THE ROLE OF MODERN INFORMATIONAL OPPORTUNITIES IN THE FORMATION OF INNOVATIONAL PEDAGOGICAL TECHNOLOGIES IN ENGINEERING EDUCATION

Vasiliy Zhurakovskiy[1], Zoia Sazonova[2], Nina Chechetkina[3] and Tatiana Tkacheva[4]

Abstract — *The informational revolution has initiated innovational processes in all of the fields of human's activity and simultaneously gave wide opportunities for their realization. For the accomplishment of novel engineering activity high-qualified specialists are required. Because of that the switch to the new paradigm of humanistic innovational education is being conducted in the Russian system of engineering education. The experience of the Moscow Automobile & Road Construction Institute (State Technical University) in the sphere of implementation of modern information technology to the development of new pedagogical technologies in engineering education is discussed in this article.The use of modern informational means: the Internet, local computer networks and personal computers – basically allows to intensify the process of education, still paying much attention to personal peculiarities of information perception of each student. The representation of educational information in electronic form on compact discs helps to supply each student with a personal library of educational and methodical literature. The study of educational materials can take place in the tempo, most suitable for each concrete student.*

Index Terms ¾ About four, alphabetical order, key words or phrases, separated by commas (for suggestions Preparation of papers, camera-ready, two-column format, ICEE format).

MAIN PART

The experience of some departments of MSARCI in the sphere of application of modern information technologies during the development of new pedagogical technologies is discussed in the current work.

The informational revolution has initiated innovational processes in all of the fields of human activity and has simultaneously provided us with broad opportunities for their realization. The global information network – the Internet – gives us the possibility of mobile delivery of the information, which is needed by the consumer, to any part of the world. Workers of high qualification are required for the realization of innovational pedagogical activity. Because of this the switch to the new paradigm of humanistic innovational education is being conducted in the system of Russian engineering education. The main objective of modern education is the universal development of a creative personality of every future engineer.

The use of modern informational tools – he Internet, local computer networks and personal computers ;ets us intensify the process of education, not sacrificing personal personal approach of teachers towards the students. The students of the MSARCI are using the local network of the university to get reference data they need, to make different calculations and to model experiments as well as modules of educational information recorded on hard and CD disks. Representation of educational information in electronic form potentially allows us to provide each student with his personal library of educational and methodical literature.

Masters, post-graduates and lecturers of MSARCI use computers in research as well as in study work. Universal use of computers lets us combine the efforts of experts of various profiles while conducting complicated applied explorations. For instance, according to the professional profile of the university a work called "Modelling of the process of management of the dynamics of car flows on the roads of Moscow" has been done by the staff of the departments of higher math, automobile transport exploitation and traffic organization. The aims of this research work are as follows:

The search for the solutions of ecological problems of large cities

Optimization of traffic for the prevention of traffic jams on the roads

Lecturers of the department of road building materials are unceasingly monitoring the state of a circle road around Moscow. Computer processing of the information coming from video cameras and different sensors allows us to detect and eliminate flaws on the surface of the road. Students take part in research works of different departments not only as operators, but as developers of computer programs that are needed to manage natural experiments. The wide

[1] Vasiliy Zhurakovkiy, Moscow State Automobile & Road Construction Institute (State Technical University), Engineering Pedagogy Department, Leningradskiy prospect, Moscow, 125829
[2] Zoia Sazonova, Moscow State Automobile & Road Construction Institute (State Technical University), Engineering Pedagogy Department, Leningradskiy prospect, Moscow, 125829
[3] Nina Chechetkina, Moscow State Automobile & Road Construction Institute (State Technical University), Engineering Pedagogy Department, Leningradskiy prospect, Moscow, 125829
[4] Tatiana Tkacheva, Moscow State Automobile & Road Construction Institute (State Technical University), Engineering Pedagogy Department, Leningradskiy prospect, Moscow, 125829

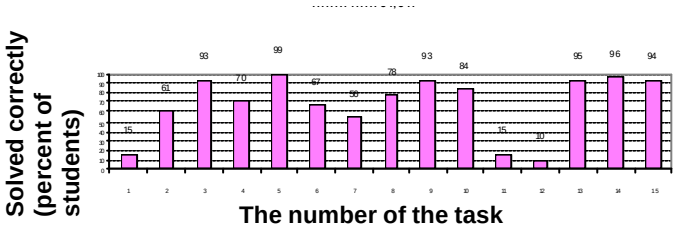
opportunities of computers are used by lecturers in educaqtional work for the following purposes:

To monitor the quality of educational process

To create integrated courses, which includes theoretical and reference material, complex model experiments, systems of contrto realize the control and self-control

To organize individual consultations for students

Interaction of general and engineering departments of the university, aimed on the solution of a general problem – the development of an engineering style of thinking of a future engineer – is coordinated by the department of engineering pedagogy of the MSARCI. The course "Basics of Engineering Creativity" (BEC) is one of the central disciplines beiung taught by the department. The course canbe considered a pedagogical structure, which integrates humanisitc and scientrific knowledge in a united complex. The use of computer technologies is a necessary attribute of this discipline. A typical engineering problem begins with the formulation of a technical need – necessary for the



function consumer. The second stage is the production of ideas, which can be used to realize the project with the help of different physical effects.

The computer lets the students activize the knowledge they got earlier – mainly of natural sciences – providing them with an opportunity of viewing banks of various physical and chemical effects. The BEC course is read in MSARCI to the students of the 2nd and 3rd courses of different specializations. Every lecture on BEC includes the control of the level of professional thinking. For instance, during the lesson different approaches to the fulfilment of one and the from the course of general physics (and those, who study at the 3rd course, also from the course of heat technology), are encouraged to overlook heat engines of different types: heat turbines, engines of internal combustion and so on. Then different conditions towards the engines are formulated: power, output, the level of ecological impact (the level of emission of harmful gases), etc. It is necessary to make an expertise of every suggestion to see, how it suits the requirements formulated. To perform this stage of work fundamental knowledge of mechanics, thermodynamics, ecology and heat machines is necessary. Computers help lecturers analyze the depth of the students' understanding of the physical ideas and phenomena being discussed and determine the level of students' readiness to take part in a serious argumented discussion. To do that lecturers use classical methods of testing [2] and develop materials, necessary for testing of concrete knowledge and skills. Results of the processing of the answers to a test "Heat machines" are presented on fig.1-2. About 250 students of different faculties took part in the testing. The total amount of questions in the test was 15. The distribution of the relative amount of students according to the number of correctly solved problems turned out to be almost a normal (a gaussian) one, which is proved by the results shown on fig. 3. The gaussian distribution of a random magnitude is described by a formula:

$$y(x) = \frac{\exp(-\frac{(x-d)^2}{2s^2})}{s\sqrt{2p}}, \qquad (1)$$

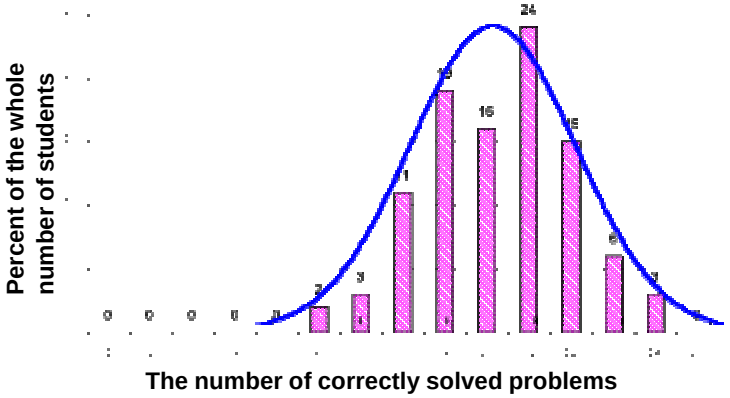
where "d" is a middle value of the random magnitude and s^2 - a magnitude, which characterizes the deviation of the results from the middle value:

$$s^2 = \sum_{x=1}^{x=15} (x-d)^2 \cdot W(x), \qquad (2)$$

where W(x) is the density of the probability of a random magnitude distribution. The results have been processed with the help of a mathematical program "Mathcad 2001".

While conducting the mathematical analysis shown here, the relative scale of measurements, oriented on the norm, was used [1]. Fig.4 lets us see which percent of students correctly did some percent of tasks from the test.

Students found those tasks, in which they had to find interconnection between physical laws in oral and mathematical forms, the easiest. Questions, in which students had to choose a correct definition of a concrete physical or mathematical model, proved to be more difficult. None of the suggested statements contained wrong answers, but only one of them was full enough and contained all the necessary information about the model. The result we obtained leaves much to be desired. It showed that in the lecture courses of fundamental disciplines not enough



attention was paid to the definition of the models used (much more time was devoted to the mathematical analysis of different processes). It is very important for students to understand that the results obtained with the help of some

mathematical methods, describe a real process only in the limits of the model used.

The results of the testing were analyzed both statistically and individually. Each student got a mark for the quality of the work done and personal recommendations, how to overcome formalism in his knowledge. Perfect fundamental preparation is necessary for the performance of the next stage of work – the universal (mathematical, economical and so on) expertise of each suggested idea. This activity requires practical knowledge of various mathematical packages. Computers let us use the knowledge of calculating math in the future profession.

Structurization of information obtained during the statistical analysis of the whole complex of materials helps to solve some important problems. One of them is a closer connection between different departments of the natural sciences faculty. The first steps have been made in this direction. The mutual discussion of such facts, when the majority of students of the same specialization couldn't amswer the same two or three questions, has been made. Treacherous questions were checked from the point of correctness of their questions and of the importance of the students' understanding of their answers for the forthcoming periods of education. As a result, some important recommendations on how to slightly change lecture courses and practical tasks, were made. The optimization of a lecture course of BEC is another very important task. It is done with the help of the computers, which provide students with a feedback to the lecturers. The regular control of the quality of the students' understanding lets us adjust methodical, organizational and sunstantial aspects of the course.

Lecturers of the engineering pedagogy department pay attention to the development of the web-site of their department. One of the main functions of the web-site is the providing of the direct student-to-lecturer contacts. Any web-site visitor can send his questions, suggestions. Commentaries and useful links from one of the web-pages.

Stage-by-stage implantation of novel computer technologies is being made in the MSARCI for the solution of educational and development tasks. Such approach to the use of broad opportunities of information technologies during the modernization of the engineering education in the MSARCI suits to the general tendency of the humanization of the process of modern education.

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