Teaching Information System Technology in Partnership with IT Companies

Viljan Mahnič

University of Ljubljana, Faculty of Computer and Information Science, Tržaška 25, 1000 Ljubljana, Slovenija,
viljan.mahnic@fri.uni-lj.si

We describe an example of partnership between a university and some major IT companies – IBM and Microsoft – to teach a course on information systems technology. The course is taught in the fifth (final) year of the university undergraduate program when students have already mastered the basic theoretical knowledge of information system development. For this reason, the course content was restructured to pay more attention to practical experience and the learning opportunities available within the environment of professional industry. During the course, students get acquainted with IBM and Microsoft products and the tools that support the development of online information systems. Special attention is devoted to group project work, which is not just intended for the improvement of technical skills, but also for the aqusition of transferrable skills such as teamwork, management/leadership, planning and organizing, presentation and documentation, searching for information, etc. We describe our experience from teaching the course in the academic years 2005/06 and 2006/07. A description of the course content is given and the results of a survey among the students are presented. Students responded favourably to the new approach and found the course very useful and interesting.

Key words: computer engineering education, university-industry co-operation, group project work, information systems technology

1 Introduction

Interaction between industry and academia is an old concept that offers considerable possibilities for further forms of cooperation in the area of engineering education, beside the traditional forms of cooperation in the development of new products, the establishment of joint solutions to industrial problems, the provision of training and consultancy and long-term cooperation in solving research tasks as outlined in Ivanco et al. (1998). While students can learn the theoretical component of their course through lectures, reading, tutorials, laboratory practice and self-learning activities, the university environment cannot provide the wealth of experience, practical applications and learning opportunities available within the environment of professional industry. For this reason, many tertiary institutions have developed different forms of partnership with industry in the area of engineering education (McKee 1999; Clausen, 1998; Neal, 1996). Such a partnership can provide a significant educational benefit, developing a broad range of generic and professionally-oriented skills (Massay et al., 1995; El-Raghy, 1999; Tedford et al., 2007). For some academic institutions, the project work of senior year students also represents an additional source of income (Clausen & Holta, 2007).

Undergraduate degree programs in Slovenia are often criticized for being too theoretical and for not giving students enough practical skills that would allow them a smooth transition from study to a working environment. On the other hand, there is a shortage of experts in specific software products and solutions. Industry also expects engineering graduates to have some grounding in business skills with an increasing emphasis on social skills such as customer relations and team-working. These skills are recognized to be just as important as technical literacy.

In order to alleviate these problems, the content of the Information Systems Technology course, which is taught in the fifth (final) year of the undergraduate program in Computer Science at the University of Ljubljana, was restructured to introduce organized group project work in partnership with some major IT companies such as IBM and Microsoft. This initiative started in the Academic Year 2005/06 when the first generation of students attended a special course on online information system development using IBM products. During the course, they became acquainted with advanced Java programming, Web technologies (Java Server Faces, IBM Portal Server) and the IBM Workplace. At the end, they split into groups of 3-4 students and developed a prototype solution to a problem of their own choosing. The solution had to be

presented as a business proposal to a panel of technical, financial and business experts (these roles were played both by employees of IBM Slovenia and by faculty members), who evaluated the proposal from all the aforementioned aspects. In this way, students not only obtained the necessary technical knowledge to develop an information system, but also practiced the communication and presentation skills that are needed for successfully marketing the proposed system.

After teaching the course for the first time, a survey was performed among the students to obtain their opinions about the new course content. The majority of students responded favourably to the new approach and found the course very useful. The results of the survey encouraged us to continue with the initiative and extend the collaboration to other IT companies.

In the Academic Year 2006/07, the course was taught in partnership with IBM and Microsoft. The overall structure of the course remained the same, but the detailed content was adapted to fit the tools of the two vendors that were used in the laboratory practice and project work. Consequently, students were offered two different contents: one based on IBM products and tools and another based on Microsoft products and tools. Students were allowed to choose their preferred content and it was interesting to note that each was chosen by exactly one half of the students. The survey we performed among the students at the end of the course showed once again that our decision to run the course in partnership with major IT companies was correct.

In the following sections, the new course content and the projects that were developed by the students in the last two years are described. Then we present a detailed analysis of the results of the survey along with the students' opinions about their most positive and most negative experience with the course.

2 Course content

The course lasts 15 weeks (6 hours/week) and consists of three parts: lectures, laboratory practice and group project work. The course content was designed taking into account the fact that students acquire a great deal of knowledge of software engineering during the first four years of their studies (viz. software project management, systems analysis and design, information systems development). Therefore, the amount of classical lectures is rather small, with most of the time being devoted to laboratory practice and group project work.

2.1 The IBM program

The main purpose of laboratory practice is to expose students to IBM software products and tools, which are later used during the group project work. This part of the course is supervised by instructors provided by IBM that are experts in these tools. To deliver the best possible content, IBM standard courseware is used. However, because of the limited time frame, the instructors take only the most important chapters and adapt the content to the students' existing knowledge. This part of the course is broken down into three major parts, as follows:

1. Java and development tools
   - Java basics, architecture, object model
   - Advanced Java topics, Eclipse
   - IBM Rational Application Developer
2. Web technologies
   - Java Server Faces
   - IBM Portal Server
   - Portlet development
3. IBM Workplace

The programming language and development environment are introduced in the first part. The second part is devoted to Web technologies, mostly used in the presentation layer. Finally, in the third part, the hosting environment for the developed solution is presented. In the Academic Year 2006/07 a new chapter dealing with service oriented architecture was added. In this way, students are fully empowered for the development of a working solution that can be used as a good prototype for the underlying business problem.

Laboratory practice is followed by the group project, which is not only intended for the improvement of technical skills and broadening the knowledge of the software tools used, but also for the acquisition of transferable skills such as teamwork, management/leadership, planning and organizing, presentation and communication, information search, etc.

When forming groups, the established guidelines are followed concerning group size, task selection, the allocation of responsibilities and assessment of the students' work as proposed by Smith et al. (1996). Group size is restricted to four and students are given the opportunity to decide who they should work with. The task and methods are determined by the group, but must be approved by the university professor (the lecturer) and the IBM coordinator. The group is asked to nominate a Project Manager who acts as contact person and has the responsibility of monitoring progress and coordinating the group. The group is also asked to identify specific roles that they feel will be important in managing the group. Students are also encouraged to work on the project outside the officially scheduled hours. There are two progress meetings (consultations) before the final presentation takes place. Students are also given a brief training to improve their presentation skills.

Due to time limitations, the main aim is not to have students develop a perfect working solution, but rather to develop the skill of generating the "big picture". They must recognize that each computer program has its business implication, audience, benefits and critical success factors. These are facts that most young students often tend to forget. The whole content is designed to foster the idea that students develop a working prototype of the complete solution and develop the logic of why this complete solution would benefit the customer.

At the end of the course, the student groups must present the prototype solution of their business idea to a "business panel" consisting of a university professor (the lecturer) and 2-3 IBM representatives. This group of people plays the role of the board of directors of a potential customer and evaluates the proposed solution from a technical, business and user point of view. Each group is given 45 minutes to present their idea and the working prototype of their solution and this allotted time must not be exceeded. The presentation usually comprises the following sections: business rationale, the technical environment, a description of the solution developed and a practical demonstration. During the presentation, detailed questions are raised, on the basis of which the group can provide evidence of their knowledge with respect to the problem domain and can justify their design decisions. After the presentation, each group receives feedback about the quality of their project from the individual members of the panel.

2.2 The Microsoft program

The Microsoft program differs in the tools that are used during the laboratory practice and group project work. The content of the laboratory practice is based on three standard Microsoft workshops that provide students with the knowledge and skills needed to develop applications using Microsoft Visual Studio 2005:

- Core Windows Forms Technologies with Microsoft Visual Studio 2005
- Core Web Application Technologies with Microsoft Visual Studio 2005
- Core Data Access with Microsoft Visual Studio 2005

After passing the exam, students receive certificates of attendance that are equivalent to the certificates given to participants of regular training courses provided by the Microsoft Certified Partners for Learning Solutions.

The project groups are formed using the same rules as within the IBM program. Students are given the freedom to decide who they will work with and which problem they will solve within their project. At the end of the course, they present their solutions to a panel of experts consisting of a university professor (the lecturer), a Microsoft university relations person and a Microsoft Visual Studio 2005 expert. Presentations are attended by all the students, who are asked to give grades for all projects except their own. Each solution is judged according to the criteria of the Microsoft Imagine Cup student contest: 15 % problem definition, 60 % design, 15 % development and 10 % presentation. The final grade is obtained on the basis of a 60 % contribution from the grade given by the panel of experts and a 40 % contribution from the average grade given by the students.

Compared to IBM, the Microsoft program pays more attention to programming skills and the development of a working solution, while there is less emphasis on generating the big picture and considering the impact of the software solution on all the aspects of company's business.

2.3 Overview of the most interesting student projects

In order to complete the description of the course content, we present an overview of the most interesting student projects.

In the Academic Year 2005/06, the best project was the "Rescue centre": a mobile application linking an emergency call centre with stationary and mobile medical units. The other projects implemented prototype solutions of the following business ideas:

- A gambling portal: portal for the online placement of bets, the purchase of lottery tickets, participation in other games of chance, as well as the dissemination of winnings information and their disbursement.
- A tourist agency: portal for the online sale of tourist offerings.
- An eMusic: portal for the online dissemination of music (the selection and downloading of music and payment via credit card or mobile phone).
- A knowledge broker: a personnel and knowledge management portal (intended for keeping track of training and education schedules and for searching for the required skills and knowledge).
- An industry tracking system: a portal for machine workload assignment, failure tracking and maintenance planning.
- An enterprise resource planning system: a simple online ERP system.
- A finance portal: An online stock trading portal.
- An automart: A web-based private car sales and service organization (sales and promotion information, scheduling of servicing appointments and customer relationship management).

In the Academic Year 2006/07, the best IBM project was the "My e-House": portal for a company that administers the operational costs and maintenance for blocks of flats. The best graded Microsoft project was the "Cars Portal", an online solution for a private car sales organization. Although the problem itself was not particularly original, the judging panel found the completeness of the implementation and the technological solutions to be better than in the other projects. There were also several other interesting projects:

- Student Coupons: an online system for administering the distribution of student coupons and payments tracking;
- Lodging broker: portal for searching for accommodation facilities for students who cannot get rooms in student dormitories;
- The Car fleet: car fleet usage and tracking travelling orders in a large company;
- Sports betting: a portal for the online placement of bets;
- An internet reality show;
- eBooking: a hotel reservation system;
- A restaurant management system.

3 The results of the survey

A survey was made at the end of the course in the academic years 2005/06 and 2006/07 with the aim of verifying whether our decision to run the course in partnership with IT companies was correct. The results are presented in 5 sections, describing a general evaluation of the course, evaluation of the course content, comparison with other courses, the students' opinions on the most positive and negative aspects of the course and their evaluation of the examination process.

In the Academic Year 2005/06, the course only ran in partnership with IBM. The survey was answered by 32 out of the 35 students, thus representing 88.89% of the students that attended the course. In the Academic Year 2006/07, 48 students attended the course; 24 of them chose the IBM program and 24 the Microsoft program. The survey was answered by 18 (75%) of the IBM program students and 14 (58.33%) of the Microsoft program students[1].

3.1 General evaluation of the course

The first two questions were intended to obtain a general evaluation of the course.

Question 1: *Do you support the decision to run the course in partnership with a software company?*

Question 2: *How useful is the course?*

The answers to both these questions are very encouraging. We were pleasantly surprised by the unanimous support for our decision to run the course in partnership with software companies, which confirms the hypothesis that students really want to obtain more practical experience during their studies. Most of them also felt that the course was useful and interesting.

3.2 Evaluation of the course content

The aim of the next question was to obtain the students' opinions on the amount of each topic taught during the practical part of the course.

Question 3: *How do you rate the amount of each topic presented in the course?*

Answers to this question are presented separately for each program and academic year in Tables 3, 4 and 5. The results in Table 3 show that the decision on the amount of each topic presented in the Academic Year 2005/06, when we started the cooperation with IBM, was quite good. The majority of students felt that all the topics were covered just right. Nevertheless, there were some topics that needed further consideration, viz. Java basics, Java Server Faces and consultation about the students' projects. It was felt that time devoted to Java basics could be reduced in order to pay more attention to Java Server Faces and consultations. Consequently (and considering that the fifth year students in the Academic Year 2006/07 learned Java as their first programming language), we decided to omit the topics dealing with Java basics and the Java development environment and to increase the time devoted to Java Server Faces and consultation regarding the students' projects. Additionally, a new topic was introduced dealing with service oriented architecture.

Table 4 shows the students' opinions on the IBM program in the Academic Year of 2006/07. Students almost unanimously responded that the amount of the course devoted to service oriented architecture was just right. A significant improvement can also be noticed in their opinions on the amount of the course devoted to Java Server Faces, though there was only a slight improvement regarding consultations on student projects. On the other hand, the number of students who were not satisfied with the amount of Workplace practice increased unexpectedly.

Table 1. Student opinions on the decision to run the course in partnership with a software company

	2005/06 IBM	2006/07 IBM	2006/07 Microsoft
1. yes	32	18	14
2. no	0	0	0

Table 2. Student opinions on the usefulness of the course

	2005/06 IBM	2006/07 IBM	2006/07 Microsoft
1. the course is useful and interesting	21	11	13
2. the course is useful	10	7	1
3. the course is not useful	0	0	0
4. the course is not useful and is uninteresting	1	0	0

[1]Some respondents did not answer all the questions; therefore, the sum of the answers in these cases does not equal the sample size.

Student opinions on the amount of each topic taught in the Microsoft program are shown in Table 5. The majority of students responded that the topics within the Core Windows Forms Technologies and Core Web Application Technologies workshops were covered just right, though there were more remarks concerning the limited time frame for some topics of the Core Data Access workshop. The content of this workshop was reduced due to the end of the semester and some topics were not adequately covered.

3.3 Comparison with other courses

We also wanted to know how our course compared to other courses at the faculty. Therefore, we asked students the following question:

Question 4: *How do you rate the course in comparison to other courses in the final year of your study?*

Microsoft the course is better 14 10 14 the course is approximately the same 18 8 0 the course is worse 0 0 0

The answers to this question also show that the students are satisfied with the course. Most of them, especially those attending the Microsoft program, feel that the course is either better or approximately the same quality as the other courses in the final year of their study. Nobody rated the course worse than the other courses.

3.4 The students' remarks: Pros and Cons

The survey also contained two open ended questions giving students the chance to describe their most positive and most negative experience with the course.

Question 5: *What did you like most?*

Question 6: *What did you like least?*

In their answers to question 5, almost all students pointed out the possibilities of obtain practical experience working in partnership with a leading IT company. They liked the course because it gave them the opportunity to get acquainted with modern software development tools and technologies and to solve practical problems in an almost-real business environment.

Students that chose the IBM program also liked the course because they improved their presentation skills through having the possibility of presenting their own projects and receiving extensive comments on the quality of the presentation. Therefore they obtained experience not only from the viewpoint of development, but also from the viewpoint of selling software solutions. Students that chose the Microsoft program most of all praised the quality of the laboratory practice supervised by instructors provided by Microsoft.

Analysis of the answers to question 6 has shown that the students were mostly annoyed by some organizational issues. In the Academic Year 2005/06, some student presentations were delayed or postponed due to other engagements on the part of the panel members. Consequently, in the Academic Year 2006/07, special attention was devoted to this problem and all the presentations were carried out according to schedule within two days. Additionally, some students who attended the IBM program felt that, during the presentation of their projects, there was too much attention devoted to presentation skills and business aspects, while the technical solution received less notice. A few of them also complained that the equipment they had at their disposal was not powerful enough to ef-

Table 3. Student opinions on the amount of each topic taught within the IBM program in the Academic Year 2005/06

	Too Little	Just Right	Too Much
Java			
• Basics, architecture, object model	0	19	13
• The eclipse development environment	4	22	5
Web technologies			
• Java Server Faces	13	16	3
• WebSphere Portal	5	24	3
• Portlets	4	27	1
Consultation on student projects	11	21	0
Workplace			
1. Workplace infrastructure	4	20	7
2. Workplace practice	4	20	7
3. Workplace and portlets	7	18	5
Consultation at the end of the laboratory practice	8	24	0

Table 4. Student opinions on the amount of each topic taught within the IBM program in the Academic Year 2006/07

	2005/06 IBM	2006/07 IBM	2006/07 Microsoft
1. the course is better	14	10	14
2. the course is approximately the same	18	8	0
3. the course is worse	0	0	0

Table 5. Student opinions on the amount of each topic taught within the Microsoft program in the Academic Year 2006/07

	Too Little	Just Right	Too Much
Core Windows Forms Technologies with Microsoft Visual Studio 2005			
• Creating a simple Windows Forms application	0	11	3
• Configuring standard controls	0	12	2
• Building menus	0	12	2
• Displaying and editing data using data-bound controls	4	10	0
• Providing user assistance and enhancing usability	0	13	1
• Creating consistent applications using dialogs and forms inheritance	1	13	0
• Adding print and report functionality to a Windows Forms application	3	11	0
• Performing asynchronous tasks using the Background Worker component	8	6	0
• Deploying a Windows Forms application using ClickOnce	2	11	1
Core Web Application Technologies with Microsoft Visual Studio 2005			
1. Creating a Web application	0	14	0
2. Programming a Web application	1	13	0
3. Adding and configuring server controls	1	13	0
4. Using master pages to establish a common layout	0	13	1
5. Managing state data	3	11	0
6. Accessing and displaying data	3	9	2
7. Controlling access to a Web application	4	10	0
8. Deploying a Web application	1	12	1
9. Creating a mobile Web application	3	4	5
Core Data Access with Microsoft Visual Studio 2005			
• Connecting to databases and reading data	0	14	0
• Querying and updating databases using commands	0	14	0
• Performing transactional operations	5	9	0
• Performing disconnected operations programmatically	6	8	0
• Performing disconnected operations using Visual Studio 2005 wizards	5	7	2
• Performing XML operations on disconnected data	5	8	1
• Reading and writing XML data	6	8	0
• Processing XML data using the Document Object Model DOM	9	4	1
Consultations regarding the group project	1	12	0
Group project work	0	13	0

ficiently run the software tools used during the development of their projects.

Students attending the Microsoft program were mostly annoyed by the fact that the lectures and laboratory practice took place on Friday afternoon. There were also some individual remarks that the amount of material covered was too large for the limited time frame they had at their disposal. Similarly, some students felt that they did not have enough time to complete their projects.

3.5 The objectivity of the grades

During the students' presentations, all the projects were graded using the same (fairly rigorous) evaluation crite-

Table 6. Comparison with other courses taught in the same Academic Year

	2005/06 IBM	2006/07 IBM	2006/07 Microsoft
1. the course is better	14	10	14
2. the course is approximately the same	18	8	0
3. the course is worse	0	0	0

Table 7. Student opinions on the objectivity of the examination

1. IBM program in the Academic Year 2005/06	4.22
2. IBM program in the Academic Year 2006/07	4.72
3. Microsoft program in the Academic Year 2006/07	4.57

ria, though in the end all the grades were normalized relative to the best project. The best project was given the highest grade possible, while the grades of other projects were adjusted appropriately. Considering that the final grade was not obtained through classical examination, instead depending mainly on the student's project and its presentation, we wanted to obtain the students' opinions on the objectivity of the grades.

Question 7: *Estimate the objectivity of the examination using grades from 1 (insufficient) to 5 (excellent)?*

The answers to this question also showed that the students were satisfied with the course. They graded the objectivity of the examination as very satisfactory and considered the grades they obtained to be fair and correct.

4 Conclusions

We presented an example of co-operation between the Faculty of Computer and Information Science of the University of Ljubljana and the Slovenian branches of IBM and Microsoft in the area of computer engineering education. Our experience has shown that university courses run in partnership with major IT companies can provide students with additional knowledge that cannot be obtained through classical lectures at the university. Students are faced with almost-real problems, which must be solved and presented to potential customers. They can do it using the newest tools and technologies, but they must be aware of the fact that it is not enough for the solution to be technically perfect. It must also be economically justified and well presented.

The results of the survey among the students have shown that students fully support such an approach. All of them agree with the decision that the Information Systems Technology course should be run in partnership with major IT companies. Most of them also feel that such a course is interesting and useful and, for this reason, better than other courses.

On the other hand, we must conclude that (at the moment) such a partnership is more the result of some individual efforts rather than a consequence of a systematic approach at the university level or within the educational system. In spite of the declared support, there are no practical solutions that would enable industry experts to participate in certain phases of the educational process. Beside, courses that require the involvement of people from the industry and group project work require much more coordination than classical courses taught completely at the university.

Regardless of these problems, we believe that such courses must become an important part of information system and software engineering curricula and should be seriously considered when new curricula (compatible with the Bologna Declaration) are prepared. We will also try to do our best to launch similar initiatives with other IT companies in Slovenia.

Acknowledgement

I would like to express my deepest thanks to IBM Slovenija and Microsoft for their contribution to the new course content, especially to Bernard Grum (IBM) and Zlatko Polak (Microsoft) who helped me resolve all the organizational and technical issues. I am also grateful to all the employees of both companies who participated in the course, either as instructors or as members of the judging panels.

References:

Clausen, T. (1998). Future regional university/industry co-operation: academic excellence through three-dimensional integration, *Global Journal of Engineering Education*, **2** (2): 135 - 137.

Clausen, T., & Holta, R. T. (2007). Industry/College cooperation on undergraduate project work as a college revenue source, Proceedings of the 10th UICEE Annual Conference on Engineering Education, Edited by Pudlowski, Z. Bangkok, 19-23 March 2007. Melbourne : UICEE.

El-Raghy, S. (1999). Quality Engineering Education: student skills and experiences, *Global Journal of Engineering Education*, **3** (1): 25 - 29.

Ivanco, V., Kostolny, K., & Kubin, K. (1998). Co-operation between the Technical University of Kosice and industry in its region, *Global Journal of Engineering Education*, **2** (2): 157 - 160.

McKee, W. (1999). Integrating education and industry through enhanced projects. *Global Journal of Engineering Education*, **3** (3): 287 - 289.

Massay, L. L., Udoka, S. J. & Ram, B. (1995). Industry-University Partnerships: a model for engineering education in the 21st century, *Computers and Industrial Engineering*, **29** (1-4): 77 - 81.

Neal, L. (1996). The development of the technical, professional and personal competencies of software engineering students through work based learning, In: *Software Engineering in Higher Education II*, Edited by Uso J-L., Mitic P., Sucharov L. J. Southampton Boston : Computational Mechanics Publications.

Smith, S., Mannion, M., & Hastie, C. (1996). Encouraging the development of transferable skills through effective group project work, In: *Software Engineering in Higher Education II*, Edited by Uso J-L., Mitic P., Sucharov L. J. Southampton Boston : Computational Mechanics Publications.

Tedford, J. D., Seidel, R. H. A., & Islam, M. A. (2007). Teamwork and its influence on learning in industry based projects, In: *Proceedings of the 10th UICEE Annual Conference on Engineering Education*, Edited by Pudlowski, Z. Bangkok, 19-23 March 2007. Melbourne : UICEE.

Viljan Mahnič is an Associate Professor and Head of the Software Engineering Laboratory at the Faculty of Computer and Information Science of the University of Ljubljana. From 1999-2003 and from 2005-2006 he was also the Vice-Dean for educational affairs. He teaches several courses in computer programming, software engineering and information systems technology at undergraduate and postgraduate levels. His research interests include software technology and the development of information systems with a special emphasis on university information systems. He has been the representative of Slovenia in EUNIS (European University Information Systems Association) since 1996, and a member of the Board of Directors since 2002. He is a member of the IEEE Computer Society and the AIS (Association for Information Systems).

Poučevanje tehnologije informacijskih sistemov v sodelovanju z računalniškimi podjetji

Prispevek opisuje primer sodelovanja med Fakulteto za računalništvo in informatiko in podjetjema IBM in Microsoft pri izvajanju predmeta Tehnologija informacijskih sistemov. Predmet je na programu v petem (zadnjem) letniku univerzitetnega študija, ko študenti že obvladajo temeljna teoretična znanja o razvoju informacijskih sistemov. Zato smo prilagodili njegovo vsebino tako, da je večji poudarek namenjen pridobivanju praktičnih izkušenj v profesionalnem delovnem okolju. V okviru predmeta se študenti seznanijo z orodji in rešitvami, ki jih za razvoj spletnih informacijskih sistemov ponujata IBM in Microsoft. Posebna pozornost pa je namenjena delu na projektih, katerih namen ni samo poglabljanje tehničnega znanja, ampak tudi pridobivanje sposobnosti za skupinsko delo, vodenje, načrtovanje in organizacijo, pripravo predstavitev in medosebno komuniciranje, iskanje informacij ipd. V prispevku so opisane naše izkušnje s poučevanjem nove vsebine predmeta v študijskih letih 2005/06 in 2006/07. Predstavljena je vsebina predmeta in rezultati ankete, ki smo jo izvedli med študenti. Študenti se strinjajo z novim pristopom in ocenjujejo, da je tako zasnovan predmet zanimiv in koristen.

Ključne besede: izobraževanje inženirjev računalništva, sodelovanje univerze z gospodarstvom, skupinsko delo na projektih, tehnologija informacijskih sistemov