

Systematic Approach to the Creation of Training and Methodological Support of Educational Process in a Technical University: Theory and Practice

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Abstract: In the article the psychology-didactic substantiations of the process of constructing the complex of the educational resources of training disciplines of technical university are examined. As the base the following principles have been chosen: the variety and availability of learning tools and pedagogical influences, practice-oriented nature of the training, the competence approach, combination of traditional classical techniques and technologies of e-learning. The pedagogical grounds for the application of information and communication technologies (ICT) in educational process are discussed. The aspects of the stimulation of the regular independent work of students, increase in their motivation to the mastery of educational programs are examined.

Key words: Educational resources • Competence approach • Information and communication technologies • E-learning • On-line learning • Distance learning • Internet-resources • Video conference • Video-practice

INTRODUCTION

The knowledge acquired by the person independently, as a result of his intellectual efforts, overcoming of certain intellectual barriers and obstacles, in literally acquired by his own work, makes the base of its education, is basis for the subsequent intellectual self-improvement, professional growth, formation and development as a persons.

The modern principles of the organization educational process at the higher school demand shift of focus from passive learning of educational information to active search, development of an initiative, creativity and a personal responsibility of students for results of the study [1]. The emphasis is on the need for a comprehension of methodology of a subject, development of its logic, understanding of interrelation of separate concepts and the phenomena. The student is not expected to memorize numerous formulas, schemas and equations, but encouraged to develop ability to derive them, owning a method, understanding logical communication of separate fragments of entire system.

The reproductive way of transfer of educational information yields the position to development of active methods of its development, there is a transition from transfer of the content of knowledge to training in methods of their mastering [2]. Slogan of the day is: “From the teaching to the learning!” It means considerable strengthening of a role of independent work of students, increase of extent of interactivity of educational process. Development and implementation of the pedagogical models focused on independent work of the students are highly relevant in modern conditions [3].

A variety of training remedies and pedagogical influences makes one of learning efficiency conditions. Educational and methodical support of educational process assumes creation of complex system of the educational resources necessary for implementation of educational activity. Such system can include the educational resources presented on various carriers: traditional paper (textbooks, manuals, methodical materials) and electronic (electronic contents, courses of lectures on CD, DVD, on the Internet, virtual laboratory practical works, computer bases of tests, etc.) [4], [5], [6].

Thus it is possible to use various technological environments, including mixed (traditional training of face-to-face, on-line, network, multimedia and so forth) [7], [8]. The special place among innovations in education is taken by a video format of representation of educational resources. Their use as in off-line (for example, in DVD video format) and in on-line (in the WEB format or a videoconference) modes is thus possible. The wide circulation was gained actually by on-line training [9], [10], [11]. Gradually gains popularity use of the virtual worlds in the course of training [12], [13]. Mobile learning becomes more and more popular [14].

RESULTS AND DISCUSSION

When developing a complex of educational resources on a subject matter "Chemistry" the author was considered need of ensuring the practice-oriented nature of training, application of competence-based approach. The special attention is given to students open access to educational resources, their variety.

Process of creation of a complex of educational resources is based on the didactic analysis of a conceptual framework of discipline, accurate statement of the setting clear learning objectives, a choice of the most effective for this type of educational information of formats of its representation. It was important to execute compliance between the set didactic purpose and pedagogical opportunities of a certain way of its transformation into an electronic educational resource.

Thus it is necessary to consider specifics of perception of the educational information presented in this or that format. Does not require proof of the fact that reading the print edition, electronic text or the perception of educational material from the screen during a video conference, lecture or webinar cause students various physiological reactions as they are connected to the operation of his various channels of information, including visual and acoustical. [15].

The technological decision at creation of a complex was based on a rational combination and mutual addition of traditional classical technologies and the e-learning technologies. The Information and Communication Technologies (ICT) are used in three directions:

- as maintenance of traditional process of training (face-to-face)-opportunity granting to participants of educational process of additional information resources and means of communication;

- as support of distance learning-real opportunity to train at distance;
- as actually on-line training-training in real time.

It is known that the technique of electronic training can be implemented in two modes: asynchronous and synchronous. In asynchronous learning student works on his own training material at a pace, which for him is available and convenient, sends completed assignments to the training site for the teacher's feedback, undergoes procedures of the current testing. Important condition of success of such training is rather high level of self-discipline, responsibility and motivation of the student. Synchronous electronic training assumes use of interactive information and communication technologies for interaction between all participants of training in real time (on-line training). The students are combined into a single virtual classroom regardless of their actual location and work together with each other and with the teacher.

We used the mixed model which means a combination asynchronous (WEB-based) and synchronous formats. For realization of such model the following tools are used: system on the organization and management of training of LMS MOODLE and the software for carrying out interactive WEB conferences Adobe Connect Pro.

During the WEB based stage the student studies the training material placed in a modular structured look in the program environment (LMS) and works in an asynchronous mode. The synchronous model is realized in a format of Web conferences. High extent of interactivity of such forms of occupations allows achieve significant educational effect/

The author of this article simulated and created a complex of educational resources on course "Chemistry" for students of the technical university. Main goal of a complex-exhaustive informational and methodical support of students during studying of this subject matter.

The Complex Includes:

- electronic content "Chemistry" for independent autonomous work of the student-on an educational WEB-site of university (www.spmi.ru) in the program environment (LMS MOODLE),
- lecture course (an original technique of reading interactive lectures on geographically distributed audience in a video-conference format; the videos of lectures placed in a free access on a video portal of YouTube, on CD and DVD; sets of lecture presentations of PowerPoint),

- laboratory practical work (traditional, interactive in DVD video format, on an open portal of YouTube, in a video-conference format),
- base of test tasks for training, intermediate and total control on discipline.

The basis of an *electronic content* "Chemistry" is the modular structured manual allowing the student to work autonomously and independently. Existence of hyperlinks in the text allows to operate of educational information, addressing as required to help data, the glossary, the biographic directory. Video inserts provide high degree of the visual nature of a training material. Training testing within each module and control testing after the end of studying of the section are carried out directly on an educational WEB-site, results of testing are summarized in process of advance on a subject matter. It allows to work in a format of mark and rating system, using integrated rating system of an assessment of knowledge of students during the whole period of studying of discipline.

At the organization of work of the student with an electronic content on an educational WEB-site communication possibilities of LMS are most effectively used: in the course of discipline studying the student has opportunity to ask to the teacher a question in any time convenient for it. For these purposes forums, chats, e-mail are used. The teacher will organize dialogue, operates it, itself offers subjects for discussion, on the basis of the pedagogical experience projects possibility of certain problems and the difficulties arising at students during studying of its discipline

The teacher quickly supervises systematic character of work of the student on a WEB-site, carries out monitoring of its educational achievements, analyzing results of testing, advises on the most difficult questions of subjects.

Students place the performed examinations and reports on laboratory works which are quickly checked and reviewed by the teacher on an educational WEB-site.

The *lecture course* of chemistry is realized in several formats: classical classroom lectures, lectures in a mode of a video-conference, the videos of lectures placed in educational sector the Internet and also duplicated on optical disks. Irrespective of a format of representation of a lecture material is accompanied by the presentations executed in the PowerPoint program. Educational presentations are developed for each lecture of a course.

Lectures for geographically distributed audience are broadcast in a video-conference format. They also are accompanied by demonstration of slides and video

fragments. However it must be kept in mind that traditional, classical high school lecture can't be purely formally transferred to video-conference conditions-the electronic format makes essential changes and to the principles of selection of educational information and to the principles of its presentation of audience.

Creation of a lecture course means process of redesigning of scientific information in the educational. The electronic format adds in this process need of the accounting of specifics of screen perception of a training material. The technique of carrying out occupations in a format of a videoconference demands considerable revision for the purpose of increase of extent of their interactivity [16]. Times of a broadcasting of the lecturing text in surrounding space passed long ago. The competence-based approach, the practice-focused training demand other methodical decisions, including directed on an individualization of educational process.

As additional training materials we developed video-courses of lectures on chemistry which are available to Internet users. Video lectures on chemistry are placed in a free access on YouTube video portal (<http://www.youtube.com/user/NWTU>), are duplicated on UniverTV portal (<http://univertv.ru/>). The student working with an electronic content at an educational WEB-site has direct access to a video-course.

Positive responses of students and existence of numerous copies of these video lectures on WEB sites of the Russian higher education institutions and colleges testify to success of this Internet project.

The *laboratory practical work* is obligatory attribute of a subject matter "Chemistry", because chemistry is experimental science and comprehension of its bases hardly possibly without chemical experiments. Performance of laboratory works on chemistry allows the student to study by practical consideration independently theoretical provisions, laws and rules, to watch a course of chemical reaction, to carry out measurements of chemical parameters. The most important didactic problem of a practical work is acquaintance of students with a technique of scientific research, practice of statement of scientific experiments.

We developed a technique of carrying out laboratory works on chemistry in two forms (in addition to classical traditional internal):

- Carrying out laboratory works in a format of a video-conference (on-line),
- Performance of laboratory works in a format of the video practical work presented on DVD video (off-line).

The *first form* of carrying out laboratory works assumes use WEB and the document cameras, established in the central chemical laboratory of university in which during this period of time the group of the students who are training in St. Petersburg works. Chemical experiments are made by them in real time.

Thus technical capabilities the document-camera allow to show chemical process in all its details and nuances. The students being far outside laboratory, watching experiment, make measurements of a number of parameters (for example, speeds of chemical reaction during laboratory work "The chemical kinetics"), describe a course of chemical reactions. Besides they have opportunity to communicate with the teacher who is carrying out laboratory works, asking him questions and listening to his comments.

It should be noted that demonstrations of experiences have no production character, they are carried out by the students who don't have practical skills of experimental work in the field of chemistry therefore flaws and oversights are inevitable. However these "shortcomings", on the contrary, strengthen extent of pedagogical impact on trainees as the teacher present on occupation corrects work of students, pointing to the mistakes made by them. Such form of carrying out laboratory works allows to approach as much as possible level of perception of the student to conditions of his real work in chemical laboratory.

The *second form* of a laboratory practical work-in video DVD format. Such format allows to delivery a practical work to students through a media library of university and a media library of structural divisions from another town. Using the video practical work, each student has an opportunity to work in any time convenient for it, choosing optimum for itself intensity of work. The video format of a practical work allows the student to see real, instead of the drawn chemical processes and the phenomena.

It favourably distinguishes it from computer laboratory works, solved in style of a computer game and very far from real chemical experiment. Certainly, passive viewing of videos with chemical experiments isn't capable to realize the considerable didactic potential of a laboratory practical work and can't adequately replace real work of the student in laboratory. When developing a technique of creation of a video practical work as the basic the principle of interactivity was used. Active work of the student belongs to advantages of this video practical work during viewing

(in particular, work on independent planning of experiment, carrying out measurements of time of passing of chemical reaction and the subsequent calculation of sizes of its speed, etc.).

CONCLUSION

The complex of electronic educational resources including system of software, electronic contents and original techniques of training is developed. The introduction of the complex in the learning process of technical university allows achieve significant educational effect, increase of a role of independent work of students, stimulation of systematicity and regularity of this work, increase of motivation of students to development of an educational program.

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