The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical University of Gomel

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Abstract:

Professional skills, as opposed to interpersonal skills, are types of skills that students learn in university. These skills are easy to quantify. The proficiency in these skills is easy to verify. Soft skills cannot be measured and tested as simply as professional skills. The authors highlight the most in-demand soft skills among employers. The article presents the results of several surveys of employers about the important requirements for jobseekers required for employment. Similar surveys were conducted among employers and employees of IT companies in the Republic of Belarus. It is concluded that soft skills are very important both for getting a first job and building a successful career. However, in the universities of the Republic of Belarus, teaching soft skills is poorly represented. The article shows how the process of teaching students of the second stage of higher education was modernized. Only the IT specialties of five Belarusian universities have undergone modernization. This work was carried out with the support of the international project MaCICT. At the same time, the experience of teaching similar disciplines in the universities of the European Union was used. To assess the effectiveness of students' acquisition of soft skills at the university, a system for assessing the results of the modernization of the learning process was developed. Questionnaires for teachers, students and employees of IT companies have been developed. A survey of all stakeholders in the results of the international project MaCICT was carried out. The paper provides information on the dissemination of the main approaches for organizing the teaching of IT specialties for teachers of another specialties of the Sukhoi State Technical University of Gomel, as well as for teaching IT disciplines of another universities in the Gomel region.

Introduction

Recently, due to the intensified competition in foreign markets, the requirements for engineering and technical specialists have increased. This has become especially noticeable in the field of information and communication technologies. It is known that every place of work, position held has a list of necessary requirements – from a diploma of graduation from a higher educational institution or a professional license to many years of work experience. While these are extremely important, there are a set of attributes called professional and soft skills that employers pay particular attention to when hiring people for their organization.

Professional skills are real skills that are usually acquired through study or learning. This is often the first thing that appears in job postings. Some job requirements are complex and including both basic technical knowledge and technical skills, as well as practical skills to work with various devices or mechanisms.

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...   85

Spending years at university developing complex skills, especially technical ones, can seem like a winning strategy for getting your first job. However, according to employers, neglecting flexible skills such as communication skills, openness to new knowledge, self-motivation, and flexibility can be a serious flaw. Many studies have shown that employers tend to value flexible skills more than job seekers, and there is often a dramatic mismatch between published job descriptions and the skills listed by job seekers on resumes. At the same time, a small change in the teaching strategy of technical students can accelerate the acquisition of interpersonal skills and give a competitive advantage in the labour market.

Research by the Society for Human Resource Management (2016) found that employers consider soft skills to be particularly important for those entry-level vacancies that are being taken on by recent university graduates. Another study by Business Roundtable (2020) found that 95% of employers have difficulty to find applicants with soft skills such as leadership, adaptability, honesty, industry knowledge, and customer service. According to a report by LiveCareer (2020), some professions that are often not perceived as requiring soft skills actually do. For example, according to a survey, software engineering job descriptions listed an average of eight cross-industry communication skills, compared to an cross-industry average of five. Thus, developing interpersonal skills can distinguish specific students from the rest when hiring.

The aim of the paper is presentation of main results of MaCICT project, which were obtained in the Sukhoi State Technical University of Gomel, that were obtained within two and a half years. We can describe two parts of these results: artifacts (documents, courses, reports and etc.) and new level of students soft skills at the end of their second stage education process. To achieve the latter results, it is necessary to consider the role of the university is seen not only as an organization, that generates knowledges, but also as an active participant in the market (Juho et al., 2019). The plan of the paper provides general information about main changes in educational process according the idea of the project and the result of these changes, describing of surveys. Research method used is described in the selected results section.

Method

Project MaCICT

The purpose of the implementation of the MaCICT (Modernization of Master Curriculum in Information Computer Technologies) project is to transfer teaching to a competence-oriented paradigm while simultaneously developing students' soft skills to increase their competitiveness in the labour market after defending a master's thesis (Piashkun and Mäkiö, 2022). The official start date of the project is November 2018. Work on the project in our university actively began in March 2019. The project was officially registered in the Republic of Belarus on November 19, 2019 (Resolution of the Council of Ministers of the Republic of Belarus №774 from 11/19/19). After this date, the teachers of our university were able to begin active trips across the Republic of Belarus and other countries, where partner universities are located in order to obtain advanced experience for teaching 2nd stage students. Program and project logos are shown in Figure 1.

Figure 1. Logos of the Erasmus + program and the project "Modernization of Master Curriculum in Information Computer Technologies to increase the professional relevance of master students"

Within the framework of the MaCICT project (Program MaCICT site, 2019; Kamrakou and Kurachka, 2021), in order to increase the competitiveness of university graduates in the labour market, a new curriculum for the second stage of higher education in the specialty 1-40 80 04 "Informatics and programming technologies" was developed. The development of the first version of the new curriculum was based on the results of a survey of representatives of IT companies in the Gomel region. In 2019, as a result of discussions with customers, a new curriculum was developed. However, the 2019 plan did not take into account

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

86   *The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...*

the opportunity for graduate students to acquire soft skills. Therefore, in 2020, a new plan was developed with soft skills in mind.

During the implementation of the project, the university is planning to modernize the discipline "Mathematical modelling". The development of the following new disciplines was planned:

— Software verification and certification;
— Neural network data processing;
— Cloud technologies and tools for processing large amounts of information;
— Management and marketing of software products;
— Presentation of results and presentations;
— NoSQL databases;
— Theory and practice of protecting new technical solutions;
— Continuous integration;
— Professional development and career in IT.

The development of each new course at Sukhoi State Technical University of Gomel was accompanied by the development of a corresponding syllabus. At the same time, the experience of developing courses at partner universities was widely used, existing courses were analysed. Workshops on the development of syllabuses were held for teachers of partner universities from the Republic of Belarus. "The first teacher's role is a course designer. It is extremely important that the goals, learning outcomes, and the specific responsibilities are clearly spelled out in the syllabus. Students need to know where they are going, how they will get there, how they will be assessed, and how to locate the resources that they will need. This gives the students a detailed road map for the course that will help them use their study time most efficiently. A student – cantered syllabus is helpful in any course, without it students are likely to get lost and off track" (Diamond, 2008; Olugbenga, 2021).

Grunert O'Brien et al. (2008) have observed: "Your syllabus represents a significant point of interaction, often the first, between you and your students. If thoughtfully prepared, your syllabus will demonstrate the interplay of your understanding of students' needs and interests, your beliefs and assumptions about the nature of learning and education, and your values and interests concerning course content and structure. If carefully designed, your syllabus will provide your students with essential information and resources that can help them to become effective learners by actually shaping their own learning". This model shifts the focus away from what teacher will teach to what the students will learn, so that teacher as a faculty member will serve less as a disseminator of knowledge than as a facilitator of learning.

Applying the knowledge gained, teachers from Sukhoi **S**tate **T**echnical **U**niversity of Gomel developed nine of the above courses and one course was modernized. However, all the best practices of European partners were not fully implemented due to the requirements of the regulatory framework of the Republic of Belarus for the organization of the educational process, the content and form of educational and program documentation.
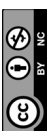
Modernization the Work after 1-st Intake

According to the Grant Agreement the MaCICT project has 3 intakes for piloting. The goal of the piloting is to evaluate, analyse new pedagogical approaches, and make improvements suggestions for the next intake. Now we have recruited students for the 2nd intake. The results, during the piloting of the first year, are described in deliverables D4.1. Intake 3 was not implemented, since the project began with one year delay.

The objectives of the master's program were adjusted in accordance with the urgent need of the labour market and feedback from employers, analysis of feedback from first intake students, the evaluation of the current curriculum, the identification of the need and purpose of its change and revision. All new study materials for the courses were checked by an internal quality assurance team (both inside the university and other partner universities).

During the implementation of the updated courses, teachers mainly used the following pedagogical technologies:

— lectures in the form of *master classes* and *interactive classes* to increase the motivation and involvement of students in educational activities.
— *Sandwich principle* sessions for the formation of skills *Communication*, *Problem solving* and *Critical thinking*.

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...   87

— Performing group assignments and small projects within small groups to develop soft skills such as *Teamwork*, *Communication*, *Project management*, *Responsibility*, *Self-organization*, *Self-education*, *Leadership*, *Mentoring.*
— Performing *group tasks* and *small projects* within *small groups* to develop such soft skills as *Teamwork*, *Communication*, *Project management*, *Responsibility*, *Self-organization*, *Self-education*, *Leadership*, *Mentoring.*
— Conducting presentations by students of the results of educational and research activities to form the skills "*Presentation*" and "*Communication*".
— *Discussions* to develop soft skills *Teamwork*, *Communication.*
  Ten courses of Sukhoi State Technical University of Gomel were modernized:
— 2 courses have improvements to enhance additional *communication soft skills*;
— 8 courses have improvements for the organization of *students teamwork*;
— 4 courses have improvements on additional work with *presentation* and *discussion skills*;
— 3 courses are integrated with other courses for the 2nd stage of study;
— 3 courses apply the following *teaching methods*:
  - *active learning methods,*
  - *"sandwich principle",*
  - *problem-based learning,*
  - *just-in-time teaching,*
  - *master classes;*
— each course was developed only in Russian.

Selected Results

According Quality Control Plan of the MaCICT project, describes Quality Assurance (QA) general method used in the project on management and educational levels. Where QA itself is divided to internal and external evaluation of the project. One of the task of the Quality Control Plan is assessing the quality of education on the modernized MSc program in ICT. This task is based on monitoring of the progress and evaluation of the achieved results. Evaluation tools for the learning process quality assessment are questionnaires and surveys for labour market and wider society representatives. For focus group interviews we invited stakeholders like students and IT-companies staff. All students were affiliated with one university and one educational course, have the same educational level, age and location. Research method for internal QA of education on the modernised MSc programme in ICT was online survey, using Computer Assisted Web Interviewing (CAWI) (Brahme et al., 2018). The questions and answers were designed either as multiple-choice, or scales. The survey was conducted anonymously using online google forms.
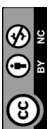
After finishing the 1st intake by the students of the 1st year of study, an survey was carried out. It was attended by 10 students of the 2nd stage of education. Table 1 provides a list of questions (24 items) that were asked to students. For the convenience of processing the answers, all questions were divided into 8 groups. Each group of questions corresponds to a specific soft skill. The students' answers in the form of chart are shown in Fig. 2 and 3. A separate radar chart was created for each group of questions. Each chart has 5 rays, corresponding to a scale from 1 to 5 points. 1 point corresponds to disagreement with the statement, 5 points – agreement (Stukalina, 2018). There are also intermediate options: 2, 3, 4.

Table 1. The list of questions for 2nd stage students

№	Text of the question	Number of question from chart
	Communication Skills (Figure 2a)	
1	Due to this module I make my verbal contributions in more comprehensible language.	Question 1 $\hat{x}=3.8$, σ=0.75
2	Due to this module it is easier for me to ask when I have not understood something.	Question 2 $\hat{x}=3.9$, σ=0.7

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

88   *The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...*

№	Text of the question	Number of question from chart
3	Due to this module I can better write technical texts.	Question 3 $\hat{x}$=4, σ=0.63
	Team work skills (Figure 2b)	
4	I participated in the work planning within the team during this module.	Question 1 $\hat{x}$=4, σ=0.63
5	I contributed to the assignment of tasks within the team during this module.	Question 2 $\hat{x}$=4.2, σ=0.8
	Interdisciplinary approach skills (Figure 2c)	
6	Due to this module I can better think across technical and non-technical considerations, can better see things from different perspectives.	Question 1 $\hat{x}$=3.6, σ=0.8
7	Due to this module I can better solve problems of different nature that I encounter at my workplace/in my own projects.	Question 2 $\hat{x}$=4, σ=0.77
	Critical thinking skills (Figure 2d)	
8	Due to this module I can better critically question and evaluate new ideas/things.	Question 1 $\hat{x}$=3.4, σ=1.11
9	Due to this module I can better find and apply information about methods, techniques and tools needed to solve an issue.	Question 2 $\hat{x}$=3.8, σ=0.87
	Self-organization skills (Figure 2e)	
10	Due to this module I can work more systematically and logically, can better collect, visualize and analyse information.	Question 1 $\hat{x}$=4.1, σ=0.54
11	I am motivated to participate in this module.	Question 2 $\hat{x}$=3.7, σ=1.27
12	In this module I have been encouraged to develop my own learning skills.	Question 3 $\hat{x}$=4.1, σ=0.7
	Presentation skills (Figure 2f)	
13	Due to this module I can better hold a presentation.	Question 1 $\hat{x}$=4, σ=0.63
	Fostering engagement (Figure 3a)	
14	I feel satisfied with this module.	Question 1 $\hat{x}$=3.9, σ=0.7
15	The content is appropriate.	Question 2 $\hat{x}$=4.1, σ=0.7
16	The content is interesting.	Question 3 $\hat{x}$=4.1, σ=0.7
17	The information in this module is appropriate for me / my company/workplace.	Question 4 $\hat{x}$=4.2, σ=0.6
18	Staff are good at explaining things.	Question 5 $\hat{x}$=4, σ=0.77
19	Staff make the subject interesting.	Question 6 $\hat{x}$=4, σ=0.77
20	Staff are enthusiastic about what they taught.	Question 7 =4.1, σ=0.7
21	The module is intellectually stimulating.	Question 8 $\hat{x}$=4.2, σ=0.6
22	I am happy with the pace of learning.	Question 9 $\hat{x}$=4.2, σ=0.7

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...   89

№	Text of the question	Number of question from chart
	Project management skills (Figure 3b)	
23	Due to this module I can better identify and develop new things at my workplace/in my own projects.	Question 1 $\hat{x}$=4.4, σ=0.49
24	Due to this module I can better manage my future projects as well as projects at my workplace.	Question 2 $\hat{x}$=4.2, σ=0.6

Each ray is marked as a percentage that is, it shows what percentage of students, when answering the current question, gave the corresponding number of points. Thus, the answer to each question is a closed broken line. The answers to different questions have lines of different colours. The graph legend contains question numbers that correspond to lines of a specific colour. Table 1 contains survey questions, the answers to which can be found on the corresponding charts by question number. In addition, on each radar chart, a line of average students' answers (Mean) is created.

A survey of students on the results of passing the updated disciplines shows the following results. All students felt they had good communication opportunities with teachers and improved their communication skills, and more than half, that improved their skills above average (see Figure 2a). All students took part in group assignments and projects, and improved their teamwork skills. Most of them believe they have improved their skill above average (see Figure 2b). Moreover, they improved better than communication skills.

The organization of the educational process contributed to the improvement of the presentation skills. Most of the students also rated it as above average (see Figure 2f). Students' answers about the development of an interdisciplinary approach (see Figure 2c) are worse than about the formation of communication and teamwork skills. This suggests that in this direction it is necessary to improve the educational process perhaps not only through the implementation of course projects, but also through the development of current assignments in disciplines, covering several of them.

Surprisingly, several students spoke negatively about the development of critical thinking skills (see Figure 2d). It can be concluded that, probably, the practical tasks have not been changed enough for students to analyse independently. Most of the students commented favourably on contributing to the development of the skill of self-organization (see Figure 2e). However, there is one negative answer. One could assume that this was due to the psycho-emotional characteristics of a specific individual. However, against the background of general positive assessments in the field of communication and teamwork, this is strange. Therefore, in our opinion, it is necessary, within the framework of the taught courses, to provide topics devoted to the issues of purposefulness and planning your own time.

In the field of project management, students showed the most positive results (see Figure 3b). We associate this with the participation of master students of the department in the training program for work on the SCRUM methodology, organized by the Copenhagen University of Information Technologies (Denmark) in the fall of 2020. At the same time, undergraduates went through all the stages of creating a project from drafting requirements to software implementation, testing and placing ready-made software on cloud servers.

In conclusion of this section, we would like to say about the students' assessment of the general level of teaching, its impact on involvement in the educational process (see Figure 3a). Most of the responses showed a level above average. This is good, but there is something to strive for in the future. The most important and effective tool in the training of IT specialists is the internship by students in IT companies. This allows you to improve the most popular soft skills: "Communication", "Teamwork". It is also important that this happens in an environment that is as close to the workflow as possible.
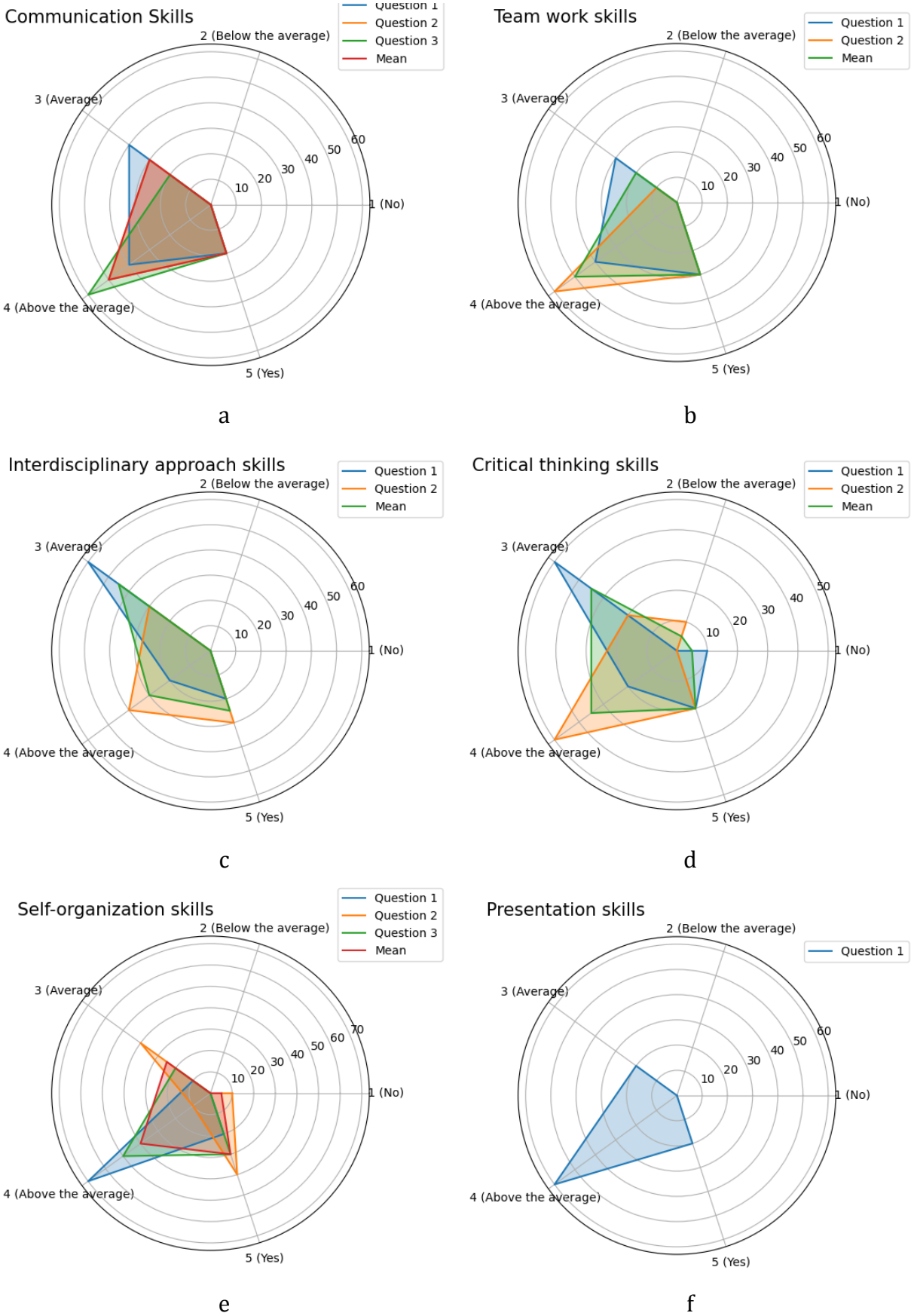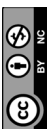
Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

90 *The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...*

Figure 2. Radar charts with the answers of the 1-st intake students

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...   91

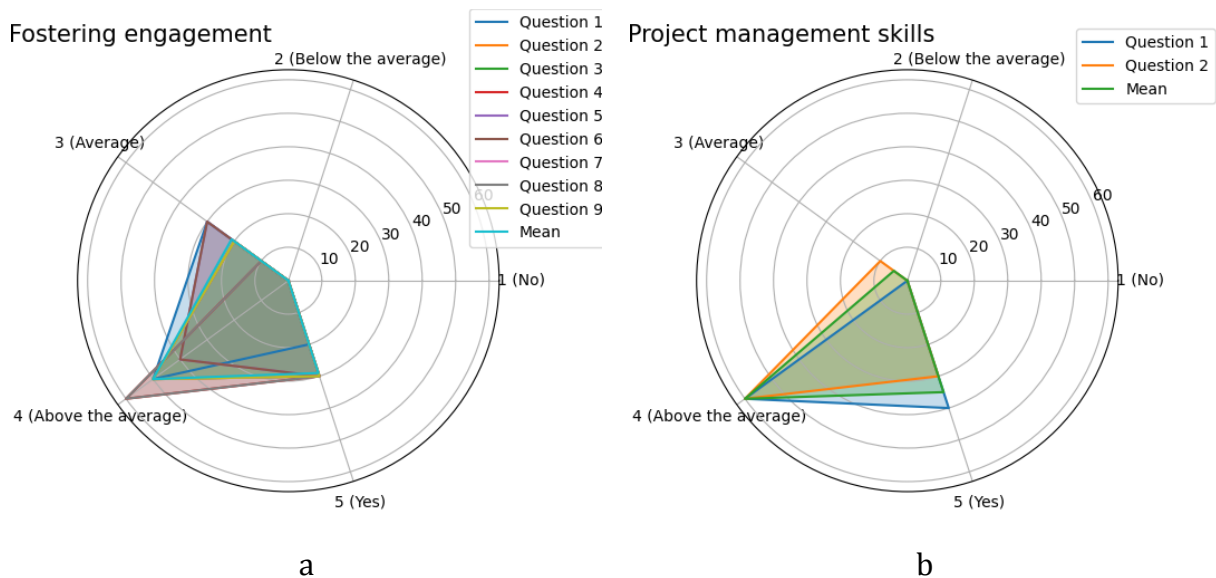a   b

Figure 3. Radar charts with the answers of the 1-st intake students

Table 2. The list of questions for IT companies management

№	Text of the question	Number of question from chart
	Companies look into the future (Figure 4a)	
1	Enjoyment of organizations to continue with the internship program.	Question 1 $\hat{x}$=4.3, σ=0.68
2	Will Continue Accepting Interns.	Question 2 $\hat{x}$=4.6, σ=0.59
3	Opportunity to Train Future Entrepreneurs.	Question 3 $\hat{x}$=3.9, σ=0.86
	Corporate policy and image (Figure 4b)	
4	Is Part of Our Corporate Policy.	Question 1 $\hat{x}$=4.4, σ=0.75
5	Opportunity to Enhance Corporate Image.	Question 2 $\hat{x}$=4, σ=0.73
	Interns new ideas (Figure 4c)	
6	Interns Offer New Ideas.	Question 1 $\hat{x}$=3.8, σ=0.95
7	Gain New Ideas on Technologies.	Question 2 $\hat{x}$=3.67, σ=0.84
	Cooperation with the university for internship (Figure 4d)	
8	Opportunity to Evaluate Potential Employees.	Question 1 $\hat{x}$=4.6, σ=0.61
9	Interns help Reduce Recruitment Costs.	Question 2 $\hat{x}$=3.67, σ=0.69
10	Opportunity to Develop Links with University.	Question 3 $\hat{x}$=4.8, σ=0.4
	Helping interns with routine (Figure 4e)	
10	Interns Relieve Full-time Employees from Routine Tasks.	Question 1 $\hat{x}$=3.5, σ=1.15

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

92   *The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...*

№	Text of the question	Number of question from chart
11	Interns Help Clear Some Work Backlogs.	Question 2 $\hat{x}$=3.6, σ=0.89
	IT community (Figure 4f)	
14	Opportunity to Contribute to the Community.	Question 1 $\hat{x}$=4.5, σ=0.72
15	Opportunity to Learn About Each Other.	Question 2 $\hat{x}$=4.5, σ=0.72

Last academic year, 72% of senior students (3rd and 4th) of the first stage of higher education and 60% of students of the second stage completed internships in IT companies. Thanks to internships, in addition to improving soft skills, students receive more opportunities to find a job, and IT companies to meet the need for personnel. At the moment, 22% of the 4th year students of the first stage and 100% of the 2nd year students of the second stage have received jobs or offers from IT companies.

Similarly to the survey of students, a list of questions is given in Table 2 and the results of the survey on a five-point scale are shown in Figure 4. A survey of IT companies' employees was conducted based on the results of internships. The results allow us to say the following. The companies' view of internships for students is positive, but less optimistic in terms of training future IT entrepreneurs (see Figure 4a). For many companies, internships are part of their corporate policy. But at the same time, they are more restrained in terms of improving the image (see Figure 4b). The vast majority of company representatives believe that interns bring fresh new ideas (see Figure 4c).
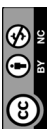
Most companies have a positive attitude towards internships as a way of organizing interaction with universities and finding employees. But sceptical about reducing the cost of hiring new employees (see Figure 4d). The results of the answers about attracting interns to real work (mostly rough work) are ambiguous (see Figure 4e). And what to do with this we do not yet fully imagine at the moment. The majority of IT employees surveyed believe that internships contribute to the overall contribution to the community (see Figure 4f).

After receiving the students' answers, a check was made to find deviations. We compared similar responses in Figure 2a and 2b and did not reveal significant deviations, therefore, the answers of all respondents were taken into account. At the next stage, we calculated the main statistical values used in surveys: the mean and the standard deviation σ (Kitchenham and Pfleeger, 2003). The calculation results were placed in tables 1 and 2. This year, the approaches to teaching disciplines at other departments have changed. Our teachers teach data analysis classes for students in other specialties. For students of economic specialties of our university, we have changed the teaching technologies for the Data Mining subject.

Summary

Soft skills are more important than ever to success in the workplace, given that teamwork and communication have a high priority in today's work environment. However, the modern curriculum relies heavily on teaching technical skills. Thus, educators must find ways to integrate soft skills into the disciplines they teach. Most of the survey results fluctuate around 4 (above average). Students gave high marks to project management skills. As we understood, this happened as a result of the development of real software products as part of the project management course. Each student development team consisted of Belarusian and foreign students, and communication took place both with Belarusian and foreign teachers. In addition, all students communicated widely with project managers of foreign companies that submitted technical specifications for the development of software products.

Student results with the lowest values are associated with the generation of new ideas and the use of various tools to solve current problems (see Figure 2d). At the same time, the values of the standard deviation are significant (for Figure 2d), which indicates a large difference in the answers of students. Similarly, employees of IT companies lowered their assessments of students' efforts to generate new ideas and use new technologies during internship program (see Figure 4c). However, IT companies are strongly interested in cooperation
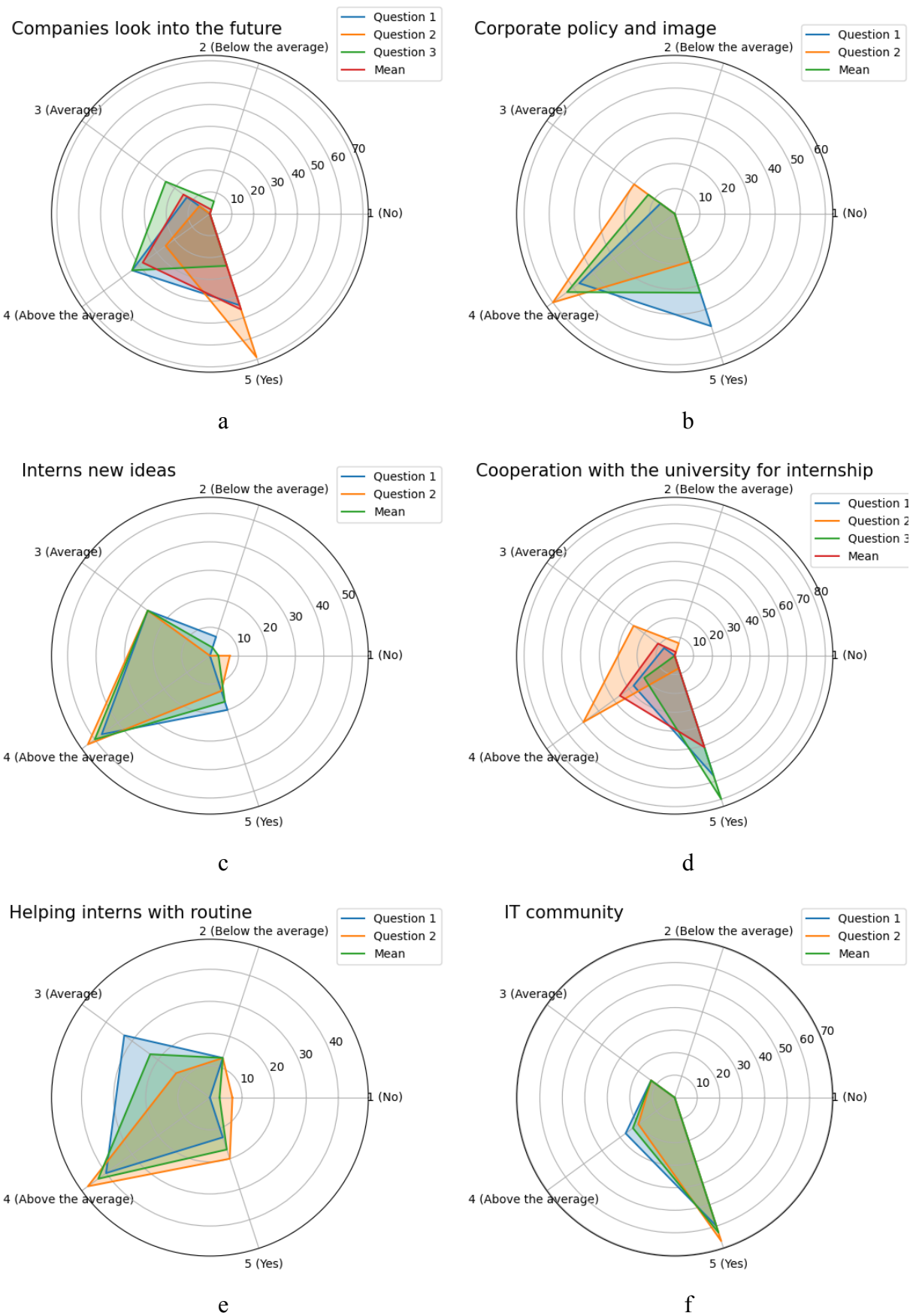
Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...   93

Figure 4. Radar charts with the answers of IT companies manager staff after 1-st intake

with universities (see Figure 4c, question 3), therefore, while continuing cooperation between educational organizations and software development companies, it is necessary to increase efforts to study new technologies and generate new ideas for their application in real software projects.

Kanstantsin Kurachka, Uladzimir Kamrakou, Vladimir Zakharenko

94   *The Introduction of Soft Skills in the Study of Disciplines of the Second Stage of Higher Education at the Sukhoi State Technical...*

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