Software Engineering Education in the Ukraine: Towards Co-operation with Finnish Universities

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Abstract

This paper presents positive experiences obtained by Kharkov State Technical University of Radioelectronics (KhTURE) in software engineering education. Economical problems postpone the beginning of the Information Society program in the Ukraine, but now it has good possibilities to benefit the best experiences of western universities to develop education to the European level. This paper presents analysis of main trends and problems in education with their cultural aspects. The paper discusses ideas of developing education in Ukrainian universities by strong co-operation with Finnish universities. The results of co-operation between KhTURE and University of Jyvaskyla are shortly presented. The paper also discusses the main goals of education which are to educate specialists who are able: to serve at strategic positions of the national Information Society program; to teach in Ukrainian universities in the up-to-date areas of computer science; to co-operate in international research and commercial projects. At the same time when these advances in education presuppose remarkable funding it offers great potential opportunities to participating partners.

1 Introduction

Ukraine is a republic located in the Eastern Europe and a founding member of the Former Soviet Union. With the total area of 603,700 sq. km and population of 51 million, Ukraine is the second largest country in Europe after Russia.

Traditionally Ukraine has high level in science and education. Current economical problems, connected with disintegration of the former USSR and

Chernobyl catastrophe, postponed the initiation of Information Society program in Ukraine. The ongoing process of infrastructure development requires solutions of several problems also in the area of education. Ukrainian universities have their own positive experiences but to become international requires closer contacts with western universities and companies.

Economical situation is now quite difficult in Ukraine. State owned enterprises are in deep crisis and there hardly exist software markets. It is very common that software is used without legal licences nowadays. However the number of new, especially private, enterprises grow quite fast and also the number of rich persons who are able to buy their own computers is growing. Thus the need for application software is also rapidly growing. At the same time most persons are computer illiterate and very few persons are able to use western languages. Software engineers usually develop tailored application software for a customer enterprise (mostly small information or accounting systems) or work as enterprise staff to use foreign software (mostly text processing and graphics). In this situation the best traditions of Ukrainian higher software schools are not completely exploited.

Information Society program has been started in the Ukraine. First official document: "National Information Society Program of the Ukraine: Urgent Steps for the period 1996 - 2000" has been signed in Kiev at 30.10.1995 by the head of Agency for Information Society Problems attached to the President of the Ukraine. The Document notes that current level of the Ukraine in the area of Information Society development is unsatisfactory (2 - 2.5 % comparably to Western countries). It also includes the analysis of factors that are slow down processes of successful development of the Information Society Program. The budget funds are planned to support: development of the National Infrastructure; development of the National Telecommunication System; information support development of the strategic directions of the State interests, security and defence, social sphere. The urgent steps are to develop the base of standards and laws for Information Society Program of the Ukraine towards to be co-ordinated with International standards.

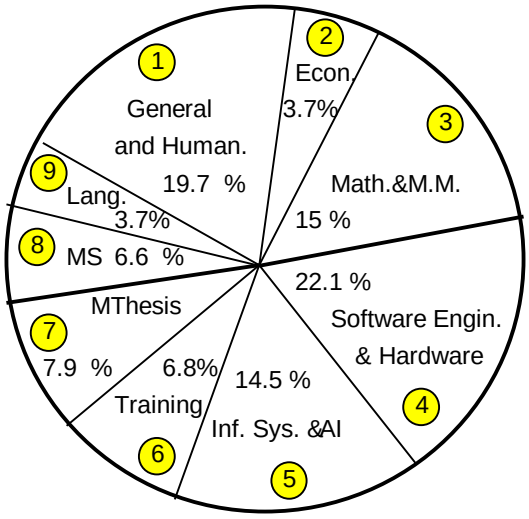
Kharkov with 2.5 million inhabitants is one of the biggest scientific and industrial centres in Ukraine. KhTURE is one of the main universities educating specialists for the Information Society program of Ukraine. Faculty of Computer Sciences is one of the leading faculties in Ukraine and it has four specialities and twelve scientific schools for post-graduate studies. It develops curricula, methods, and teaching medium that are applied in education at the similar faculties of all other Ukrainian technical universities.

This paper discusses experiences in software engineering education at the KhTURE and developing it towards the western standards. The paper also discusses some of the main problems in the education. We also survey experiences of co-operation between the KhTURE and the University of Jyvaskyla in Finland. The paper also discusses the ongoing education development project, which is focused on co-operation in software engineering education between the KhTURE and Finnish universities and companies.

2 Traditional software engineering education in KhTURE

In this chapter, we describe the software engineering curriculum used in KhTURE. Then we shortly present the experiences gained and last current trends that should be taken into account in the curriculum.

Traditional orientation in software engineering education at the KhTURE is to provide students with wide skills in programming and deep knowledge of mathematics and artificial intelligence. The goal of this education is that students will be able to do scientific research, to participate national conferences, to produce articles for magazines, and to participate software exhibitions and competitions. The structure of 5-year software engineering education in Ukrainian universities is presented in Figure 1, where in the table Ucu designates "Ukrainian credit unit" (1Ucu = 54 hours of student work).



#	Name of Block	hours	Ucus
1	General + Humanities Studies	2025	17.5+20
2	Studies in Economics	378	7
3	Mathematics and Mathematical Models	1539	28.5
4	Software Engineering + Hardware	2268	32+10
5	Artificial Intelligence + Inform. Systems	1485	19+8.5
6	Educational & Industrial Training	702	13
7	Master's Thesis	810	15
8	Military Studies	675	12.5
9	Language Studies	378	7
♦	The Degree Total	10260	190

Figure 1. Traditional 5-year software engineering education in the Ukraine

This curriculum has been successfully used in KhTURE during last five years to educate 250 high quality software engineers. However the beginning of the Information Society program requires also other type of Computer Science specialist. These new requirements presuppose some essential changes both in the structure of the curriculum and in the contents of some courses. For example, the Information Systems block needs to be totally developed, the contents and amount of economic studies should be reconsidered, language education should be improved, and even the traditionally strong area of Artificial Intelligence should include new modern topics.

Current problems in organising education include the small amount of computers available, the absence of Internet and WWW networks, the availability of legal software, the lack of new especially western books, the small amount of teachers with economic- and business-orientation, and the modest knowledge about the organisation of co-operative work.

Previous experiences and results of software engineering education have shown needs to develop software engineering education to support Information Society program of the Ukraine. The main recent trends that effect are:

1. Changing markets. Nowadays acting in markets requires finding customers, negotiations with them, advertisements, markets forecasting, and so on. This situation is very different compared to the earlier days when the only customers were large state owned enterprises.

2. The fast progress of Information Society program. Ukraine needs more and more highly educated specialists to develop this program. It is reasonable to exploit experiences in the countries that are ahead with similar programs.

3. International contacts of Ukrainian software engineers and software companies are growing. This means that software engineers need better qualifications for international operations.

3 New computer science curriculum

In this chapter, we discuss about the requirements that current trends set to any new curriculum. Then we introduce the structure of the new curriculum planned. We end up this chapter focusing to the most essential differences between the traditional and the new curriculum.

The recent trends, above, have directed the new computer science curriculum under the title “Intelligent information processing and decision making systems”. From the above trends, one can develop several new requirements to the new curriculum. Among these there are:

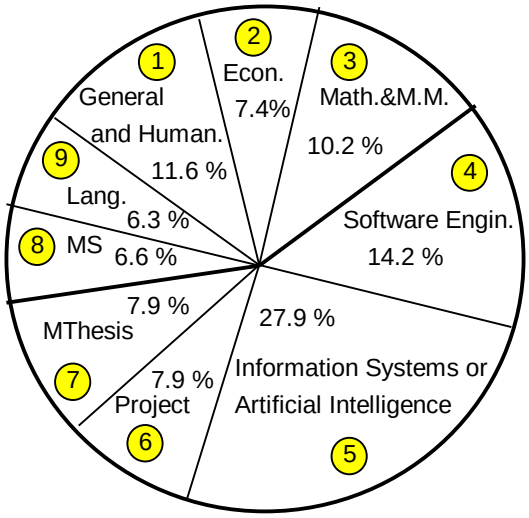
1. Changes in markets require so that technical education has also to include enough credit units in economics, communication and negotiation skills, information management, and other western economy oriented skills.

2. Development of Information Society program needs persons who are competent to exploit up-to-date experiences of countries that have had similar

programs. Education has to include enough global society, organisational, and human aspects of information systems and their culture oriented features.

3. The growth of international contacts anticipates that education has to offer better qualifications into international co-operation. These include abilities to co-operate with foreign specialists from universities and companies in joint research projects and exchange programs. This requires more advanced level of education in foreign languages and cultures, better qualifications in multinational co-operative work, and international culture to use legal software.

Of course, the goals of the new curriculum include best of the goals of the traditional software engineering curriculum as: the ability to develop research-oriented intelligent software and tools, the good ability to use mathematical notation and theories, the ability to act as a teacher of software engineering in Ukrainian university, and the ability to act as a researcher in the area of artificial intelligence. The new 5-year degree structure is presented in Figure 2.



#	Name of Block	hours	Ucu
1	General and Humanities Studies	1188	22
2	Studies in Economics	756	14
3	Mathematics and Mathematical Models	1053	19,5
4	Software Engineering	1458	27
5	Information Systems or Artificial Intelligence	2862	53
6	Systems Development Project	810	15
7	Master's Thesis and Seminar	810	15
8	Military Studies	675	12.5
9	Language Studies	648	12
♦	The Degree Total	10260	190

Figure 2. New computer science curriculum with a choice of main speciality

The new curriculum of Figure 2 includes the following main changes:

1) economical education is extended twice and the contents of it takes into account changes in Ukrainian economics towards the market orientation;

2) mathematical education has still essential role in the curriculum but it is also improved by developing the contents of some courses, for example, statistics, symbolic mathematics, and optimisation methods;

3) the curriculum includes choice of main speciality of two ones: Artificial Intelligence and Information Systems. The traditionally high quality AI education will be strengthened by additional up-to-dated courses. The block of Information Systems courses is totally renovated. It will include the following courses: Information Management, Tools of Personal and Group Work, Object-Oriented Development of Information Systems, Designing Information Systems, Advanced Course on Developing Information Systems, Theoretical Foundation of Information Systems, Strategies for Information Technologies and Business Development, Computer-Supported Co-operative Work, Management Strategies for Information Technology and its Assessment;

4) the Educational and Industrial Training, which has previously been shared through the whole 5-year education using summers, has now been reorganised into the System Development Project according to the best experiences of the Department of Computer Science and Information Systems of the University of Jyvaskyla;

5) the language education is extended almost twice and the language studies are planned to be essentially improved by modern methods and students' exchange.

In the new curriculum software systems will to be developed and used during many courses as: in general studies small information and expert systems will be included, in economic studies accounting and other economical systems will be used, in mathematical studies training systems will be used, in artificial intelligence studies some research prototypes will be produced, and most of M.Sc. thesis will also include development of software that implements or verifies the ideas presented. Students will also be supposed to produce and present software in workshops, conferences, and exhibitions as previously.

4 Co-operation with Finnish universities

In this chapter, we describe co-operation between KhTURE and the University of Jyvaskyla so far. Then we discuss plans and ideas concerning future co-operation in research, in post-graduate education, in graduate education and in student and teacher exchange.

The research co-operation between the Department of Computer Sciences and Information Systems, University of Jyvaskyla and Metaintelligence Laboratory, Software Department, KhTURE is going on since 1991 and it is supported during 1996 by the Centre for International Mobility (CIMO). There was joint scientific seminar that took place in Kharkov and Jyvaskyla by turns.

Several common papers have been published in international conferences. Research was focused mainly in the area of knowledge representation, acquisition, and refinement with multiple experts.

From 1992 the International Summer School organised by the University of Jyvaskyla has acted also as co-operative working arena of researchers, teachers, and students of the KhTURE and the University of Jyvaskyla resulting the exchange agreement between the two universities. Docent, PhD Helen Kaikova developed the new curriculum in Finland during 1996 with support from the Ministry of Education of Finland. This ongoing curriculum development strives for closer co-operation in education. The new curriculum will be applied in the education of KhTURE at the beginning of 1997 in spite of the problems considered above. KhTURE is planning to develop its infrastructure and to organise distance education (lectures and summer schools for teachers and students). Fortunately the University of Jyvaskyla which is the main foreign partner of KhTURE has long experiences in the use of tele-learning facilities.

Preliminary discussions show that the image of new Ukrainian Computer Science engineer (abilities of quality software development plus mathematics and artificial intelligence) is in very good harmony with image of software engineer from Department of Computer Science and information Systems, University of Jyvaskyla (information systems plus economics). It was decided to organise joint Finnish-Ukrainian students' teams to prepare M.Sc. thesis and co-operate using equipment for teleconferences. It is supposed that results will be both in theoretical research area and software development up to installation of software product at the certain firm.

The KhTURE has certain reasons to co-operate with University of Jyvaskyla. The possibility for KhTURE students to have some part of education in the University of Jyvaskyla or through tele-learning is the first reason of co-operation. Another reason is the possibility to apply the best experience of western institutions in developing education in the KhTURE to international standards. Also the reason is to strengthen contacts of KhTURE with western institutions and companies and prepare specialists to participate joint projects. The possibility to obtain recent information about publications and conferences, to publish research results on the international level in co-operation with western researchers, is also the important reason.

The University of Jyvaskyla is also considering the co-operation with KhTURE as important and useful. The possibility to learn and apply the experience of education in KhTURE, establish contacts with teachers and researchers, is one such reason of co-operation with KhTURE. The possibility to teach students who are interesting in Ukrainian economics is the another reason of co-operation. Very important reason is the possibility to strengthen authority and popularity of University of Jyvaskyla through participation one of the largest Information Society programs in Europe. The possibility to develop in co-operation some new ideas and results and together define ways to apply them to Finnish economy, is also the reason of co-operation with KhTURE.

5 Co-operation with companies

Changes in computer science education try to take into account interests of Ukrainian and European companies and industries. Growing Ukrainian enterprises and their foreign partners are going to have an essential part of the fast growing information technology markets in Ukraine. Good planning of educational programs needs also specialists of enterprises. We evaluate these needs in connection with the current trends and their changes in future:

1) the ongoing process of change in Ukrainian economics. Its effects to the needs of information system support of companies are supposed to be huge. The education should clearly understand the needs of companies. KhTURE (the leading Ukrainian technical university in the area of software) will develop its education co-operating with local and foreign companies operating in the growing information technology markets of Ukraine. The choices made by the leading technical university through educational and research projects will have influence upon decisions made in companies;

2) the progress of the Information Society program of Ukraine. Ukrainian companies and even individuals will have very fast growing needs of hardware and software. Companies need to establish computer based information systems or update their old ones. Education to be successful has to be able to use products that will become in use. The educational use of hardware and software effects to the choices of products made in companies;

3) growing international contacts. Importing hardware and software does not need much knowledge about international contacts. However, if Ukrainian companies want to take part of global or even local information technology markets, then international contacts become essential. In education this means international contacts oriented attitude. KhTURE wants to help partners to build contacts through co-operative national and international projects funded by companies and other sources. KhTURE's infrastructure needs further investments to make electronic communication in everyday research and educational use. These investments are essential also for companies that are expecting well-educated specialists capable to international operations.

6 Conclusion

This paper uses an example of the leading Ukrainian technical university to acquaint the European society with situation in computer science education in the Ukraine. It also shows, how Ukrainian university is improving education towards strengthening co-operation with Finnish Universities and applying their best experiences taking into account local economical and cultural peculiarities. Authors are optimistically considering perspectives of Ukrainian computer science education and its effect to fast development of Information Society in the Ukraine. The going-on co-operation seems to be beneficial to both sides as well as to possible partners from industry.