

## THE EXPERIENCE OF UNIVERSITY-INDUSTRY INTERACTION IN TELECOMMUNICATION SECTOR

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One of content providers in «Corporate management» for the CIS countries is a Russian ITU DL Centre situated in Novosibirsk on the basis of Siberian State University of Telecommunications and Information Sciences (SibSUTIS). In 2009 about 250 participants from 10 countries took part in the courses held in ITU DL Centre on the basis of SibSUTIS. Another example of university-industry interaction in telecommunication sector – the corporate e-learning course for top and middle managers from the telecommunication company was described. The Siberian State University of Telecommunications and Information Sciences (SibSUTIS) has been using e-learning technologies for higher education services almost about 10 years. The number of students studying at the workplace by distance is steadily increasing.

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**Keywords:** engineering education, distance learning, university-industry interaction

### DL Courses for CIS Countries

International Telecommunication Union (ITU) has implemented the network of world Centres of Excellence with the aim to promote the knowledge accumulated by the international community in the telecommunication sphere among ITU country-participants. In the realization of the Centre of Excellence project for the CIS countries it has been decided to bring into operation a network of excellence amongst potential content providers, like universities, technological institutions, training centers etc, which will provide on-line solutions. One of content providers in «Corporate management» for the CIS countries is a Russian ITU DL Centre situated in Novosibirsk on the basis of Siberian State University of Telecommunications and Information Sciences, SibSUTIS [1, 2].

The technical support service in the DL system is the most expensive one because it consists of skillful personnel and exploits expensive equipment. This service consists of: programmers, who provide interactive communication, develop software for DL and elaborate databases; specialists in multimedia; network and web-server specialists, whose aim is to provide a regular work of all servers, access to Web-servers over the Internet, video conferences, functioning of a local network, protect information against any fatal errors, and introduce new DL technologies.

The DL platform is created on the base of Web-technologies and Email. The structure of DL course includes:

- Calendar schedule for training;
- Abstract of lectures;
- Practical tasks;
- Computer-based program;
- Additional training materials;
- Test;
- Reference section;
- Write an email;
- Tutors' contacts;
- Forum.

In DL course the following methods of training and knowledge evaluation are used: study of theoretical materials; performance of practical tasks and case study; performance of tests; use of computer-based programs for doing practical tasks; discussion of burning issues at a remote forum (telecommunications Internet); examination and reviewing of calculations made in the tests; evaluation of independence and activity of trainees during the forum; testing of trainees' knowledge.

The learning material of the course is divided into self-instructional units. This structure allows step-by-step learning, each step paying attention to a particular unit. The learning objectives of the course and each unit are clearly determined. The learning material is self-sufficient and lets trainees to do all types of training work and achieve stated learning objectives. The material is oriented to self-study; trainees have an opportunity to make calculations, solve different problems, and do practical exercises. The structure of the learning material contributes to the interaction of a trainee, and allows him/her to communicate with trainers, tutors, specialists, and other course participants. Every unit has self-assessment questions and tasks, which will enable a trainee to check progress and mastery of the learning material. The learning program provides trainees with tests, which are checked and evaluated by trainers. The learning material is also provided with access devices such as course guides, course curriculum, trainers' email addresses and reference materials.

A number of performance problems (case studies), which require analysis and trainees to make decisions, are included in the learning program. To discuss those problems with other participants, trainees have access to a Web conferencing system offline taking into account different time zones. To manage trainees' study there is a billboard, where one may put all general information. All materials are issued in

HTML, with all necessary hyper references for convenient navigation through course material. Trainees may observe learning materials both online and in an autonomous regime.

The main objective of distance learning is to provide interactive training. Integrated application of ASP and databases allows providing trainees with access to resources of the Web site as well as giving information about grades received in the learning process, possible debts, and current assignments. On the basis of ASP, VBScript, and JavaScript, programs for distance testing of trainees are developed. Software for group work and case study, which permits holding discussions on learning issues with forum and chat technologies, is elaborated in the DL center.

Communication activity provides great support for the trainee who is isolated from the institution: communication with administrative staff, trainers, tutors, and other course participants. This allows trainers to quickly answer trainees' questions, identify their difficulties as well as render immediate assistance, form a sense of constant community among a dispersed group of trainees, compare their own study progress with that of other course participants, and give mutual assistance. On the developed site one of the main means of communication is email. By email trainees send their papers and other outcomes of their activities to the DL center. The other channels of communication are a debating forum and billboard.

In 2009 about 250 participants from 10 countries took part in the courses held in ITU DL Centre on the basis of SibSUTIS. The quality of training was evaluated by questioning trainees.

All course participants are provided with questionnaires to evaluate the quality of training in accordance with ITU requirements. Processing of questionnaire results has allowed us to draw the following conclusions: almost all course participants speak positively of the quality of training; they point out that the course is up-to-date and express their interest in it; and the course turns out to be very useful for enterprise employees' practical work.

#### **The Corporate DL Course for Telecom Company Managers**

Another example of university-industry interaction in telecommunication sector – the corporate e-learning course for top and middle managers from the telecommunication company will be described. Company management took a decision to hold retraining of top and middle managers of the company. This large company has its departments in different areas of the Siberian federal district and numbers more than 40 000 employees.

Siberian State University of Telecommunications and Information sciences (SibSUTIS) – the large branch-wise university located in territory of the Siberian federal district – became an educational institution capable of offering effective programs and methods of training [3].

On the one hand, e-learning course content solved corporate queries and has been adapted to market. Besides, it was also concentrated on the future interests of corporation and development of this market. In whole E-learning course consists of 5 modules and meant for training within 6 months (600 hours). Duration of teach time on each module makes 120 hours. From them 96 hours are taken away on network training which occupies from workers about one month (from calculation no more than 4 hours per day), and 24 hours are occupied with short internal session. E-learning course is made by modular concept on the basis of interdisciplinary approach. The course program is an integral program in which various teachers' activity is completely coordinated.

Electronic-educational E-learning course environment aims students at self-managing personality-oriented learning, provides necessary students informational interaction and includes the following elements:

- Curriculums of all course and its each module.
- Planned schedule for E-learning course.
- Schedules of independent studying of every module materials.
- Abstracts of lectures.
- Practical tasks on each module.
- Tests on each module and program in a whole.
- Group discussion forums about study problems on each module.
- Forum of acquaintances.
- Schedules of teachers remote consultations.
- Visiting cards of teachers.
- Access to e-mail for sending of performed educational tasks.
- A billboard for students informing and educational process control.

In E-learning course nonconventional methods of training based on partnership represented by process of interactive dialogue in the conversational form, group work, collective discussion of various situations (case-study), command work at joint projects and etc. are used

All teaching materials of E-learning course the most connected with direct professional activity of learning company employees. The practical E-learning course component contains particular tasks that must be performed during studying by company employees. During E-learning course participants of training con-

tact by means of built-in in the module e-mail with teachers, colleagues, experts from the company. Trainees and teachers get acquainted by the use of the "visiting" cards system with photos. Acquaintance between students and formation of common educational collective begins with a forum of acquaintances.

Each module is provided with feedback in the form of consultations, checks of practical tasks performance, testing and control of knowledge, questioning of trainees. As the program is oriented on adult people, it is provided with group discussion of studied problems and performed tasks in modules. At internal sessions methods of work in small groups are used.

For training quality evaluation and efficiency of educational activity at corporate university the system of educational process integrated monitoring has been implemented. At the end of studying materials of each distance module questioning of E-learning course trainees about their contentment about distance educational process was conducted. The questionnaire contains three kinds of questions: evaluation of distance learning organization, evaluation of electronic teaching materials quality and evaluation of trainees' survey. Each trainee should evaluate convenience and comfort of work with educational site, quality and completeness of communication with colleagues and administrator of educational process by five-point scale; to draw the conclusion about completeness and quality of electronic teaching materials.

The analysis of questioning results has shown that almost all participants expressed satisfaction from web-site, access to it, service information on a web-site and work with them the manager of educational process. Trainees practically had no claims to quality of teaching material on a distance learning web-site.

Gradually in process of training students procedure satisfaction at the university. completely adapt to distance learning form, therefore they evaluate efficiency and quality of E-learning course at the end of training higher than at the beginning. It should be noticed that satisfaction about discussion of problems at a forum increases to an end of studying (4,82 points at the end of studying contrary to 3,29 points at the beginning). Similarly, satisfaction from dialogue with colleagues at the end of studying was estimated higher than at the beginning (4,86 points contrary to 3,9 points). In process of studying trainees understand how much given training can help with their professional work (4,45 points contrary to 3,71 points at the beginning). It is obvious that electronic discussions have appeared quite comprehensible for trainees and have allowed to acquire better a

teaching material and to manage their studying more effectively. At the average managers have evaluated E-learning distance course to the 4,86 points and are assured that it would be rather useful for their colleagues to study on similar E-learning course (4,86 points). Not only managers' evaluation of this program is an evidence of successful work of network corporate university, but also positive comments from corporate publications. The majority of these managers had career development.

### **DL Education on Communication Engineering and Computer Science**

Perhaps, any sector of Russian national economy wasn't so shocked revolutionary over the last ten years, as telecommunications one. In technical extension of this sector there were five qualitative leaps: the element base of equipment was replaced (instead of lamps and transistors there were digital very large integrated circuits); principles of equipment operation have changed (the outmoded analog principle was replaced by modern digital one); principles of communication networking have changed (instead of slow switching of channels there was a superfast switching of packages with speech and video information); the transmission medium has changed (instead of electric signals transmitting by metal conductors light beams on optical fibers are transmitted); automated control systems of networks have been introduced.

In this connection before sector of telecommunications still ten years ago a problem of mass retraining of the technical and administrative personnel of sector was set. There would be a threat of «a personnel collapse» without solving problem in sector.

Since 2000 in Siberian State University of Telecommunications and Information sciences the corporate distance university functions [4]. Employees of the telecommunication companies and corporations can graduate distantly on telecommunication, information and economic specialties from the corporate distance university. It aims its educational services at telecommunication sector of the Russian economy, and also the CIS countries. A necessary condition for the Internet-learning organization is availability of a Web-server, database and control system of learning at the university.

Support system for e-learning at the workplace fulfills functions which include design of learning courses, teaching of students using the Internet, management of training process, support of e-library. In the process of e-learning organization three categories of users take part. They are students, teachers and administrators of training process. The support system for e-learning at the workplace provides communi-

cation among users and administrators of training process.

Learning courses developed by teachers get archived and are stored on the server. The database server is used to manage e-learning database which contains data about students, teachers, managers, curricula, learning specialties, subject, learning progress and teachers' reviews. The Web-server provides access to e-learning recourses for all categories of users. The Web-server's functions include publishing of information, reference and learning materials; access to the database and storage of learning materials. The server of a remote laboratory allows students to work with devices and equipment in remote access mode. The storage of student's works includes all works performed by students and sent by email as archived files. In order to send student works and information teachers and managers use a special mail service. Automated workplaces for students, teachers and e-learning administrators are workstations where browsers provide access to e-learning recourses.

The main functions of the support system for e-learning at the workplace, which ensures students' training process, starts with student identification, which is made by entering a login and a password. If the identification is done successfully, the student gets authorization to information and learning materials of the present semester. Support system for e-learning at the workplace provides students with administrators' and teachers' contact information; allows to send emails; gives recommendations how to work with Microsoft Office and archiving programs, which are used in e-learning; provides students with access to e-learning curricula, tutorials and e-learning forum.

The function «copy of learning courses» enables students to download an archived file with learning materials of the selected subject into own PC. Once the file is dearchived, students get a local mini-website, which contains all necessary materials for successful learning. The function «sending of performed works» enables students to send files with performed learning works to the e-learning server in order to get registered in the database and to place their learning works into the storage of student's works. The student's work stored on the server becomes available to a teacher for checking and to an administrator to control training process. As it is very important for students to carry out constant control of their learning progress,

the system includes «monitoring of student's progress».

Functions of the support system for e-learning at the workplace for to deal with teachers are the following: once being identified, the teacher gets access to e-dean's office, where the teacher may get the list of student's works assigned for a concrete subject. The e-dean's office's page contains filters, which allow a quick search for the certain student's work using such search criteria as student's name, surname, number of his/her group, subject name, category of a student's work (all, checked, unchecked). Every line of the list contains data of one student's work including links to a student's email, a file with performed work and a student's personal details. The button «check» is used to open the page enabling to make a revision and send it to a student. The review and enclosed file are saved in the database and in the storage of student's works. The database also stores grades given by a teacher and as a result, students can see their grades.

E-learning via the Internet becomes more and more appealing. The Siberian State University of Telecommunications and Information Sciences (SibSUTIS) has been using e-learning technologies for higher education services almost about 10 years [4, 5]. The number of students studying at the workplace by distance is steadily increasing. The students, who are graduating, with the distance learning course, 23% of graduating students are fully satisfied; 58% of graduating students are mainly satisfied and only 19% of graduating students are partially satisfied with the distance learning course. It is necessary to notice that there has been no unsatisfied graduating student this year as well as previous years.

#### References

1. Krouk B.I., Sitnikov S.G. Intergovernmental DL Training Center in Telecommunications, Information Technologies, Economics and Business for CIS Countries // Human Recourse Development published by BDT ITU. – 2002. July no 88. – P. 25–33.
2. Krouk B.I., Zhuravleva O.B. DL Training Center in Telecommunications for CIS Countries // IEEE Communications Magazine. – 2003. – Vol. 41, № 7. – P. 31–32.
3. Krouk B.I., Zhuravleva O.B. Distance Learning Program to Raise Skills of Managers from Russian Telecommunication Enterprises // IEEE Communication Magazine. – 2004. – Vol. 42, № 5. – P. 30–31.
4. Krouk B., Zhuravleva O. Dynamic Training Elements in a Circuit Theory Course to Implement a Self-Directed Learning Process // IEEE Transactions on Education. – 2009. – Vol. 52, № 3. – P. 394–399.
5. Kruk B., Zhuravleva O. Corporate E-Learning Strategy // International Journal of Advanced Corporate Learning (IJAC). – 2010. – Vol. 3, № 4. – P. 41–44.

## MODERN APPROACHES TO ENGINEERING EDUCATION

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The authors of this paper explore alterations in subject – object relations between a teacher and a student in new educational paradigm when students direct their own learning-cognitive activity. When implementing new pedagogical technologies such as distance-learning, e-learning and m-learning, one of the major problems for teachers is to create educational environment that allows students to direct their own learning-cognitive activity. Different information barriers impede travel of information flows and their perception. These barriers reduce potential value of learning material. In new educational technologies (distance-learning, e-learning and m-learning) students receive strong psychological support through their communicative activity. New educational environment brings about new learning situations and relations.

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Pedagogy, as the science of education, learning and human development, originates from the ideas of Demokrit (460–370 BC), Socrates (469–399 BC), Platon (427–347 BC) and Aristotle (384–322 BC). Erasmus Roterdamus (1465–1536) is considered the first teacher and John Amos Comenius (1592–1670) is the first didact.

Until recently classical pedagogy has dominated in education. Classical pedagogy based on didactic of John Comenius when a teacher being bearer of great volume of systemized information conveys this information to a student and the student has to master this considerable volume of knowledge.

Rapid development of the Internet and multimedia has given a strong incentive to the appearance of new pedagogy and new pedagogic technologies. The use of internet and multimedia technologies in education is becoming more and more popular among the majority of population. The advantages of computer – or web-based education over traditional classroom education include the ability to: study while at work, remain in one location with no need to travel; plan own training, attend courses across physical, political, and economic boundaries. In turn, higher education institutions obtain modern educational tools at their disposal. Distance-learning, e-learning and m-learning provide individualized learning, individual oriented approach and humanization of learning.

This paper presents three important aspects of a modern educational paradigm. It describes new subject-object relations established among students and teachers who are involved in learning process on condition that of self-directed, individual-oriented and student-centered teaching methods are used; analyses issues of pedagogic value and utility of electronic educational environment; addresses issues of information interaction among students and teachers in new educational environment.

Educational need includes two components: need to receive information and need to

learn the surrounding world, which are not one and the same. Satisfaction of information need relates to obtaining and use of information, but satisfaction of cognitive need relates to obtaining and use of knowledge. Analysis of the information – knowledge correlation allows one to understand that information activity of the individual relates to his/her perception and use of this information in the process of communication, while cognitive activity means creative activity, which is aimed at obtaining of new knowledge. The formation of the subject's or the student's thesaurus results from the activity which aim is to meet information and cognitive needs. The individual, who is in conscious action of cognitive activity, has to direct his/her learning cognitive activity.

Student's self-direction of learning cognitive activity has become important since internet-education, distance-learning, e-learning and m-learning emerged. In these models of education the student is to become a true subject of learning activity and at the same time the student is to remain the object of the teacher's control. The student, as the subject, should form his/her learning cognitive activity, but this activity is to be realized in the frame of the model developed by the teacher.

The goal of Self-Directed Learning (SDL) is to develop the student personality when he/she masters knowledge in the concrete subject field. Personal development means step-by-step action from learning under the teacher's control to self-directed learning and from SDL to self-learning. As a result abilities for self-education, self-discipline and self-developments are formed. The essence of SDL is that the teacher should direct the process of student's self-learning activity formation (Ellis H.J.C., 2007; Splitt F.G., 2003; Kruk B., Zhuravleva O. 2009; Kruk B., Zhuravleva O., 2010).

The term «interaction» implies counter activity: actions like «object-subject». The moment of interaction happens when the subject, who conveys information, receives informa-

tion about the object's state via feedback channels and, what is most important, the subject learns of the changes, which occur in the object in the result of interaction. Feedback allows the teacher to bring about improvements into methods and means of teaching.

Learning and education mean control of human consciousness. Mechanism of learning and education is subject-object relations in info-interaction. Objective of learning and education is to teach an individual to solve nonstandard problems, which require unconventional methods of approaching and this, in turn, supposes high level of intelligence and abilities to think independently. The main objective of any learning is to form student's intelligence and prepare the student to a certain intellectual (professional) activity. Intelligence cannot develop out of info-interaction. The analysis of subject-object relations show that this activity is based on the following circumstances. Cognition process occurs due to specific mechanism which is termed information interaction. Info-interaction is founded on subject-object relations established between the subject (teacher) and the object (student). Object's activity depends on subject's activity: the teacher may suppress student's cognitive interest or on the contrary, develop student's interest to the level when high intellectual abilities are formed. If there is a feedback channel from object to subject, it allows the subject to improve the object's learning-cognitive activity and create conditions for SDL.

When the conditions needed for SDL created, the most essential thing for the object is ability for self-direction, self-control, self-education and self-development. In this case, the student is transformed into a true subject of learning-cognitive activity; furthermore activity of the student's information interaction is considerably increasing. Only an active person proving to be an individual in learning and influencing on the whole learning process and on progress in learning may act as the subject of learning-cognitive activity.

One of the major problems for teachers is to create an educational environment that allows students to direct their own learning-cognitive activity (Garofalakis et al., 2002; Gick, Holyoak, 1987; Glaserfeld, 1989). Self-directed learning assumed particular importance at the time when on-line learning made its appearance (Evans and Sabry, 2003; Dearholf et al., 2004). According to the theory of self-directed learning, the student builds his/her own learning and cognitive activity within the framework of the model developed by the instructor (Petridis et al. 2003).

In e-learning information-educational environment acts as a tool of subject-object in-

formation interaction meant to form student's fund of knowledge – thesaurus, which is enriched during the life and is a basis of any kind of activity. An individual's ability to use accumulated knowledge in order to achieve a certain objective testifies to his/her intelligence. The student's information interaction with training material underlies formation of intelligence and knowledge, i.e. the student's thesaurus. Therefore it is very important to investigate axiological characteristics of e-learning environment.

In traditional interpretation the value means ability of an object and a thing to satisfy some requirements of an individual. The more the individual is satisfied, the higher the value is. Similar to this, the characteristic of information-educational environment allowing students to use this environment to achieve set objectives act as pedagogical value. It should be noticed that one and the same information-educational block can have different pedagogical value from the point of its use for various learning objectives.

Another axiological category, namely, pedagogical utility of teaching material is closely associated with the category of pedagogical value. Pedagogical value is a more general characteristic than pedagogical utility. There are two categories of value: potential and actual. It is possible to notice that pedagogical utility is a actual pedagogical value. In other words, the information, which is useful to achieve a learning outcome, is of actual value.

It is necessary to understand clearly that the degree of actualization of pedagogical value depends on a number of factors and personal characteristics of the student, i.e. the object of information interaction. The larger fund of knowledge and the more complex thesaurus the student possesses, the more successfully the student applies the information received in order to achieve a learning objective or, in other words, the more useful this information is for the student.

The pedagogic value of information-educational environment is not an invariant axiological category. Horizontal and vertical alterations are typical of information-educational environment. Horizontal alterations mean that pedagogic value of information-educational environment is acknowledged not only by individuals or small social groups, who benefit a lot from the teaching material, but by the general pedagogic public and many students. Vertical alterations of this category lead to increase or decrease of pedagogic value of information materials. Upward motion has a subjunctive meaning and relates to the information updating by the doer and downward motion has an imperative meaning and relates to the process