

Problems Related to Teaching Informatics at the University of Defence

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Abstract: - The paper deals with the University of Defence, its objectives and place within the educational system of the Czech Republic. The Department of Automated Command Systems and Informatics as well as its task in formation of the students' computer skills are mentioned. Applied approaches and the earliest tasks for the general informatics basis are introduced. A good deal of attention is paid to the subject "Computer networks".

Key words: - Informatics, computer technology, computer networks, programming, CIS, security, UoD, FMT, CAF, MoD

1 University of Defence and its place in the educational system of the Czech Republic

In accordance with University Law, the University of Defence (UoD) in Brno is a state university. It was established on September 1st, 2004 and included three former military colleges – Military Academy in Brno, Military University of the Ground Forces in Vyskov and Jan Evangelista Purkyně Military Medical Academy, in Hradec Kralove.

The main goal of the University of Defence is the dissemination of learning, development of thinking and independent scientific research in the areas vital for the security of the Czech Republic and accomplishment of its allied commitments. The spheres of action at the UoD are aimed at education and training of military professionals for needs of the Czech Armed Forces (CAF) and scientific activities in favour of the Ministry of Defence (MoD) department.

Educational and training processes at the UoD are primarily focused on military. Students are trained to be independent, creative, persevering, devoted and well-disciplined. The branches of human cognition are taught in relation to their military applications. Nevertheless, the graduate study programmes are versatile and offer their broad lifelong use in professional as well as civilian life.

The UoD provides education in accredited study programmes and in branches which are structured to ensure academic education in accordance with both the needs of the CAF and requirements for use of acquired knowledge in civilian institutions. The university

offers accredited education in bachelor and master programmes as well as in doctoral studies.

It should be emphasized that compared to civilian schools military education has a few important differences. It is relatively small, for example, the numbers of graduates in one specialization reaches by a few dozens. This situation is caused by "customers' demands" – i. e. by the MoD department which keeps to the CAF figures planned. Bearing in mind future graduates' positions, the thematic content of subjects is to be partially tailored for work experience.

To sum it up, the MoD department requires those graduates who are apt to carry out their assignments in an independent and prompt way. In most cases the graduates are assigned to basic special positions, rarely to basic command ones.

2 Department of Automated Command Systems and Informatics (ACSI)

At the UoD, formerly the Military Academy (MA), graduates of various specializations have been educated. They will be specialists in the fields of telecommunication, automatic control and regulation, electronic computers, communication and information systems (CIS). At present the CIS specialists are prepared at the Department of ACSI of the Faculty of Military Technology (FMT).

The Department specializes in problems of operation systems, programming languages and programming, architecture and construction of digital computers, information systems and decision support, computer networks, computer security, diagnostics and

maintenance of computing facilities, simulation technologies and combat action modelling.

The research and knowledge-based activities are focused on the field of information systems and security, distance education, operation systems and software design, simulation and computer modelling and the application of microchip computers in military systems. Since 2004-2009, the department has been engaged in the research project titled "The Development, Integration, Administration and Security of CIS within the NATO". Further, its personnel participate in the defence research tasks and is a grant winner in the fields mentioned above.

Department experts are members of NATO working groups in the field of information systems, distance education and computer modelling. Moreover, they are members of science boards of the Faculty of Military Technology, the University of Defence, Czech Technical University in Prague, Technical University in Brno and they work in special scientific bodies on the governmental level of the CR and of the MoD department.

It is useful to emphasize the crucial importance of security problems, reliability, stability, recovery system operations after accidents etc. The problems of computer networks are nearly always connected with the security but it might be the topic of a particular article.

The department recommends the continuous development in informatics studies for all students with regards to requirements specified at NATO Prague Summit. One of the topical NATO drafts is Network Enable Capability which includes an integrated network interface and security of troops on a battlefield.

Our graduates are engaged both in the scope of CIS administration of the MoD and permanent networks on the country's territory as well as in field conditions including foreign missions.

It is of vital importance to prepare them so that they are able to tackle challenging situations independently and improvise if necessary.

3 Informatics teaching at the Military Academy and the University of Defence

Graduates from various types of secondary schools attend the Military Academy in Brno, since September 1st 2004 the University of Defence. Their knowledge and practical skills of computer technology and programming often differ considerably. During the winter term, the first grade students are expected to acquire a background in informatics that will be

gradually developed according to needs of their study branches and specialization.

3.1 General informatics framework of military professional

A background informatics of a military professional at the UoD is linked with the subject "Computer Technology and Programming" (CTP). In the course of year 2004 a project on the CTP objectives in relation to education was worked out. Its educational goals were as follows:

- The main objective is to teach the subject CTP uniformly according to elaborated background papers (study support for students), to update the subject content and teaching methods and to confer classified credits objectively so that students can see that their evaluation is proper.
- Due to a great number of study groups and teachers and the impossibility of wider integration mainly in laboratory exercises, it is necessary to standardize content of the lessons so that different substitutes who teach in one group may know the main objectives of the lessons. For each of the problematic chapters, the students must have an opportunity to use texts of a very high quality. The teachers who specialize in particular technical fields have elaborated these texts. It is a matter of great importance to update the study texts with standardized tasks and exercises which can decrease the number of contact lessons. It enables young teachers to go by sophisticated methodology elaborated by experienced co-workers.
- At the end of each term, an assessment of technical, methodological and organizational opportunities of management and teaching are carried out. Both students and teachers fill in the questionnaire focused on content and the subject form. The results and statistical figures are analysed and, therefore, the teaching and methodology should be kept up-to-date.
- A referee, chosen from the teaching staff of the department, is responsible for the introduction of agreed rules into the teaching process.

The project has been solved in accordance with the concept that was agreed upon by all the staff of the department at the beginning of 2004. The main aim of prepared materials was to modernize the content and methods of the subject CTP.

Basic teaching objectives included in the approved concept were as follows:

- To inform the students about basic technical terminology of the subject, essential principles of

typical computer software and peripheral equipment.

- To make the students acquainted with the possibilities of Intranet at the UoD and the Internet. To teach the students how to use basic software tools for computer nets implementation. To learn them to follow computer security regulations and the appropriate treatment.
- To teach the students how to search algorithms and to apply selected operations beyond the limits of data structures. To teach them skills and lifelong habits for the application of specific programming language which is MS Visual Basic.
- To make the students acquainted with information systems of the CAF. To learn them to design applications in the specific system of the operating database which is MS Access.
- To inform the students about the principles of computer simulation and its development in the CAF. To make them acquainted with special simulation system which is ModSAF in the CAF. To arrange the ModSAF system demonstration in the National Centre of Simulation and Trainer Technologies (NCSTT).

The subject CTP is planned for 60 lessons and since the winter term 2004/2005 it has been divided into five thematic blocks which are presented in the table below:

1.	Rudiments for Hardware - computer components and peripheral equipments	4 lessons
2.	Computer Networks - Intranet of UoD, e-mail - Internet, its sources and exploitation - computer security	20 lessons
3.	Algorithms and Programming - principles of algorithms and data structures - programming language which is MS Visual Basic.	16 lessons
4.	Database Management Systems and Information Systems - terminology, information systems CAF - project creation in MS Access	14 lessons
5.	Principles of Computer Simulation and Specialized SW - principles of computer simulation, system ModSAF demonstration - special SW, division and samples	4 lessons

For required quality of teaching and particular desired outputs in the five fields mentioned above each of the teachers involved in the project was responsible for all the requirements (written materials for the students, teaching methods) of the corresponding fragment of the subject.

The teachers included into the project worked out the following tasks:

- To draw up a part of the subject study schedule (SSS) relating to the teacher's specialization, school premises and material support.
- To define particular educational output concerning the questions given.
- To make a list of applicable information resources (both printed and electronic ones) for the specific subject.
- To define detailed content of particular lessons according to the subject study plan.
- To elaborate suitable study materials for both students and teachers.

In the second half of 2004, materials preparation for a new subject – Informatics – was carried out. The department could offer this subject as an option instead of CTP starting from the new academic year 2006/2007.

Currently, the students have had written study materials for all the five parts of CTP at their disposal. For the first part “Rudiments for Hardware” and for the fourth one “Database Management Systems and Information Systems” there are new printed lecture notes. For the second part “Computer Networks”, there are only electronic materials so far but their printed version will be published at the beginning of 2005. For the third part “Algorithms and Programming”, the printed materials were already issued in 2003. For the fifth part “Principles of Computer Simulation and Specialized SW”, there are materials in the electronic version.

An objective project assessment will be feasible at the end of the winter term. Questionnaire methods will be used. Acquired data together with credit results might show weak points that may be eliminated in the next academic year.

3.2 Acquired work results in preparing proposal of the new subject – Informatics

In November 2004, required preliminary work concerning the new subject – Informatics – was finished. The teacher team's goal was to develop special modules that would satisfy the main interest of the departments of the University of Defence. From the modules offered (B – basic, E – extended, C – complete), it will be possible to compile the subject of

informatics in a more detailed way according to special needs of particular study groups.

Currently, the department experts have designed 18 modules:

- Support of decision-making process – module B
- IS and OTS in the MoD and the CAF – module B
- Interoperability within NATO – module B
- Database and information systems – module B
- Computer software and options of its use – module B
- Computer graphics – module B, E
- Principles of algorithm development and programming in Pascal language – module B, E
- Principles of algorithm development and programming in Visual Basic language – module B, E
- Principles of algorithm development and programming in C language – module B, E
- Principles of algorithm development and programming in Delphi language – module B, E
- PHP – www applications programming – module B, E, C
- Principles of computer typography – module B, E
- Principles of Windows 2000 administration – module B
- Principles of XML – module B
- Computer networks – module B, E
- Principles of UNIX and Linux – module B, E
- Specialized software and computer simulation – module B, E
- Computer Hardware – module B, E.

The following tasks within the run-time paper are as follows:

- To draw up questionnaires for the subject of CTP before the end of the winter term 2004/2005. To assess and analyse acquired data and entire information from both students and teachers and discuss them within the teaching staff or methodological sessions of the department. The results to use for the subject study schedule (SSS), study materials and methodology textbooks for teachers.
- To improve the quality of the present study materials in the course of the summer term and to make them accessible on the Study Portal of the University of Defence.
- To compile a syllabus for all the drawn-up modules for the new subject of informatics.

3.3 Computer networks and their place in the profile of the graduates of the University of Defence, specialization CIS.

Besides, general informatics and other common subjects, the students attend lessons related to their specialization. As an example, there is a description of computer networks teaching that began in the early 80's of the 20th century. First of all it appeared in the subject of Automated Command Systems. Then, in the late 80's the special subject of Computer networks has been taught in 180 lessons (regarding the integration of study specialization the number of lessons will be reduced in the next term). The subject content has been changing in accordance with cognitive development and practical options in order to achieve a maximum benefit. The students are obliged to take the exam in computer networks.

Both theoretical and practical parts of teaching reflect the needs of the future appointment of graduates. Relevant teaching content is connected with the current level of knowledge in the given areas and corresponds with the requirements of future graduates – military professionals.

For better orientation a brief list of topics might be presented:

- Proceeding standards LAN, WAN, WLAN
- Standards of cabling systems and structured cabling
- Project network plan procedure and documentation situation
- Principles of cable installation and structured cable routes
- Multilevel network projecting
- Routers and switches, their configuration principles, backup
- HDLC, PPP, Frame Relay and ISDN protocols
- TCP/IP protocol family (IPv4, IPv6) including application layer
- CIDR and VLSM computations
- Switching methods, Spanning Tree algorithm and its versions
- VLANs, trunk setting
- Theory of routing, RIP, OSPF, IGRP, EIGRP and BGPv4 protocols
- Routing in multicasting networks
- Testing and network diagnostics, network management, SNMP protocol
- Problems of the quality of service (QoS) within IP and ATM, SLA definition
- MPLS, DifServ and RSVP technologies, traffic engineering, computer-aided quality assurance.

Some of the practical lessons where unavailable technical equipment is required sometimes take place in external workplaces. It is often rather difficult because military students, in comparison with civilian ones are not so attractive for commercial companies that cannot select prospective employees among them.

Both in the past and at present, especially in favour of the MoD department, a good number of research and science projects on computer networks and their security was solved. The projects were aimed at the assessment of the next development of the area and served as project documents for the communication infrastructure modernization within the MoD department.

Some of the department teachers have gained grants and have been involved in research projects in the area of computer networks application beyond the scope of the MoD department. As an example, the CESNET development fund project can be given. The project deals with a protected videoconference system operated within the Internet.

3.4 Supplementary possibilities of computer networks education at the University of Defence.

The university is involved in the education project - Cisco Network Academy (CNA) – for network specialists. Establishing a regional training centre at our university has enabled to furnish department laboratories with needful technical equipment. The project facilitates data communication topics to be incorporated into regular education. This education has a practical orientation and, therefore, it enhances theoretical knowledge.

How does the study proceed? It combines lectures, tutorials, distance education and e-learning. Practical activities are considerably emphasized. The Internet enables access to the central web server that contains a wide choice of study materials in English and other world languages, amended with helpful references. With the help of Internet lectures, tutorials, virtual classes and discussions may be organized.

In the standard education the students go through particular educational sections individually. In most cases these sections contain animated pictures or soundtracks. The study materials include instructions for laboratory exercises and references to other additional sources. At the end of each chapter the students can check their knowledge in a test. Continuous and final tests are placed on the central web server. The centrally kept entire agenda is accessible to both students and their teachers.

Participating in CNA program our department gained several considerable benefits. First of all it is laboratory equipment and good access to information sources for the students of the university as well as participants of MoD department courses. Moreover, there is a good cooperation between the University of Defence and other universities in our country and abroad.

The basic CNA course consists of four sections (semesters) but their length may vary according to specific conditions, for example, entrance requirements or study effort. After finishing those sections the students acquire knowledge at the level of the CCNA qualification degree (Cisco Certified Network Associate). The study includes a large number of topics that is up-dated continually.

4 Conclusion

The ACSI department pays much attention to the subject of “computer technology and programming” and the offer of the new subject of “informatics” because the knowledge and practical skills of military professionals in the spheres of information and communication technologies form an integral and important component for current military practice. Only careful monitoring of information development technology trends and quick feedback in educational and training program can ensure the achievements within the CAF.

The accepted strategy of the NATO information superiority agreed on the Prague Summit will be implemented within the scope of Network Enable Capability. The military professionals must be properly prepared for the successful implementation of the project.

The authors of the paper consider the following period of military professionals training to be of crucial importance and to highlight the clever and efficient use of progressive educational methods especially e-learning and distance learning.

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