

# INNOVATIVE TECHNOLOGIES TO MANAGE EDUCATIONAL PROCESS IN HIGHER EDUCATIONAL INSTITUTIONS

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## ABSTRACT

The paper deals with one of modern effective pedagogical technologies in relation to management of the educational process with students of higher educational institutions. The authors discuss the concept of virtual excursion, formulate its advantages over traditional technologies, clarify the principles of modern pedagogical activity through a virtual excursion for the teachers and students.

The paper presents one of the lecture plans devoted to a virtual tour using Internet resources. Relying on live resources, the authors argue that a virtual excursion brings students closer to their professional tasks, teach them to associate theoretical material with practice. As for an instructor, the effective use of modern innovative, computer training technology can improve the efficiency of teaching different subjects, streamline learning activities, optimize the processes of understanding and memorizing learning material.

## KEYWORDS

*virtual tour, innovative technologies of teaching, modern pedagogical activity, energy saving.*

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## 1 INTRODUCTION

The world we live today has become increasingly dependent on information technologies. They are widely, intensely and effectively used by people in all spheres of life. Computer today has become a standard attribute of everyday life, becoming an indispensable facilitator in learning, work and recreation. It is computers who freed mankind from routine labor, simplified the search and obtaining the necessary and up-to-date information. Informatization of all spheres of life of society has led to the emergence of new category of culture – the informational culture. The information technology has also been widely adopted in the educational process. Since there have been changes changes in educational goals, the emphasis shifted from "acquiring knowledge" to the formation of "competencies", there is a reorientation to a person-centered approach. That is, the main goal of training is not the transfer of a certain amount of knowledge, but the formation of skills to obtain and process information, to form a high-level thinking skills: analyze,

synthesize, and evaluate. All this requires the introduction of teaching technologies into the educational process.

Today, the leading position is taken by methods and techniques of training, based on the use of modern computers, computer programs, simulators, because modern youth are very much pulled to them considerably. In our opinion, it is the personal computer, the Internet that can act as direct teachers' assistants to intensify the process of learning with students. Modern engineering education, as never before, requires a new type of teacher who uses and skillfully introduces into practice modern methods and technologies of education, the tools within psychological and pedagogical technology, methods of independent designing of pedagogical process in the context of defined practical activity. Each university teacher faces the task of making their disciplines interesting for students, raising motivation to study, helping students to discover their talents, boosting their cognitive activity. A graduate of the university must be an expert in his or her field, be mobile, be able to quickly and adequately react to changing circumstances, to ensure the most effective result of their work.

The main criterion for the quality of student learning is competence in various areas of future activity: professional, communicative, socio-economic, and general cultural ones.

In our opinion, the most effective means of developing competencies is the use of project and search methods in the learning process. It is project technologies that are one of the active forms of pedagogical technologies - they develop a high motivation for educational and cognitive activity and provide for the effective use of information and computer technologies (ICTs). The students of power engineering are very eager to participate in project or quest classes, in short, they enjoy cooperation, they enjoy to solve complex technological problems together, to put theoretical knowledge to practical actions. Relying on practical side of our students' work and continuing to search for ways to enhance motivation and opportunities to use ICTs in our work, we became interested in yet another innovative technology - a virtual tour.

Excursions accompany us all our lives, they are great teachers and reveal the cognitive motto: "It's better to see once than to hear a hundred times." The learning potential of pedagogical excursions is great: they enable the younger generation to grow intellectually, to develop the feel for beauty of the surrounding world, they are a way to combine learning with life, with practice, and they are an important means of boosting educational process. During collective excursion activities young people develop the ability to act collectively, "to get used" to the environment, both natural and social.

## 2 SETTING THE RESEARCH OBJECTIVES

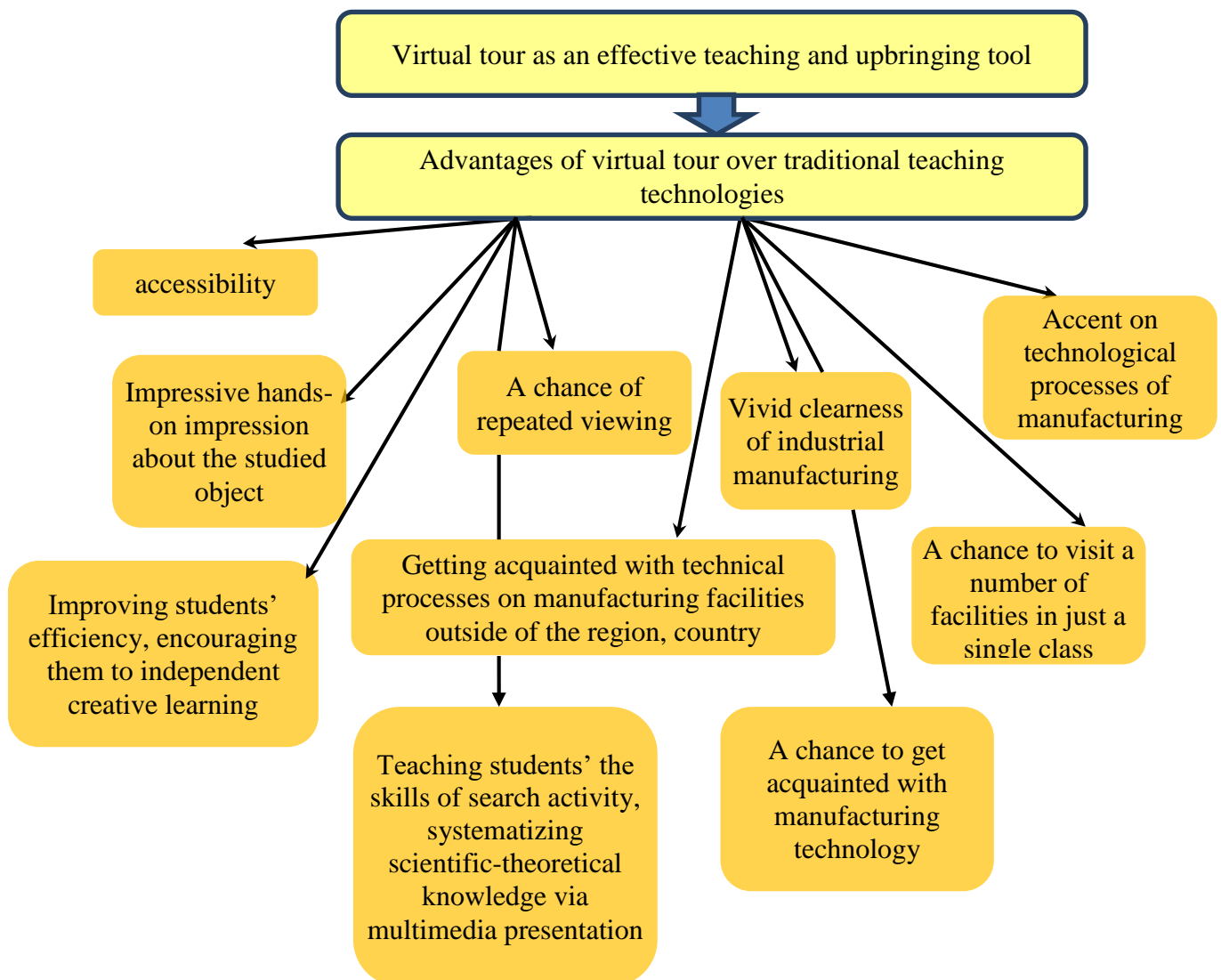
- 1) to describe new forms, methods and means of teaching material for the purpose of successful organization of student's educational activities;
- 2) to model the advantages of innovative technology for organizing learning process with students;
- 3) to see the ways a virtual tour can facilitate students' acquisition of knowledge in the field of construction and operation of boiler plants in terms of energy conservation and environmental protection.
- 4) to develop and design complex and modern systems in the heat engineering, leaning upon certain ideas of advanced achievements in the design of facilities in heat and power engineering.

The main benefits of a virtual tour over traditional learning technologies can be presented in the form of a scheme depicted in Figure 1.

**The main objective of the virtual tour** is "It's better to see one once than to hear a hundred times."

Pedagogical potential of virtual tour tool:

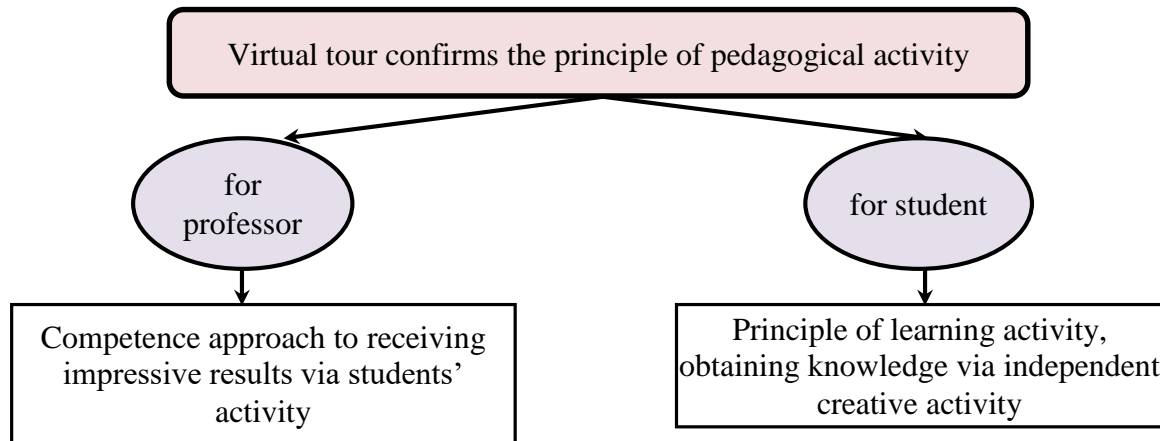
- represents an effective opportunity to increase their intelligence, level, development, observation;
- is a combination of learning with observable life, with practical activity, which is an important means of activating the educational process;
- forms the skills of collaborative work in mini-groups, pairs;
- permits short acquaintance with various production facilities (according to the class topic), which are far apart from each other;
- allows to present the activities of industrial production enterprises and professions demanded on the job market;
- helps to make the main step towards the targeted professional orientation of students;
- allows for the use of multimedia panoramas (videos, graphs, diagrams, drawings, texts, links);
- permits to widely include illustrations, audio and video fragments.



**Figure 1** The benefits of a virtual tour over traditional learning technologies

**Teachers’ tasks during a virtual tour are:**

- to invite students to note interesting moments, copy the necessary materials into their note books;
- to perform creative research tasks in order to consolidate the studied material;
- through the final conversation, problem-solving to teach students the skills of summarizing, systematizing the information they have heard and seen during the class. Together with students, to identify important moments of learning activities;



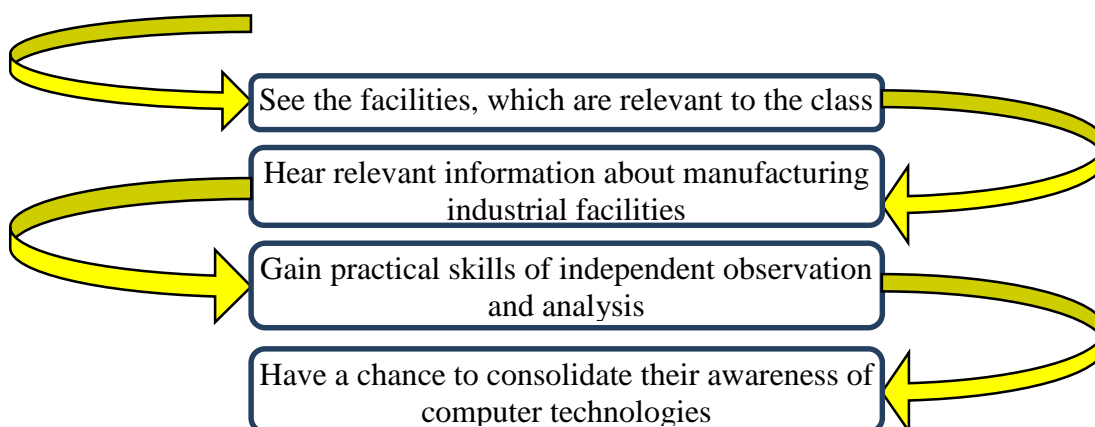
**Figure 2** Principles of realization of virtual tour

- to make annotated price lists of positions in industrial enterprises, which were visited during the virtual excursion; focus students on specialties that have high demand in the labor market in the region and country;
- to change the approach to the content of tasks for self-fulfillment and practical tasks. The tasks for independent studying can be both traditionally thematic and selectable (according to the individual training of the student), outrunning in nature with the goal of starting teacher-student cooperation.

These can be creative-cognitive tasks such as:

- creative report after excursion, practice in production facilities;
- create an album or presentation of the necessary technical documentation on the topic being studied;
- prepare a mini-report on the topic of the next lesson using the materials of the virtual tour.

**STUDENTS DURING VIRTUAL EXCURSION**



**Figure 3** Knowledge acquired by students during a virtual tour

### 3 RESEARCH RESULTS

The excursion work at our university is systematic and planned, and has a close connection with the curricula of specialty disciplines. First of all, the excursions to production facilities strengthen students' motivation to work in the chosen profession, excursions serve as a form of visual familiarization of students with technologies, production management, the content and working conditions, help them obtain profound knowledge for further work in the field. Besides, most importantly, during excursions students have an opportunity to get effective information to choose a subject and fulfill the course and diploma project more successfully.

Today, the actual solution to this problem is becoming a bit harder due to some technological reasons. To help study the technological processes we can use videos made in production plants, though their quality does not always meet the requirements. The analysis of video stories shows that sometimes there are actual errors, expressive features of the screen do not always correspond to didactic tasks, interactivity is not supported by cognitive activity.

This is where we can apply the innovative pedagogical technology of virtual tour over the Internet. Students' connection to the Internet provides them with an individual cognitive trajectory, which makes the process of learning more manageable, rational and more productive in terms of opportunities for the development of the creative potential of each student.

The term "virtual" in English means "a similar one, the one that can not be distinguished". A virtual excursion is an organizational form of learning that differs from real tour with virtual mapping of objects, where we observe conditions for self-observation, a collection of necessary facts. Characteristic features of virtual reality are: real time simulation; imitation of the environment with a high degree of realism; the ability to influence the surrounding circumstances and have feedback.

The planning and conduction of educational virtual tours consists of three stages: preparatory, excursions themselves and the final stage - summing up the excursion.

#### I. Preparatory stage.

1. The purpose of the tour is defined - development of skills of dealing with various information sources, ability to analyze and transmit information, study production and technological processes in the given field, aspects of organization behind technological equipment and ways to improve production efficiency.
2. The selection of the object of study. The objects of excursion are the Internet images of real objects; the description of technological processes, raw materials needed, photo gallery of products, equipment, price lists, video clips. Having already learnt the object of the tour, the teacher introduces himself or herself with the information of the site and creates for the students the route of excursions (a guide to the sites) - this may be a list of URLs. The route of the excursion is developed as follows: the teacher indicates the pages and the sequence in which they should be reviewed by the students.
3. Formulation of problems, setting the tasks which students will need to solve in classes (which objects demand special attention and what needs to be observed).
4. Determining the forms of reporting or visual representation of the results of the tour.

In preparing for a virtual tour the teacher must adhere to the sanitary and hygienic norms of work on the computer, take into account the spontaneity and uncontrollability of the placement of information on the Internet. The instructor must prepare for a virtual tour in advance, as there can be some unforeseen

circumstances during the excursion: low speed of information transfer, termination of work, or, conversely, updating of a website or a link that was given as a part of assignment.

II. At the stage of virtual tour itself students get acquainted with the materials on the presented online. They select information, organize the selected information according to the specified features, transform information and finally create their own presentations for reporting. The search method plays an important role in activating students' work during the virtual excursion. Students not only get acquainted with the technical process, but also actively search for information about the materials used, technological equipment in production. This is achieved by raising problematic issues before the tour or by obtaining certain creative tasks. More difficult tasks can be given to students who have been working on the Web for a long time and have the skills necessary for independent search for information. During the excursion, students can record abstracts in a notebook, copy materials from the site into their excursion portfolios, make notes.

**III The final stage.** The tour ends with a final interview when the teachers together with the students summarize, systematize what they have seen, heard, teachers highlight the essential, the most important, see students' impressions, do preliminary assessment, define the deadlines for creative home task. When planning creative tasks, the teacher expands the range of reporting activities, which allows to create a "free choice situation", where students can choose from a range of reporting forms or offer their own within their interests and opportunities. These may include posters, presentations, photo sessions, written reviews, posts, articles to the magazine or the compilation of albums using the illustrative material of the sites visited. Information collected by students during a virtual tour can be embodied as flash animation and become a learning tool that the teacher can use in other groups or courses.

#### **Algorithm for preparing a virtual tour**

1. Defining the topic of the class.
2. Setting the goals and objectives of the selected excursion.
3. Preparing the route of the virtual tour (structure of classes, methodical tools, modes of work).
4. Selecting and studying the excursion objects (mini-presentations, presenting reports, creative presentations, viewing abstracts from educational video films about a certain production facility).
5. Recommendations, announcements of additional information sources on the topic.
6. Completion of the " excursion portfolio" (photographs, drawings, diagrams).
7. Choosing interactive methodical techniques for the guided tour.
8. Demonstrating the tour, including it in the course of the lesson.

#### **Practical class on this problem.**

**Lecture** in group ТЕП-14-1д

**Lecturer:** Ph.D., associate professor Glushchenko O.L.

**Discipline:** "Boiler installations of industrial enterprises"

**The topic of the lecture:** "Boiler installations in systems of power engineering of industrial enterprises".

**Goal and tasks of the lecture:**

To deliver to students the knowledge in the field of construction and operation of boiler plants under conditions of energy saving and environmental protection.

As a result of studying this section the student should

**k n o w:**

- general scheme of the boiler plant;
- construction of steam and water heating boilers and separate elements.

**b e a b l e:**

- to draw up the thermal circuits of boilers and determine their parameters;
- perform calculations for heat boilers.

Studying this section will allow the student to acquire such **professional competence** as the ability to demonstrate practical engineering skills in the design and operation of heat and power equipment.

**Program learning outcomes:**

1. The ability to develop and design complex products in the heat energy industry, processes and systems that meet established requirements, which may include awareness of non-technical aspects (society, health and safety, environment, economy and industry); the selection and application of an adequate design methodology.

2. The ability to use some awareness of advanced achievements in the design of objects in heat engineering.

**Type of class:** virtual tour.

**Route list of virtual tour**

*1. Introduction into a new topic. Motivation of students' educational activity.*

Designation of boiler plants.

- a) teacher-student cooperation, the viewing of videos, prepared by students, a preparatory task for independent study;
- b) computer presentation
  - types of boilers;
  - types of fuel for boiler installations;
  - what is the waste after production of overheated steam?

(drawing up of the "portfolio of excursion", summarizing the main points in their notes)

c) interesting facts from the material being studied, for instance;

"In the early 19th century the first steam boilers produced steam with pressure 0.5 - 0.6 MPa and had a productivity of hundreds of kilograms per hour. Currently, steam generators with a pressure of up to 25 MPa (and even up to 31 MPa) are used for steam production at temperatures up to 570 °C and with productivity up to 4000 tons per hour. "

*2. Initial consolidation of the material heard and seen.*

**Frontal Interrogation** (work in groups).

I - What is the purpose of boiler plants?

II - What types of boiler units can there be?

III - What types of fuel are used in boiler plants?

IV - What is used to produce water vapor?

### *3. Presenting new material.*

Introduction to technological schemes of boiler plants:

a) the ones that work on solid fuel (virtual excursion to the technical drawing office)

On the screen, with the help of a projector, we present a general technological scheme of a boiler plant, which works on solid fuel (analyzing the scheme, copying it into students' notes - "briefcases of excursions").

Watching the film "The running of a coal-fired power station in the city of Drex (England)"

- Students' mini-reports, consideration of each component of the boiler plant (furnace, feston, drum, steam overheater, economizer, air heater)
- Element of creative-search tasks for independent study - to recommend to students to find materials on the Internet as to the work of boiler plants on solid fuels in the country and region (photo materials, video clips).

b) the boiler plants working on gaseous fuels:

- designing the circuit with the projector on the screen. Analyzing the structure of the boiler, understanding its characteristics;
- watching a video about the work of the boiler unit on gaseous fuels.

consolidating the seen and heard through a written response to the control questions on the topic (express test).

**Collective reflection** as to a problematic question: "What is your opinion, which boiler plants are more effective? What kind of fuel and what boiler plants will be used in future?"

Recommendations for students as to additional information sources on the topic, a brief summary of section in the textbook for independently study.

### *4. Conclusions of the class, evaluation of student performance.*

Each student compiles a "portfolio of excursions" (diagrams, drawings, answers to problematic issues; theses during the heard and seen during the virtual tour, photos).

#### ***Teacher's concluding remarks:***

Let me thank you for your creative work today. Thanks to our effective cooperation we managed to make the first steps in the study of the topic "Boiler installations in power systems of industrial enterprises". Using the virtual tour technology we combined the theoretical and practical part of our lesson and we are now acquainted with the main issues of the first sub-topic, namely: the designation of boiler plants and their specificity depending on the type of fuel selected; we determined which kind of fuel for boiler plants is more rational and advantageous today in terms of expenses.



In the next lesson, we will become acquainted with the classification and marking of boilers. In order for the next lesson to enrich your cognitive interest, I suggest that we get prepared together:

**(outpacing home task):**

- to find on the Internet some video clips about the work of boilers with natural and forced circulation (virtual excursion to enterprises of the city and region);
- to prepare schemes for the circulation of water and steam-water mixture in following kinds of boilers:
  - with natural circulation;
  - with multiple coercive circulation;
  - direct traffic.

*(for more efficient performing of these practical tasks, it is recommend to use online materials and the following textbooks:*

1. Sidelkovsky L.N., Yurienev V.A. *Steam generators of industrial enterprises*. – M.: Energia, 1978. – 336p.
2. Sokolov B.A. *Boiler plants and their operation: a textbook for the intr. professional education* - M. Publishing Center "Akademiya", 2007. – 432 p.
3. Lipov Yu.M., Tretyakov Yu.M. *Boiler plants and steam generators. Moscow-Izhevsk: RI "Regular and chaotic dynamics", 2003. – 592 p.)*

**CONCLUSION**

Based on personal experience, we claim that the creation of virtual tours is a complex process that requires a lot of creative effort. However, the result is worth it, since virtual excursion implements the principles of modern pedagogical activity: the principle of competence approach – obtaining high results through the activities of students, the principle of cognitive activity – through independent, creative activities for obtaining new knowledge. Virtual excursion thoroughly contributes to the popularization of the use of modern computer educational technologies in the study of special technical disciplines, is a methodological benchmark for preparing students for their chosen specialty. Thus, if we teach students not only to work, to learn on their own, to overcome difficulties, but also to enjoy it, then we can argue confidently that we have fulfilled the main challenge facing higher education today.

We are convinced that the future of education is in comprehensive innovations, in personal growth and the search for new ways and opportunities for future development.

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