the board and not interrupting the speech.

The interactive board consists from the active monitor and electronic pen. The board has its own menu, which allows performing various actions. For example, open a new page, using an electronic pen to write remarks, formulas, etc., change the mode to pointer, a smart pen, also open the application (presentations, videos, create projects in GIS systems.)

This device, which allows the lecturer or reporter combine three different tools: a screen for displaying information, an ordinary whiteboard and an interactive display. Board provides an opportunity to show slides, videos, make notes, draw, draw various schemes as on a conventional board, real-time applied to the projected image overlays, make changes and save them as computer files for further editing, printing, printer, mailing fax or e-mail.

They allow the teacher to work with electronic maps, charts, drawings, paintings. Possibility of data transmission over the Internet makes electronic interactive whiteboard great tool for distance learning.

Economics and Land management Faculty uses combined capabilities of electronic boards and technology multimedia lectures, video and Internet capabilities.

Fig. 1 show the classroom with active electronic panel and the board.

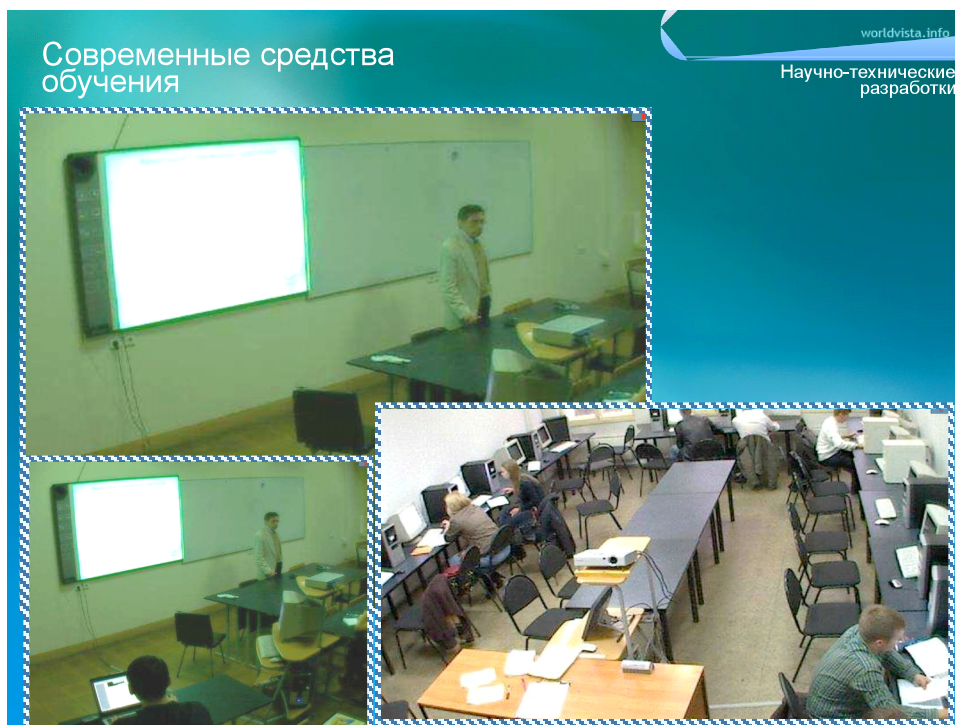


Fig. 1. Example of working with electronic boards.

Board allows making complex education technology, combining various techniques.

There are different possibilities which are considered below.

Controlling and training programs.

The simplest example of the controlling program is a test program. In this case, usually offered question and answer variant, among which there are “correct” and “not correct”. Sometimes it is necessary to arrange the answers in the correct order. Typically, such programs can be used for self-testing (Fig. 2).

Пример контролирующей программы

Вероятность попадания на отрезок.

$$F(X) = \begin{cases} 0 & \text{При } X \leq 0 \\ \frac{x^2}{2} & \text{При } 0 < X < \sqrt{2} \\ 1 & \text{При } X \geq \sqrt{2} \end{cases}$$

Определить вероятность попадания на отрезок $P(0.1 < X < 1)$.
Записать в виде формулы.

Ответ.
 $P(0.1 < X < 1) = F(1) - F(0.1)$

Определить вероятность попадания на отрезок $P(0.1 < X < 1)$ в
численном виде

Ответ.
 $P(0.1 < X < 1) = F(1) - F(0.1) = 1/2 - 0.1^2/2 = 0.5 - 0.005 = 0.495$




Fig. 2 Example of the controlling program.

The difference between the training program and controlling programs is that there is usually not possibility to choose the options of answers. Accordingly test and verification of the answer (correct or not) occurs after the introduction of the answer by student. Whether answer is correct than test could be

continued with the following question. Whether answer is incorrect, there are different possible further options (for example, program switch student to the block, which explains essence of the error) Fig. 3.

Пример обучающей программы

Материал чередуется.
 Порция теоретического материала
 Задача
 Задана функция распределения.

$$F(X) = \begin{cases} 0 & \text{При } X \leq 0 \\ x^2 & \text{При } 0 < X < \sqrt{2} \\ 2 & \\ 1 & \text{При } X \geq \sqrt{2} \end{cases}$$

Определить вероятность попадания на отрезок $P(0.1 < X < 1)$.
 Записать в виде формулы.

Ответ.
 $P(0.1 < X < 1) = F(1) - F(0.1)$

Ответ верный?

да → Следующий вопрос

нет → Возврат на теоретический материал




Fig.3 Example of a training program.

Educational film on geodesy.

It was created a training video film for program Geodesy in 2005. It is demonstrated to students on first year of training as an accessory material. The film consists of 10 parts, length 55 minutes. This film is shown before the start of training first-year students to give students a general idea of geodesy. Each part of this film is related to a specific subject topic. Students learn more thoroughly each topic with a teacher on lectures.

Slide lecture.

Slide multimedia lectures are a set of slides made in Power Point. The sequence is accompanied by the

findings of animated features Power Point. For example, a definition of value, costs and prices is given by using the next slide.

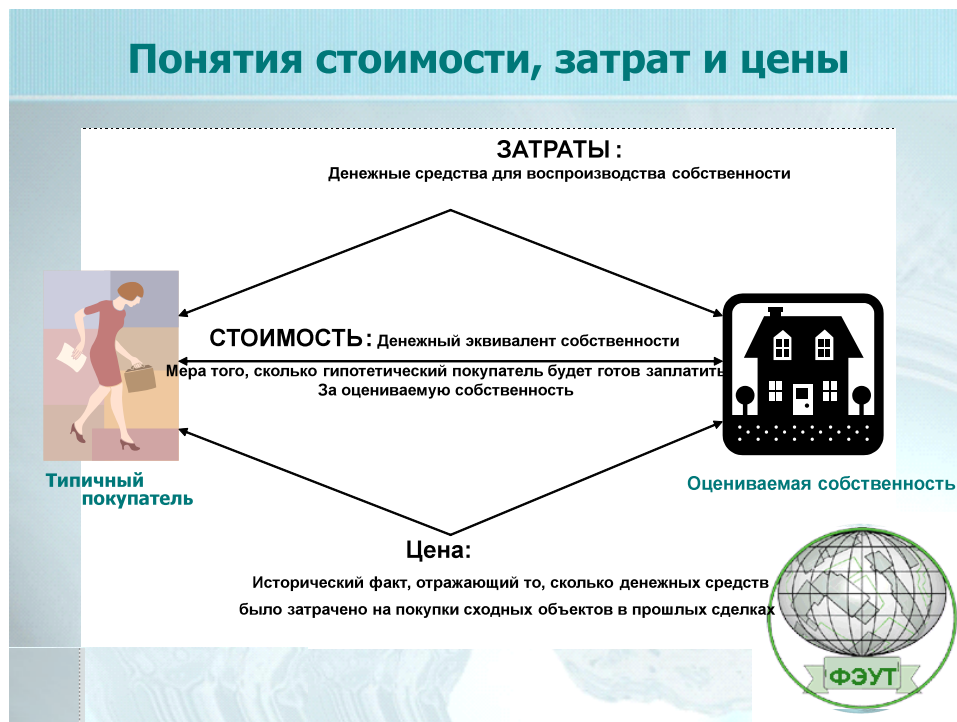


Fig.4

Animated slide.

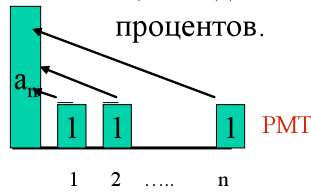
In this case, the animation allows to consistently provide the definition of price, cost and value. Namely it is used one slide which has consistently changing content. Of course, the same slide can be represented as a sequence of three slides. But the perception would be worse.

Another example is the concept of present value of the annuity. It also uses animation effects that can form a logical sequence of presentation.

Текущая стоимость аннуитета

Обычный аннуитет – аннуитет, при котором платежи осуществляются в конце каждого периода начисления процентов.

Текущая стоимость аннуитета



РМТ – периодический платеж

$$a_n = \frac{1}{(1+i)^1} + \frac{1}{(1+i)^2} + \dots + \frac{1}{(1+i)^n} = \sum_{t=1}^n \frac{1}{(1+i)^t} = (\text{pvaf}, i, n) = \frac{1 - \frac{1}{(1+i)^n}}{i}$$

$$PV = \text{PMT} * a_n = \text{PMT} * \sum_{t=1}^n \frac{1}{(1+i)^t} = \text{PMT} * \frac{1 - \frac{1}{(1+i)^n}}{i}$$

$$PV = \text{PMT} * (\text{pvaf}, i, n)$$



Fig.5

These examples are taken from the course "Real Estate Economics" and «Real Estate Management". Below is a slide from another topic "Equalizing geodetic networks". Animation allows demonstrating the process of drafting the conditional equations connection.

Условные уравнения связи

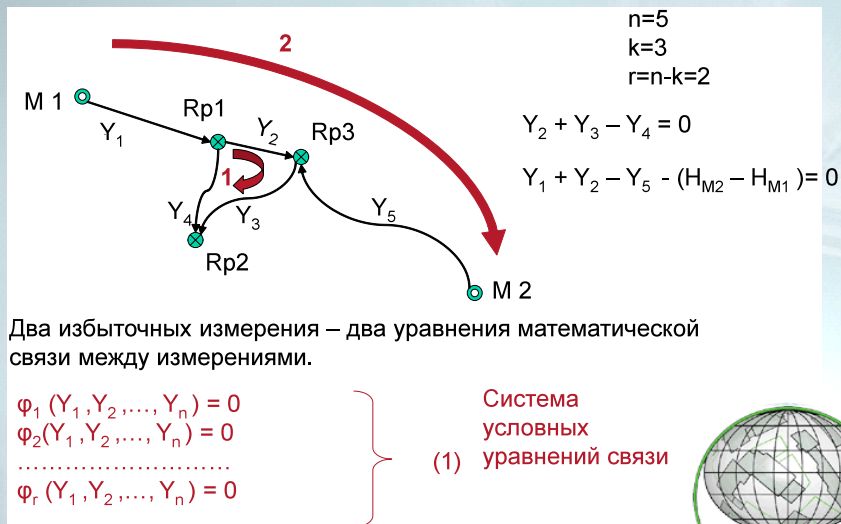


Fig.6

Currently, subjects such as "Real Estate Economics", "Theory of mathematical processing of geodetic measurements", "Internet technology in Geodesy and Cadastre" are fully equipped with a slide lectures.

Sometimes attached presentations are used. During one presentation teacher can click the link to another presentation.

Training of GIS technology with the use of electronic boards.

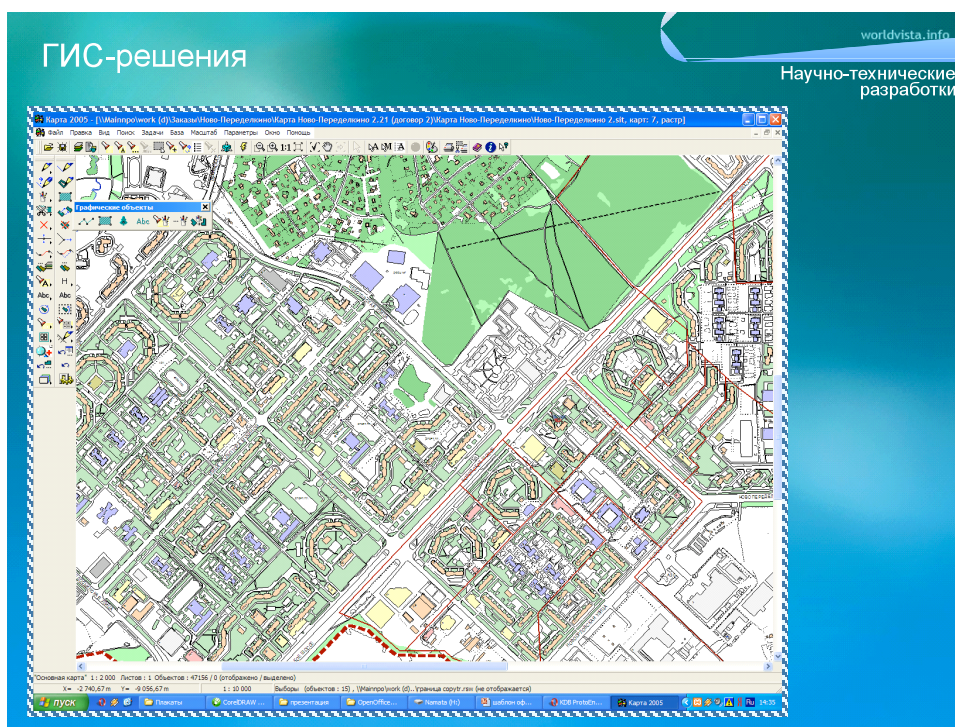


Fig.7

Lecturing with the use of interactive whiteboards makes more efficient presentation of the material on GIS technologies.

Here you can demonstrate the real possibilities of GIS systems, query, receiving results of such inquiries.

Simulating programs.

Lectures are illustrated by programs simulating certain processes. For example, in the course “Theory of probability” it can be demonstrated a program simulating an experiment on a coin flip. Here you can set the initial rate of tossing a coin and noise.

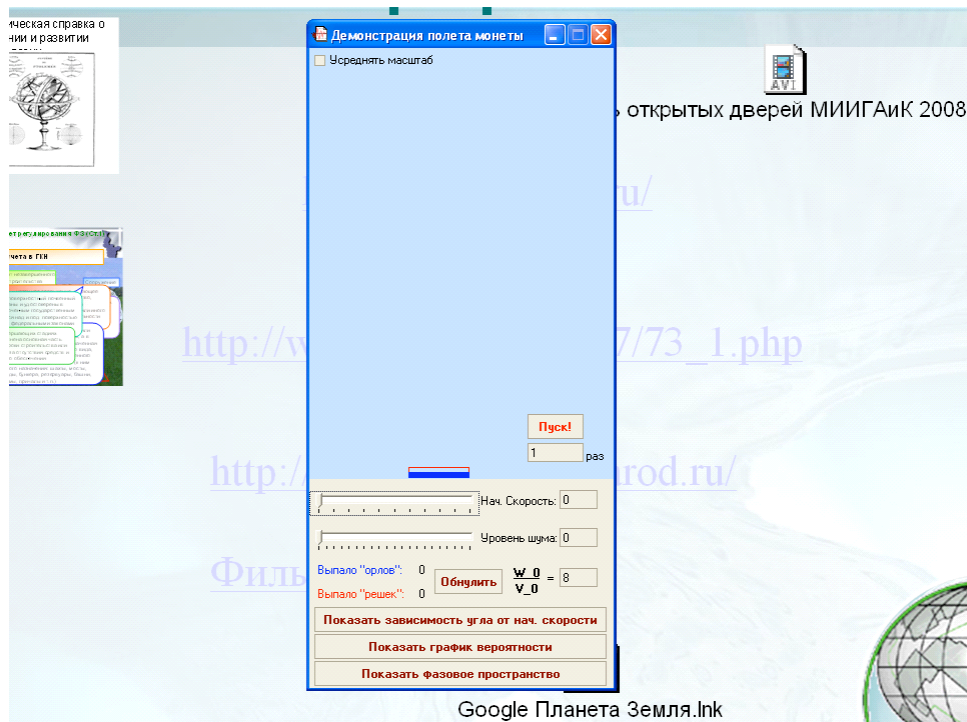


Fig. 8 Example program simulating the process of tossing a coin.

Using the Internet in the learning process.

Electronic boards allow using the Internet during lectures at any time. For example, to find a site that allows you to calculate the values of the functions or to receive compound interest rate differential corrections for GPS-processing of satellite observations. Then back to the slide lecture. It is very effective to use GOOGLE for some disciplines. Google allows demonstrating space image of investigated area and using it to demonstrate the preparation of a project.

For example, the picture presented reconstruction of one of area in Moscow. (Point development). It is constructed two seventeen homes and it is shown to the basement for the construction of another house. But he is unacceptably close to the old house, leaving him in the shade almost all day. It violates the building code.

Innovative technology in management of education.

Innovative technology in organization and management of education are as important as the learning process itself.

The university has developed websites, where placed all teaching materials for the students and keeps records of tasks performed by students.

One of these website before presented at the next slide

Here is the database for accounting students' progress. It is possible to create any inquiries, trace the history of a particular student's learning, to do statistical analysis of training for specific occupations, courses, prepare for printing the diploma supplement, etc.

денты | приемная комиссия | кадры | бухгалтерия | обучение | дипломы | вуз | филиалы | Сервис | выход

просмотр успеваемости

Фамилия, Имя, Отчество: **Андрюшков Андрей Александрович** № зачетки: **498/04**

Дисциплина	№	Вид испытания	Оценка	Дата	ФИО преп.	№ вед.	Примеч.
Отечественная история	1	Экзамен	4	16.05.09			
Сбор данных для ГИС-кадастра	1	Зачет	зач.	16.05.08	Кругликова, Пер		
Спутниковая геодезия	1	Зачет	зач.	16.05.08	проф. Шануров Г		
Технология выполнения кадастровых работ	1	Зачет	зач.	16.05.08	асс. Миклашевск		
Иностранный язык	1	Зачет	зач.	08.05.09			
Инженерная графика. Топографическое черчение	1	Дифференцировк	3	10.12.08			
Кадастр застроенных территорий	1	Курсовая работа	3	16.05.08	Кругликова, Пер		
Административно-гражданское право	1	Экзамен	5	21.11.07	Голубев В.В.	123	123
Физическая культура	1	Зачет	зач.	08.05.09			
Высшая математика	1	Экзамен	3	16.05.09			
Геодезия	1	Экзамен	3	16.05.09			
Природопользование и почвоведение	1	Экзамен	4	16.05.09			
Природопользование и почвоведение	1	Экзамен	4	16.05.09			
Отечественная история	1	Экзамен	4	16.05.09			
Инженерная графика. Топографическое черчение	1	Дифференцировк	3	16.05.09			
Физическая культура	1	Зачет	зач.	05.12.08			
Экономика недвижимости	1	Зачет	зач.	16.05.08	проф. Голубев В		
Безопасность жизнедеятельности	1	Зачет	зач.	16.05.08	Миронова Е.М.		
Информатика и программирование	1	Зачет	зач.	08.05.09			
Геодезия	1	Зачет	зач.	08.12.08			
Информатика и программирование	1	Зачет	зач.	02.12.08			
Высшая математика	1	Зачет	зач.	05.12.08			
Информатика и программирование	1	Зачет	зач.	05.12.08			
Физика	1	Зачет	зач.	01.12.04			
Физика	1	Зачет	зач.	08.05.09			
Метрология стандартизация и сертификация	1	Зачет	зач.	16.05.08	доц. Былинцкий		
Высшая математика	1	Зачет	зач.	08.05.09			
Геодезия	2	Практика	3	16.05.09			
Экономика	2	Экзамен	4	16.05.09			
Информатика и программирование	2	Курсовая работа	3	16.05.09			
Информатика и программирование	2	Курсовая работа	3	16.05.09			
Информатика и программирование	2	Экзамен	3	16.05.09			
Экономика	2	Экзамен	4	16.05.09			
Инженерная графика. Строительное черчение	2	Дифференцировк	3	16.05.09			

Всего записей об успеваемости 124

Добавить | Дополнительно

Запись: 3 из 124 (Фильтр)

Fig. 9 Fragment of a database of students' progress of the faculty.

It has been developed the special website of electronic library containing electronic textbooks and links to various publications. Also it has been developed site that helps teachers to write textbooks, which, subsequently, can be easily edited, which is important for our area, because often the changes in the regulations require an adjustment to the learning process.

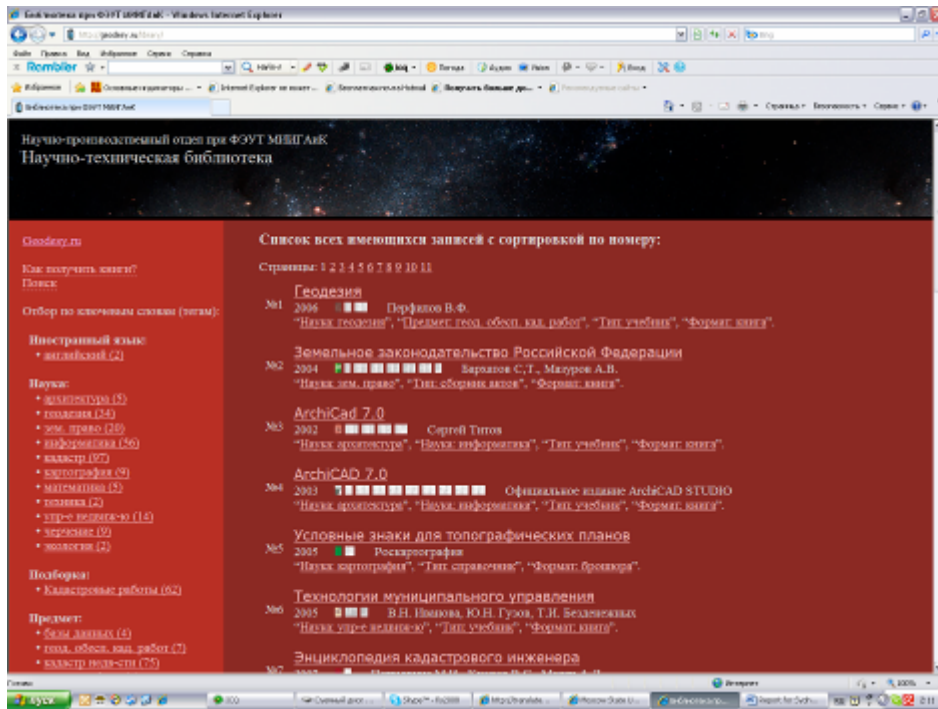


Fig. 10 Website of electronic library for students.

Besides it has been developed website that enables dialogue student and a teacher outside of class. It shows the current state of affairs of a student on a particular subject, passed subjects, teacher comments, etc.

Some distance learning technologies.

The University is conducting experiments to study with students located in other cities. This can occur through the Internet. Scheme of transmission lectures over the Internet is presented on the following picture. It is possible to send images and sound and get feedback. Student has the opportunity to send a question in writing form or by voice even during oral presentation of lecturer. Moreover, all students have the opportunity to listen and watch this dialogue. Naturally, all this is achieved by using specialized equipment and software. Simultaneously a few hundred students located in different locations can listen to a lecture. The possibilities for receiving the lectures can be arranged either individually for each student, or collectively for groups of students. We organized three specialized place for collective use in three cities: Penza, Murmansk, Kirov.

Передача лекции в режиме реального времени через интернет

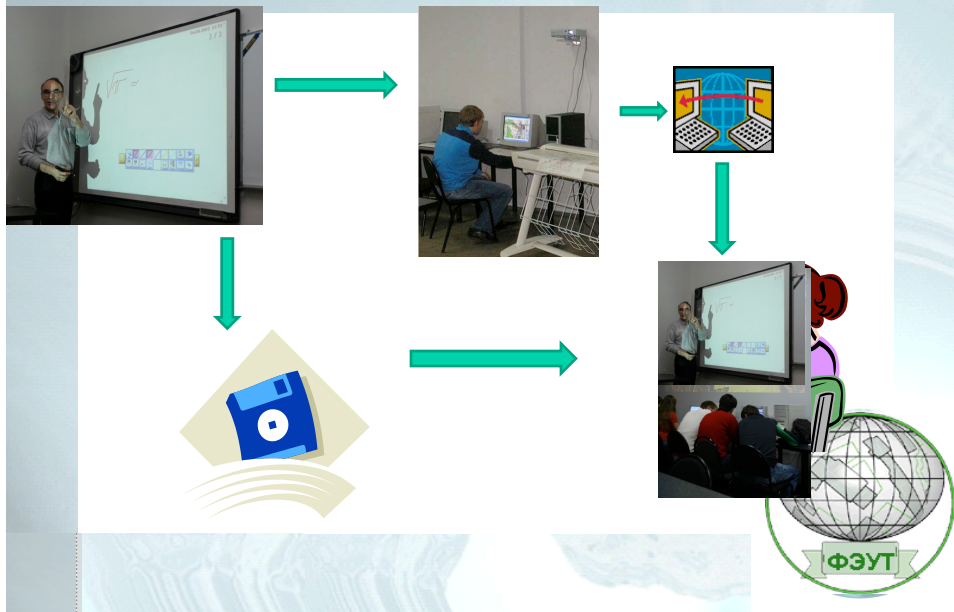


Fig. 11 The scheme of teaching lectures in real time

The satellite antennas are installed in the collective reception points in University to increase the capacity of the Internet, transmission of information.

Использование спутникового интернета

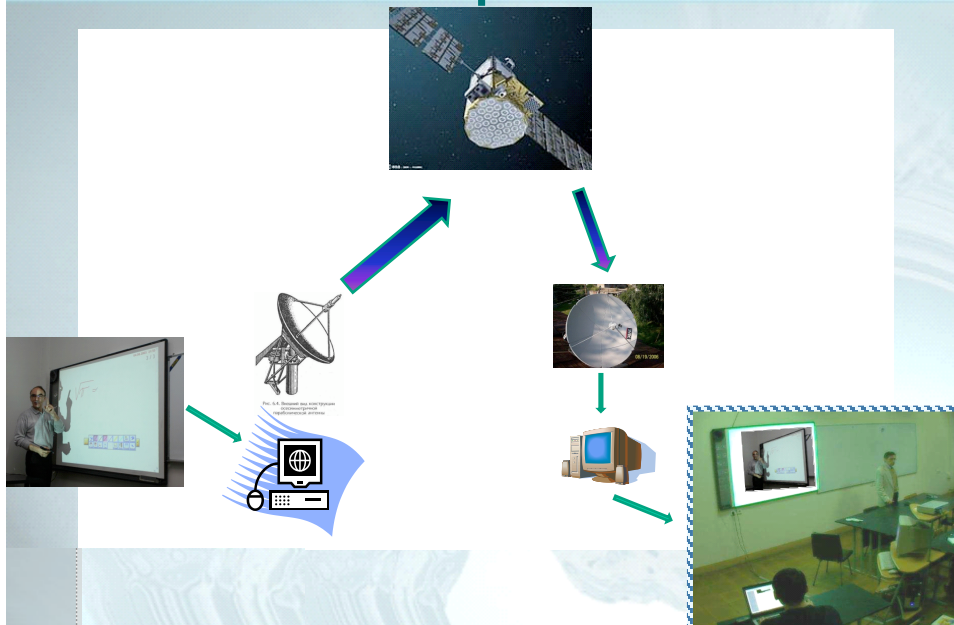


Fig. 12 The use of satellite Internet.

Delays in the transmission of images and sound are considerably less when using the satellite antennas

Students can individually put a satellite antenna with the appropriate software. But the failures in this case may be either. Therefore, most qualitative results can be obtained by using satellite television.



Fig. 13 The use of satellite television.

In this case it is necessary to have special equipment and software in a television studio, software for making a television signal at points of reception and rent the channel broadcast at a certain time. In both cases the satellite Yamal 2009 coverage of which is shown in the following figure.

CONCLUSION.

The combination and integration of various technologies to automate the process of learning can significantly improve the quality of education, to submit educational material more visibility and accessibility. These innovative training technologies are very effective, but require a careful and

methodical elaboration of educational materials, high labor costs in preparation. In consequence such technologies facilitate the work of teacher and allow students to learn better and faster educational material. Such technologies can be used for distance learning, which is very effective for the system of retraining.

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