

# Experience of implementation of Internet/Intranet Technologies for Technical Education in Ukraine Zaporozhye Industrial District

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## Abstract

*The project on development of Technical Educational Program with using Internet/Intranet Technologies and Instructional Methodology for Teaching has been started at Zaporozhye State Technical University (ZSTU) five years ago.*

*The development of Educational Internet/Intranet Technologies have demanded changes in base and special courses using Case methodology. The typical Course Case contain the Lecture Course (electronic textbook), methodical materials for virtual laboratory practice and interactive testing study tools, instructional for Course Theme Project and Specialists/Masters Diploma Works. All Course Cases are used Internet/Intranet Technologies and distributed among students in electronic multimedia form.*

## Key words:

*Educational program Internet/Intranet technologies, qualification level workforce, distance learning, course case*

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## 1 The development of Educational Infrastructure in Ukraine Zaporozhye Industrial District

Rapid development of natural sciences and science-based technologies move the accents of leading countries competition into scientific and educational field, thus requiring considerable changes in educational aims shifting contents and methods of teaching. Engineering education had occupied leading positions in new technologies development, creation of modern production means and technological processes` managing methods, thus ensuring production cost and quality, its place in world competition, and, finally, define countries place in world community.

The modern ten years period of independent development of Ukraine was characterized by wide structural changes in economical, industrial, social and educational infrastructure. The educational infrastructure is formed with the state and private educational institutions. The number of universities has grown from four up to eight during last of ten years period. The private high schools are comprise half of all educational institutions, but state universities are a major and greatest part of this sphere for the Ukraine Zaporozhye Industrial District. For example, ten thousand students are taught in the oldest and largest Zaporozhye National Technical University. The university leads a complex with thirty five schools, lyceums, grammar schools and seven colleges in four Zaporozhye district towns. More than 35000 schoolchildrens and students are taught in the educational institutions of this complex. Other state universities possess analog complexes too. The typical complex of any private university includes only one or two schools and one college.

## 2 The basic initial conditions before implementation of new educational Zaporozhye National Technical University project of Internet/Intranet Technologies for Technical Education

### 2.1 Historical traditions of engineering education in Zaporozhye National Technical University

The life story of the oldest and largest University in Zaporozhye goes back to 1900 when in a provincial town of Alexandrovsk a seven-year Mechanical Vocational School that trained mechanics and technicians was established. Since that time the educational establishment changed its name and status several times until 1994 became Zaporozhye State Technical University. Now Technical University achieved higher level status of National Technical University (ZNTU).

Historically our basic faculties were of machineconstruction, metallurgical and electrotechnical engineering. Scientific schools in these fields were created in 40s-early 50s under the leadership of academician Y.Shulte, doctors of Science B.Natapov, B.Borisov, professor P.Michailov ensured high standards of engineering education for largest in ex-USSR and Europe metallurgical ("Zaporozhsteel", "Dnieprospecialsteel", "Ferrrousalloysplant" etc.), machineconstruction (automobile plant "Kommunar", tool plant) and electrotecnic(transformer plant, hydroelectric station ) enterprises.

Later in 60s-70s rapid development of radioelectronics in our city required sufficient number of with engineers specialized in radiodevices, microelectronics that resulted in foundation of radiofaculty in ZNTU with 3 basic specialties. Thus more than 45000 engineers were trained and graduated from ZNTU in previous years being sent to industrial enterprises of all regions of ex-USSR, and as for Zaporozhya and region engineering staff of largest plants consists mainly of our graduates, not to say of teaching staff in our University itself where more than 80% lecturers in basic, fundamental and special chairs gained their diplomas and academic degrees in ZNTU. Our University has great experience in working with foreign students. Within last 20 years more than 1000 qualified specialists were prepared for many countries of Europe, Asia, Africa and South America.

Since 1995 the specialists training started due to integrated teaching plans in 15 specialties. New possibilities of professional orientation and qualification abilities of school graduates appeared with organisation of educational – scientific – industrial complex "Zaporozhye Regional Center of Politechnical Studies". Its creation was aimed at politechnical specialist training quality rise due to integral system of continuous learning, joint application of technical base and teaching staff of educational institutions.

Thus a general agreement of Zaporozhye educational – scientific – industrial complex "Zaporozhye Regional Center of Politechnical Studies" was signed together with 35 agreements of cooperation. All educational activities are carried out on the basis of center's status being searched out by our faculty of pre-graduate studies.

According to the abovementioned agreements Zaporozhye National Technical University ensures:

- the fulfillment of joint professionally – oriented work of schools aiming to find professional skills and abilities together with development of interest to technical disciplines. Thus different forms are being used as organization and caring out of scientific conferences, symposiums, excursions to university laboratories, application of ZNTU technical base etc.;
- choice of highly qualified teachers from professors and lecturers of ZNTU for teaching pupils in mathematics, physics, informatics, foreign languages;
- joint working-out and correction of teaching programs for deeper studies of the abovementioned subjects based on high school demands;
- development of pupil-to-student transformation conditions;
- development of materials (tests) for competitive choice of pupils;
- profile discipline's Olympiads carried out;
- acquaintance of entry procedure to different faculties;
- elaboration of methodical recommendations for separate courses and parts, carrying out methodical seminars and consultations for school teachers;
- attendance of lessons, exams etc. in schools and gymnasiums by university lecturers for getting information of pupil teaching.

### 2.3 Basic experience of cooperation between ZNTU and leading industrial enterprises

In difficult economical situation in Ukraine we have insufficient financial support from the government, that's why we strengthen direct ties with industrial enterprises irrespective to their state or private nature. So, in 1997 our university had signed new multicomponent agreements with leading machine-building and metallurgical companies that are widely known as manufacturer of highly-effective productions. Leading specialists of these companies take part in educational process, special laboratories are equipped with real models and computer technics from the plant, our students have their practical training at plant's shops and departments, and after graduating from the university they are employed as engineers at the leading industrial enterprises. As practical example of derived cooperation we can speak of University chairs activity with leading Ukrainian aviation enterprise "Motor-Sich":

- complex of laboratories of aviation motors equipped with modern samples was created due to "Motor-Sich" financing;
- special discussions were carried out aiming the definition of major lines for engineers training employed at "Motor-Sich";
- direct participation of leading specialists of "Motor-Sich" in education and methodical work,

including director-general of "Motor-Sich" Dr.Sci, Prof. Boguslayev as University Council Member;

- organization of practical training and education for university students at "Motor-Sich", including university branch at the plant;
- students participation in diploma projects fulfillment and scientific investigations at "Motor-Sich" request with their further employment there;
- "Motor-Sich" recommends school-leavers to be taught at ZNTU and after graduating from university they are employed at "Motor-Sich".

Such cooperation between industrial enterprises and technical university ensures further development of collaboration ties in engineering education. Recent activities in new engineering specialties opening brought into being those that appeared to be necessary for Zaporozhya industrial enterprises. E.g. such specialty as "internal combustion engines" is aimed to fulfill the requirements of Ukrainian – Italian joint venture "Motor-Sich IVECO" producing huge diesel engines, and is also interesting for joint venture "Avto-ZAZ-Daewoo" for renewing the engine production.

Another new specialty "special computer systems" is based on really huge potential of computer training in ZNTU and is able to satisfy the need of wide variety of enterprises.

The third specialty "marketing" is aimed to fulfill the goals of economical restructuring proceeding since 1991.

## 2.4 The initial level of development of networking infrastructure

At a prior period of five years Ukraine Zaporozhye Industrial District had not Research, Industrial and Educational networking infrastructure integrated into Global Open Information Society with Internet technological for commercial users, such as industrial enterprises, or non-commercial users from Educational regional infrastructure. There was not defined regional policy and regional coordinate program on development of networking infrastructure integrated into Internet. Some existing enterprises and universities program was oriented on solving particular problem and was not regional or state coordinated. The regional administration could not provide coordinate and integrated policy because had not any government funding.

The development of networking and information educational infrastructure was not regarded as priority sphere in hard economical conditions. The leading industrial and commercial enterprises had not sufficient network capacity for local cooperation with some educational institutes. The lack of centralized ideas in computerization of our university resulted in purchasing of comparatively large number of electronic-calculating machines that weren't connected between each other, and frequently it was impossible to organize any net because all machines were of different classes.

Fifth years ago international funding of new directions of network capacity increasing leading state universities implemented some limiting part of networking information technologies in research and educational processes. The leading specialists of networking technologies, computer systems and programming of defense enterprises work as university teachers with a higher level of extra pay.

## 3 Main principles and practical realisation of Zaporozhye National Technical University project of Internet/Intranet Technologies for Technical Education

### 3.1 The basic aims of project of Internet/Intranet technologies for technical education

The special regional education project on development of Technical Education Program with using Internet/Intranet Technological and Instructional Methodology for Teaching has been started at Center of Information Technology of Zaporozhye National Technical University five years ago. The main aim of this project are connected with the solving problem of preparing Higher Qualification Level Workforce with using new Internet/Intranet technologies.

The new development of all this Educational spheres are characterized with knowledge-based processes by wide use of modern computer communications technologies. These progressive Internet/Intranet technologies are provided access to international informational resources. Creating elements of Open Educational Infrastructure of Zaporozhye Industrial District of Ukraine in Global Information Society empower each employer in all economical, industrial, social and educational sectors by providing rapid access to world-wide information and the ability to share international information basis.

The modern high level engineer must have the open knowledge for the successful professional work with computers informational technologies in Global Open Information Society. The important role of the educational sphere in the development of all infrastructures of area demands a new reconstruction of the educational complex as a combination of open education and development of creativity in schools, colleges and universities, and a acquisition of new skills of work in World Global Information Infrastructure, and adaptability to knowledge-based economy through life-long training. The administration of educational

sphere of region takes into account, that the open education combines local, national and international cultures and increases a share of the humanitarian block of each cycle in technical education.

It is really impossible to imagine high school progress without complex information of whole system, taking into consideration not only supply of technical university with modern means of information and calculation techniques together with program equipment, but mostly solving the problem of computer nets creation for university and local university communication together with new information technologies introduction to education and science.

The basic target groups requiring new higher Qualification Level Educational defined two types of categories. Traditional categories includes students in full-time education; teachers of school, teachers of college and teachers of university, which raising the level of one's skill in new educational technologies. Modern categories includes the specialists who need second professional education or higher level professional education, low level specialists who need professional education of bachelor or specialist (engineer) level; VIP in related institutions; workers or low level specialists who need to be trained externally.

We consider as basic lines in education informatization for these types of student categories:

- informatization of educational process and scientific investigations;
- creation of united information media of high school;
- informatization of high school management.

### 3.2 The basic directions of project of Internet/Intranet technologies for technical education

Modern realization of the above-mentioned lines requires the implementation and development of such information technologies as:

- computerized systems for studies and control;
- data bases and local nets;
- information expert systems;
- electronic libraries and multimedia technologies;
- technologies of far excess to data bases (through Internet/Intranet) etc.

The orientation on access of reaching real practical results have declared main directions of building instructional methodology for modern Internet/Intranet teaching technologies of complex technical, technological, technical design and non-technical education. We formulate four main principles of teaching with using Internet/Intranet technologies for technical education. The First Principles are known as co-operative model of course management with using of student initiatives of learning. Wide use of computers modelling and multimedia technologies among students can disconnect teaching from real practice. The Second Principles must be formulated as a contribution of leaning model in the solution of real practical problem. New Internet/Intranet technologies eliminate differences between traditional and distance leaning, because they include interactive on-line and off-line communication. It is declared as the Third Principles. Conception of active position is the Fourth Principles, when faculties and departments of university are developing their own Internet resources.

### 3.3 The implementation of project of Internet/Intranet technologies for technical education

This project solves four basic problems: organizational, informational, technical (computers, communication, network equipment), methodical and financial. For acceleration of practical realisation of project of Internet/Intranet technologies for technical education it demands special Course Cases (more part of computers and programming specialities and some technical specialities). The typical Course cases contains the Lecture Course (analogy of electronic textbooks), methodical materials for virtual laboratory practice and interactive testing study tools, instructional for Course Theme Project and Specialists/Masters Diploma Work. All Course Cases are used Internet/Intranet technologies and distributed among students in electronic multimedia form. The Cases technology of Internet/Intranet education decreased time of practical realisation of project by 25%, because teachers used more 30% traditional methodical materials.

The increasing part of Internet/Intranet teaching in Education process and a higher level of extra pay forces some teachers and students of the technical and economical specialities to Second computer education. Today the part of such teachers and students is increasing up to 15%. Now major part of lecturers are engaged to development and introduction of new computerized educational programs, active means of computerized support of education such as electronic books, imitation and modeling programs, multimedia systems. E.g. such systems of computer modeling was installed at the special class for aviation gas turbines ensuring the possibility of graphic design of different engine systems together with strength analysis of engine elements.

The state universities have a few directions of financing. The Zaporozhye National Technical University, like other state universities, is financed by Ministry of Education and Science of Ukraine and also the enterprises and private students payment, the government credit, grants of the international funds, associations and other organizations. The Ministry of Education and Science of Ukraine promoted the associations of state universities with the leading industrial and commercial enterprises and scientific organizations. These associations unite innovations in the industrial, technological, commercial and educational spheres. The higher level service of educational marketing is creates conditions for stable funding increasing. The project financing exceeds 1,200,000 \$USA with using the payment of private student education (40%), corporate enterprises payment for student education (40%) and Government (Grant) financing (20%).

All–University computing and information network possesses 2500 meters with more than 650 Intell Pentium, Intell Xeon and Risk computers being organised into 27 computer classes and laboratories. All computers possesses the possibilities to carry out mathematical calculations using huge server of information technology department.

Monthly volume of information received from global Internet exceeds 1.8 Gbait, with further efforts to increase the efficiency of Internet excess in ZNTU. Thus, the capacity of connection channels with Internet was risen from 28.8 Kbit/s to 33.6Kbit/s with potential possibility to 128 Kbit/s excess (and additional channel of 64 Kbit/s and potentially 2 Mbit/s).

We complete the organization of connection channel to information computer network of Ukrainian scientific and educational centers (in program URAN led by National Technical University of Ukraine).

In 2000 the computer library hall was opened being equipped with two scanners, laser Jet, TV system. This hall is connected to all–university system Intranet and Internet. That ensures the possibility to use the library funds situated in Russia, Poland, USA etc.

Web–site of our University considerably changed ([www.zstu.edu.ua](http://www.zstu.edu.ua)):

- pages devoted to the chairs of physics, microelectronics, electrical machines and radiodeviceconstruction faculty were added;
- electronic version of "Radioelectronica, informatics, management" magazine was added;
- electronic version of "Machineconstructor" newspaper was added;
- scientific achievements chapter was added;
- information for school–leavers was added.

The abovementioned site of radiodeviseconstruction faculty contains methodical guides and other teaching materials needed for student's study, thus giving possibility for distance forms of education to be employed in the nearest future.

Thus we went in the direction of fulfillment the recommendations to European Council "Europe and the global Information Society".

During the same time modern computers were installed at every dean service, administration staff (rector, professors, chief specialists etc.), scientific departments, financial and economic services with introduction of special programs.

The main intermediate results of project realization can be stated: creation of initial University Network technical base with 650 Pentium II, III, IV computers, main Course Cases creation, high quality of Education, the of ZNTU graduating student employment increasing (more than 5,200 Specialists and Masters).

## 4 Summary

The basic initial conditions are characterised: hundred years history of technical education, higher level teachers and research and scientific schools of university, new organizational form of cooperation between university and leading industrial enterprises, low level of computerization coordinate policy and government funding for research and teaching.

The development of Educational Internet/Intranet Technologies have demanded changes in base and special courses with using Case methodology.

University Network technics connect 650 Pentium II, III, IV computers,

The employment of ZNTU graduating students has increased (more than 5,200 Specialists and Masters).

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