Preparation of Economists and Managers for Enterprise Computer Science

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Abstract: The first part of the paper describes the teaching of computer science to economists and managers at Tomas Bata University in Zlin, Faculty of Management and Economics. It states the objective, overview of subject areas and methodology of teaching as well as the use of information and communication technologies. The experience of teaching and assessing students’ knowledge are summarized. The second part contains the results of the research on the Computer Science for Economists course, its importance for students, focusing mostly on enterprise computer science. The analysis of the research results makes possible to suggest options for further development of the course.

Keywords: Computer Science, education, research, FoME/TBU.

Abstrakt: Příspěvek v první části popisuje výuku informatiky pro ekonomy a manažery na Univerzitě Tomáše Bati ve Zlíně, Fakulta ekonomiky a managementu. Je uveden cíl, přehled témat a metodika výuky; uplatnění informačních a komunikačních technologií. Jsou shrnuty zkušenosti z výuky a ověřování znalostí studentů. Ve druhé části je zpracován výběr výsledků výzkumného předmětu Informatika pro ekonomy (IPE), jeho význam pro studenty prezenční (PIPE) a kombinované formy (KIPE), se zaměřením na podnikovou informatiku. Analýza výsledků výzkumu umožní lépe rozvíjet předmět v budoucnosti. Další výzkum bude orientován na požadavky garantů předmětů, jež navazují na výsledky výuky IPE.

Klíčová slova: Informatika, výuka, výzkum, FaME/UTB.

1. Introduction

Today’s dynamic world has brought about fundamental changes in the requirements for education and training people. The structure of industry, agriculture and especially services is constantly changing; some specialized fields appear and disappear as well as the demand for a specific range of experts. People are forced to change their specialty during their life-time and continuously study and improve their skills. Knowledge drives the global economy. The development of the Internet has brought new alternatives to traditional forms of study, in which information and communication technologies (ICT) play a key role [5], [10].

The information age and information and knowledge society require computer literate citizens with well developed computer skills. For university graduates, it is doubly true. In the long term, the discussion has been held on what content should such instruction have. One of the results is the understanding of the importance of working with the Office Automation (OA) tools, which is, for instance, also reflected in the recognition of the qualification level when obtaining the European Computer Driving Licence (ECDL) [4].

The article summarizes the experience of teaching computer science to economists and managers at the Faculty of Management and Economics (FoME) at Tomas
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Bata University (TBU) in Zlin (www.utb.cz). The results of the research into how the course meets the expectations of the future graduates of Bachelor’s study programme are presented. The methodology of teaching the undergraduates of full-time and combined forms of study is described, and some factors associated with teaching are mentioned [2], [5].

The research took place in the academic year 2009/2010. Based on the evaluation of questionnaire surveys, the findings concerning computer science teaching in both full-time and combined study programmes have been gained, namely on conducting the instruction and the attitude to testing students. The responses are statistically processed and analyzed, and will be used to improve the preparation for teaching, course content and instruction itself [6]. The article focuses only on one of the research objectives [2] - how the course meets the expectations of the future economists and managers about the use in practice [4].

2. Concept of teaching Computer Science at the FoME

Computer Science for Economists (IPE-Informatika Pro Ekonomy) is a compulsory course for the students of the full-time (PIPE-Prezenční IPE) and combined (KIPE-Kombinovaná IPE) study forms in their first year of the Bachelor’s study programme at the FoME, TBU. The course broadens the knowledge and practical skills in the field of computer science. The aim is to provide students with a possible widest overview of ICT [8]. The course builds on the knowledge gained at secondary schools; the content is updated and extended. The course consists of theoretical [10] and practical parts [3], which are closely connected and complement each other.

2.1 Course objectives and its role

Within the theoretical part of the course, the students are familiarized with new developments in computer science, information systems and ICT. After the introductory lecture, the information and knowledge society is presented, and the concepts of data, information and knowledge are explained. Then the students are lectured on software and hardware, information systems and software for enterprise computer science. It is followed by network technology, the Internet, information security, ergonomics and trends in ICT development. The theoretical part is almost identical for the students of both full-time and combined study forms [10].

The practical part aims at working in LAN, the improvement in operating Office Automation application package, and the use of Internet services. The achievement of this goal is the basis for the preparation of solving economic and managerial tasks in the subsequent courses of the Bachelor’s and Master’s study programmes. The practical part of instruction applies to the full-time students only.

One of the key questions is the content and scope of such instruction [2], [5], and the ratio between the theoretical and practical parts. General views on the achievement and development of computer and informatics literacy have been changing over the course of history and are yet different [1], [5]. As a unifying requirement in achieving a measurable level of knowledge and practical skills [2] might serve, for example, the requirements specified for earning the ECDL. This
fact is reflected in our methodology: the students who present a valid ECDL certificate have fulfilled the requirements and are not obliged to enrol in the course.

To sum up the above-mentioned facts, the aim of teaching computer science in the IPE course is as follows [8].

- Developing skills in working with ICT.
- Consolidation of the knowledge and skills in working with ICT in the students who possess different computer science and informatics skills.
- Preparing students to subsequent subjects at the university.
- Focus on professional activities after graduation from the university, specializing in enterprise computer science.

2.2 Study materials and using ICT in the course

At the beginning of the semester, the students use the university Information System (IS) [3] to enrol in courses and chose particular seminars and practical training in laboratories. Thus they optimize their own study schedule.

The communication between teachers and students of both full-time and combined study forms runs through the TBU portal STUDIUM. Although all students have their own university e-mail addresses, for the communication of over 600 students with their tutors it has not proved effective. E-mail communication is used only in specific and urgent cases requiring operative solutions and decisions. Important study materials, assignments, lectures and seminar topics can be retrieved from the Internet FoME portal VYUKA [9] (see Figure 1).

For the theoretical part of the instruction, educational materials in the form of university textbooks are available [10] as well as guidelines for practical work in laboratories [1, 9]. Students have also at disposal a large number of sample study materials created in OA, and thus they can compare their products with the proper examples.

2.3 Study requirements and knowledge verification

In the first lesson, the students take a placement test, covering all important fields for practical use and knowledge concerning the access to ICT. The test divides the students into three groups: excellent, advanced and others. The excellent students immediately earn credits for the theoretical part of the course, advanced students can sit their examination ahead of the regular examination period, and the others have to attend the whole course. They are not allowed to take an early examination.
To earn credits, the students have to complete an assignment on a given specialized topic in the ICT area. The tutors check if the students have explained the core of the topic and if the assignment formats are appropriate. It is also expected that students express their opinion on the topic in the conclusion of their work. Besides, the students prepare a presentation on their assignment. Thus they develop the skill of defending their projects. The students submit their assignment via the FTP server [3].

After going through one third of the specialized subject areas, the students are tested. Thus the students verify their knowledge achieved, and the lecturers and tutors get feedback on students’ preparation and the effectiveness of their teaching. The final test can be considered as preparation for the examination; its content and format are similar to the theoretical part of the examination. The examination includes successful completion of the test, preparing questions based on the theoretical part of the instruction (min. 60% correct answers are required), and executing practical tasks on the PC in a limited period of time.

3. Research into the innovation of the teaching of Computer Science for Economists

At the end of the winter semester in the academic year 2009/2010 a questionnaire survey of the content, form and quality of the IPE course was carried out. The aim was to gain students’ opinions on the course and their evaluation, with the intention to improve the IPE teaching in the future [3].
To obtain the results, two target groups of students who have successfully completed study requirements for the 2009/2010 winter semester were addressed. After finishing the course, the students of combined study form (KIPE) were asked to fill in a paper questionnaire. The full-time students (PIPE) were asked to fill in an online questionnaire. The intention was not only to gain the views of students, including the assessment, but also to compare the two approaches in research and teaching the subject. Almost 70% of questionnaires were completed and submitted, which borders on a successful research (in theory [6], 75% questionnaires should be submitted).

3.1 Survey

The paper questionnaire (test 1, see Annex A) contained 13 questions. The questions aimed at obtaining the views on the IPE course, thus they pursued a single goal. Up to 11 items were designed as closed (dichotomous) questions, with the option to comment on them. One item was a closed (dichotomous) question without any comment and one item was an open question. The filter, control and indirect questions were not used; they were not necessary to meet the goal of the research.

The respondents could have written comments to questions 1 to 12, which multiplied by the number of returned questionnaires theoretically gives 1308 possible comments. In reality, only 141 comments have been obtained, which is 11%. It seems that students are either reluctant to express their opinions, or had little time for reflection when quickly answering the questions. The completion of the questionnaire did not exceed 15 minutes, which is consistent with the theory [6].

The questions were not very demanding; the prerequisite was the attendance at lectures and completion of the assignment. The success of obtaining the completed questionnaire was ensured by the fact that the questions were distributed during the exam. This also influenced the research results because it addressed only the students who attended the course by the examination date. We were unable to interview the students who did not take part in the course, and those who were given credits without examination (the graduates of earlier years, ECDL certificate holders and excellent students selected by the placement test).

3.2 Survey web application

The processing of the survey web application (test 2, see Annex B) was based on the design of tests 1. The content of the questionnaire was adapted to include questions concerning practical training of PIPE students. This was ensured by 3 questions; the third of them was a question requiring information about the student’s tutor. To carry out the survey, a web application enabling the students to respond to the questions was created. The students participated in the research in computer laboratories provided with access to the Internet.

The questionnaire contained 14 questions in total; 12 of them were designed as closed (dichotomous) questions. One question was a yes/no question and one was an open question. The filter, control and indirect questions were not used, since the objective of the research did not require them.

Concerning question number 14, a total of 90 comments was recorded, whereas the answers such as “no comment” or “I am satisfied” were filtered out. This option
was used by more than a half of the students (if the responses filtered out were added). The students completed the questionnaire within 20 minutes, which is consistent with the theory.

The questions were not very demanding; the prerequisite was the attendance at lectures and completion of the assignment. Those who met there requirements answered the questions easily. The success of obtaining a completed questionnaire was ensured by the fact that the survey was carried out in face-to-face instruction [2].

### 3.3 Comparison of the survey results

The questionnaires within test 1 and test 2 were similar in content. Both sought to determine how the students perceived the IPE instruction. Test 1 was more detailed and offered more open questions. Test 2 included questions about practical training and was designed in a way which forced the students to react to each question; only then were they allowed to proceed further. In test 1 some questions were not answered.

The preparation of test 2 in the web application form took some extra efforts. On the other hand, the evaluation of the survey including the PIPE students was carried out continuously and was easier (it was automated in the application). The evaluation of the survey including KIPE students could be commenced [3] only after gathering all the answers and was quite demanding.

The credibility of the answers in test 1 was guaranteed by distributing the questionnaire forms to selected respondents only and collecting them after passing the examination. In test 2 it was not guaranteed that some respondents did not fill in the questionnaire more than one times.

### 3.4 Number of respondents and students’ study results

More than 69% respondents took part in test 1 - students of the combined form of study - (109 out of 158 students). Similarly, 69% of respondents participated in test 2 (200 out of 290 students). The result is surprisingly consistent. Test 1 captured the views of students in a wider range and detail; test 2 recorded the views of more respondents also dealt with practical training. Test 1 did not force the respondents to answer all questions, whereas test 2 ensured 100% completion of all items.
Of the total number of 229 KIPE students, 176 students successfully finished the course. The evaluation of the students of combined study form was carried out through a written test. Figure 2 shows the overview of the results.

Of the total number of 290 full-time students, 258 students successfully finished the course. The evaluation of the full-time students was carried out by a combined examination (written and practical test). In Figure 3, the overall statistics of the results is shown.

4. Evaluation of the research

The research into innovation in teaching of the Computer Science for Economists (IPE) course contains statistics on the responses of individual questions of the questionnaires [2], [4]. Final evaluation compares the results of both tests. These include the following areas:

1. Benefits of lectures to students and the difficulty of the course.
2. Quality of the lectures.
3. Organization of the course.
4. Teacher - student communication.
5. Assignments, source materials and the difficulty of the course.
6. Testing and examining in the course.

In line with the objective of this article [7], the concern here is to deal with the benefit of lectures to students only [8].

4.1 Benefits of lectures to students

In both tests, the benefit of the IPE course subject areas was examined in detail. Individual subject areas were marked; the average mark in test 1 is 1.98 (1.68 is the best and 2.14 the worst one); the average mark in test 2 is 2.27 (1.80 is the best and 2.76 the worst one), see Table 1. The least beneficial subject area marked by the KIPE students were areas 3 and 7; the PIPE students identified areas 3, 6, 7 and 8. The subject area which also includes the issues of enterprise computer science earned the average mark of 1.97 by the KIPE students and 2.50 by the PIPE students.
Regarding the fact that lectures at the FoME/TBU, are not mandatory, students’ attendance was decreasing steadily from almost 100% at the beginning of the course to less than a half. The PIPE students lacked motivation to participate in lectures, and therefore they challenged the benefits and importance of the lectures. They expressed more criticism; however, it is vital to state here that they have less or no practical experience in the use of ICT in practice. They have not been able to assess the importance of the course in view of the future needs so far, and thus their marks were lower than the marks suggested by the KIPE students.

Table 1 Importance of the IPE subject areas for students

<table>
<thead>
<tr>
<th>Order</th>
<th>IPE subject area</th>
<th>KIPE</th>
<th>PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction, IPE placement test</td>
<td>1.68</td>
<td>2.16</td>
</tr>
<tr>
<td>2</td>
<td>Computer science as a scientific discipline, basic concepts</td>
<td>1.92</td>
<td>2.41</td>
</tr>
<tr>
<td>3</td>
<td>Information and Knowledge Society</td>
<td>2.14</td>
<td>2.76</td>
</tr>
<tr>
<td>4</td>
<td>Data, information. Codes and data compression</td>
<td>1.83</td>
<td>2.24</td>
</tr>
<tr>
<td>5</td>
<td>Software</td>
<td>1.80</td>
<td>2.27</td>
</tr>
<tr>
<td>6</td>
<td>Technical means of data processing - HW I.</td>
<td>1.98</td>
<td>2.49</td>
</tr>
<tr>
<td>7</td>
<td>Computer components - HW II</td>
<td>2.13</td>
<td>2.46</td>
</tr>
<tr>
<td>8</td>
<td>Information systems and enterprise application software</td>
<td>1.97</td>
<td>2.50</td>
</tr>
<tr>
<td>9</td>
<td>Computer networks, Internet and network services on the Internet</td>
<td>1.68</td>
<td>2.00</td>
</tr>
<tr>
<td>10</td>
<td>Computer infiltration, malware</td>
<td>1.77</td>
<td>1.80</td>
</tr>
<tr>
<td>11</td>
<td>Computer security and data protection, cryptography</td>
<td>1.93</td>
<td>2.08</td>
</tr>
<tr>
<td></td>
<td><strong>Average</strong></td>
<td><strong>1.89</strong></td>
<td><strong>2.27</strong></td>
</tr>
</tbody>
</table>

4.2 The difficulty of the course for students

The difficulty of the course for students in the range from challenging, demanding, mean and easy (scale of A, B, C, D) was assessed as a percentage:

PIPE (test 2): 5.5; 31.5; 48; 15.
Table 2 Importance of the IPE subject areas for students

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=very good</td>
<td>20</td>
</tr>
<tr>
<td>2=appropriate</td>
<td>58</td>
</tr>
<tr>
<td>3=I do not know</td>
<td>9</td>
</tr>
<tr>
<td>4=less appropriate</td>
<td>2</td>
</tr>
<tr>
<td>5=irrelevant</td>
<td>0</td>
</tr>
<tr>
<td>no response</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
</tr>
<tr>
<td>Average</td>
<td>1.57</td>
</tr>
</tbody>
</table>

The result has met the expectations; it shows a normal distribution in which the peak in the KIPE students is shifted to a higher degree of difficulty, which corresponds with the distance from the teaching of ICT (which could not have such a standard and importance in the past as it has now).

The question of the appropriateness of the choice of subject areas presented in lectures was assigned to the PIPE students only. The teaching should reflect the requirement for getting the ICT skills of students from various schools on the same level, preparing them for work with ICT at the FoME, and enhancing the professionalism of work with ICT for enterprise computer science. Table 2 shows the result of the responses. The vast majority of students consider the subjects areas appropriate [3].

5. Conclusion

There is the basic information about experiences with informatics teaching at the TBU/FoME in the paper; composition of the subject themes, content and form of the credit work, students testing procedure, and communication teacher – student are mentioned. Although the paper does not cover of all aspects of the Computer Science for Economists course at TBU [2], [5] in favour of enterprise computer science, it presents the basic framework schema of teaching and experience of tutors. Teaching computer science responds to the demands of the information society [8] and globalization trends [2]. The tutors try to improve the course constantly [1], develop the ICT use [4], and thus prepare students in accordance with the requirements of the social environment [5], [8]. To obtain adequate feedback, an extensive research was carried out [3]. It confirmed the correct aiming of the course, but also identified possible areas of improvement. The paper analyzes just one aspect of the research - the importance of the IPE course for students. The form of the research project is applicable at the other faculties with the similar goals of studying. The students responses and reactions supported importance of the informatics teaching and will be used by subject quality.
improvement. In the future the research will be extended to the guarantors of the subjects building on the results of the IPE teaching.

Bibliography


Annexes

Annex A: Questionary of the test 1.

1. Selection of lectures.
2. Classification of lectures.
3. Quality of lectures.
4. Course organisation.
5. Difficulty of the credit work.
6. Requirements for the credit work.
7. Manner and form of credit work handover.
8. Manner and form of credit work evaluation.
10. Final test examination.
11. Complexity of the subject.
12. Proposal for the subject improvement.
13. Other comments, suggestions, recommendations.

Annex B: Questionary of the test 2.
1. Selection of lectures.
2. Quality of lectures.
3. Contribution of practice.
4. Quality of practice.
5. Course organisation.
6. Difficulty of the credit work.
7. Requirements for the credit work.
8. Manner and form of credit work handover.
9. Manner and form of credit work evaluation.
11. Testing procedure in the subject.
12. Complexity of the subject.
13. Name of practice tutor.
14. Other comments, suggestions, recommendations.