

Information Technology impact level perception of Students at Electrical Engineering Faculty in East Sarajevo

Srđan Nogo*, Nikola Davidović, Radmilo Borovina

¹ Faculty of Electrical Engineering, East Sarajevo, Bosnia and Herzegovina

* srdjan.nogo@etf.ues.rs.ba

Abstract: *The paper investigates status of Information Technology (IT) impact level perception of students studying at the Faculty of Electrical Engineering in East Sarajevo. Competitiveness on the labour market of the future graduated engineers are narrowly related to their level of competences and possible adoption of skills in teaching process. This paper includes the results of a research involving all students in the Computer Science and Informatics program at our university, starting from first year of studies up to fourth year. Three areas have been identified as additional value for the students during the teaching process at the faculty. The focus was on the student's perception of professional IT skills that they have to adopt before their first employment. Based on the research results, amending of current curriculum of the Computer Science and Informatics program at the Faculty of Electrical Engineering in East Sarajevo has been proposed.*

Keywords: *Information Technology impact level perception; On-line survey; Electrical Engineering Faculty*

1. INTRODUCTION

What is an optimal level of *Information Technology* (IT) impact perception at the first cycle of studies among students, as well as the level of required skills to be competitive on the labor market is a question that brings a whole list of answers. We could say that students should predict and recognize trends that are changing in the IT industry through education process, and related to that conclude what is an optimal level of IT skills that they should adopt. One of the answers is that systematic approach to improvement of student's knowledge is through the quality improvement of the study program at the faculty. According to Vyalikova, Erofeeva, Plekhanova, Pluzhnikova and Saveleva in [1], "Considering the formation of students general Information Communication Technology (ICT) competence from the point of view of the system-and-activity methodological approach, it is possible to characterize it as a system that consists of a number of elements, has connections with the external environment (EIES), is aimed at a certain result (students mastering an adequate level of competence)".

From the previous statement, it can be concluded that the main objective for the students is to adopt skills and competences during their university education that will be adjusted to future EIES. Highlighting the requirements for the IT engineers to be professionally enabled for solving problems based on the requests of the end users of IT applications and information systems in general on

a daily basis. *Olaisen and Revang* in [2], state that "Experts knowledge is accumulated through education and practical experience enabling experts to apply his knowledge in order to be regarded as a professional". *Gulatee and Combes* in [3], stated that "How students really use technology for learning is very important for schools and universities, as technology is being rapidly incorporated into educational settings". Considering the opinion of students at the Faculty of Electric Engineering, it is obvious that they should predict technology and economic factors that drive towards change in society. However, the curriculum must be adjusted towards the accelerated technological development. Primarily, the focus should be on those areas with direct impact on the worlds IT market growth.

Mole, Dim and Horsfall in [4], claim that, "This also affected education in many fields resulting in the introduction of subject dedicated to ICT in existing university curriculum, and has led to reengineering and improvement of education practice to meet industrial needs".

In the interest of creating knowledge-based society, it is very important to plan development of IT professionals through the university curriculum in a systematic and unified way in line with the world standards dictated by the industrial needs. Engineering disciplines require balance between demographic, economic and social standards and daily tasks that employers expects from students to be able to carry out when they enter into labor

market as graduated IT engineers. Dahlstrom and Bichsel in [5], and Tumbleson in [6], claim that, "Users (students) demand digital content on laptops, tablets, and smartphones to enhance learning especially with library resources". Based on this assertion, authors confirmed that improvement of the existing IT skills of the students is directly related to improvement of the speed and quality of providing the latest hardware configurations and deployment of web application tools into the learning processes at the Faculty of Electrical Engineering. Mestre in [7], and Zang, Watson, and Banfield in [8] states that "The Learning Management System (LMS) offer instructors the ability to create extensive tutorials (content) that can be viewed at a self-paced administration before it becomes outdated".

Based on this statements, one or multiple web-based platforms (e.g. Moodle—open source learning platform) used at the Faculty can be identified. Due to its scalability, it may be used on any hardware configuration available to students. Through experimentation, Zhang and Zuo [9], discovered that the teacher-student interaction is influenced by the interactive environment, personal traits, events of different emotional valences, and the emotional state of students. Naturally, the teacher is required to identify and deal with such parameters through the teacher-student interaction.

Through usage of the IT solutions mentioned above, student's mobility would be ensured, enabling them to master the learning content and new IT skills, even though they are not physically in the classroom. Teacher-student interaction through use of the latest IT web platforms for distance learning will be applied if a student is not able to attend.

This research aims to identify the basic needs of students and, through their recommendations resulting on research conducted, to incorporate them into improved curriculum in the future.

Authors will identify which IT tools and skills today are the most needed to be incorporated into the curriculum in the first cycle of study in the future through web-based distance learning platforms. These results would serve as a base to upgrade the teaching process in other cycles of study, primarily, the second and third cycles on the Faculty.

The purpose of this paper is twofold:

- 1) Analyses the current state of the digital skills level and perception of requirements for IT improvement, so as enhancement of IT knowledge of the students on the Faculty where all students of the first cycle of studies (all four years) have been included. The analysis is given in Section 3.
- 2) Based on the survey we will give recommendations for the future improvement of current curriculum for the study program

Computing and informatics, as given in Section 3 (Table 1).

This paper is structured as follows: After Introduction, there is a discussion about optimal level of IT skills of the first cycle studies students, so as the level of required competences to be competitive on the labor market", there is Section 2. Where authors identify the precise profile of the participants and areas of knowledge that students have in order to make certain recommendations for the improvement of the whole system of strengthening digital skills and possible update of curriculum against research results. In this section, the Methodology for the implementation of the survey is described. Section 2.1 (Research question), as the usage is concerned, is a starting base to generate the results of the survey outlined in Section 3. Section 3. contains main focus of this survey paper with technical details required for analysis and recommendations for Proposal of IT skills to be included in curriculum on the Faculty, which can be compared to similar surveys in this area. Practical analysis of the results described in Section 3 provides us with a visual means to confirm our summary and conclusion outlined in Section 4.

2. PARTICIPANTS

According to Bourke, Kirby and Doran in [10], "The first stage in Problem Based Learning (PBL) is to identify what you already know about the problem that you are trying to solve. Ideas will generate from this approach and will be reformulated based on what exactly you need to measure". First phase in our research focuses on identifying which factors most significantly impact how students perceive technology (such as demographic and economic changes) and social aspects of their own lives.

In brief, the Faculty of Electric Engineering in East Sarajevo is the oldest higher education institution in the field of electrical engineering in Bosnia and Herzegovina. The Faculty was founded in 1961 by separating from the former Technical Faculty in Sarajevo, when begins to operate independently within the University of Sarajevo. After a one-year pause in 1992, the Faculty reopened in 1993 within the University of East Sarajevo. Since academic year 2004/2005, teaching activities at the faculty are carried out based on the new curriculum which is in line with the Bologna Declaration. According to the Declaration, the studies are organized through three levels of studies: bachelor's (first cycle), master's (second cycle) and doctoral (third cycle) [11].

The headquarters of the Faculty is located in East Sarajevo and this higher education institution was chosen for our research due to several reasons. As mentioned above, this is the oldest and most prestigious educational institution that is part of a public university and where the responsibility of

students to take participation in researches is at a very high level. Moreover, the Faculty encourages the use of the latest ICT technologies in everyday teacher-student interaction. Recently, the Faculty has been constantly tracking the needs of students, which is directly related to the requirements of the labor market for IT staff in BiH, in order to attract as many students as possible to enroll this Faculty. Of course, this goal would not be met without trying to include in the teaching process as many ICT technologies that have additional value for students in the process of acquiring new skills in this area.

Therefore, this research is consisted of a range of students, encompassing the all four years of the first cycle students. The total number of participants was 105, of which 37 female students (35,23%) and 68 male students (64,77%). Regarding of the year of studies, the situation was as follows: 44.8% of participants were in the first year of the Faculty, 22.9% in their second year, 24.8% in the third year and the rest of 7.5% were in the final fourth year. There were 67.7% first and second year students studying based on the general curriculum who participated in this study while there were 32.3% of the third and fourth year participants studying according to the curriculum of the Department of Computing and Informatics. Eighty-eight (88%) per cent of the participants aged in-between 18-22 years.

2.1. Research question

This research seeks to determinate status of IT skills perception level of students. The questions in the research are divided into three groups and asked in a sequenced order. Based on that, the first group of questions are focus on area which are the drivers of change in the world when it comes to demographic, economic and social factors and what are the technological and economic factors that drive change in society.

Throughout our study, quantitative methods based on web questionnaires are used. Nancarrow, Pallister and Brace in [12], find that, "Using the Web is cost effective and time efficient, enables the researcher to gain a snapshot of the current state of affairs". Moreover, Braunsberger, Wybenga and Gates in [13], claim that, "Web questionnaire allows a fast turn-around for data collection and has been shown to be a reliable alternative to telephone surveys". Web questionnaire also provides anonymity for participants allowing them to answer the questions in a friendly environment which would not be the case if the interview method was applied, since authors have a subjective influence on the teacher-student relationship.

In order to analyze the state of affairs as regards IT skills of students who are using the University information system, the following methodology is used:

- Creation of survey questionnaires
- Filling an on-line survey questionnaire by students
- An analysis of the response set to cover topics that are of primary importance to our research.
- Collecting and analyzing the results obtained from the web questionnaire.

The questions for the questionnaire were developed using the Google Forms tool, which is an online research tool available on the Internet [14]. This tool was chosen because it enables us to collect information from students through personalized quizzes or surveys. Then, it is possible to connect the info to a spreadsheet on Sheets to automatically record the answers. The spreadsheet then populates with the responses from the quiz or survey in real time.

All questions could be answered by one of the four (4) different browsers, Mozilla Firefox, Google Chrome and Microsoft Edge version. All participants performed on machines with installed Windows operating system or smart devices with usage of Android or iOS operating system. A questionnaire is made with Google Forms tool. This free software allows us to gather data from participants.

Surveying of the students was conducted at the Electrical Engineering Faculty in East Sarajevo from 1 October 2021 to 31 December 2021. The study included all students from each of the four years study curricula of the first cycle of studies.

3. RESULTS

Survey questions on Information Technology skill level of the students at Electrical Faculty in East Sarajevo provided the following results and addressed the issues from 1 to 4 presented in Figures in Section 3.

The survey included 105 respondents from the Faculty of Electrical Engineering at the University of East Sarajevo, who answered three sets of questions about world-changing trends, and its results are:

The first set of questions referred to the trends that are changing the world today.

When asked which the drivers of change in the world are when it comes to demographic, economic and social factors, students chose one or more answers shown in Figure 1.

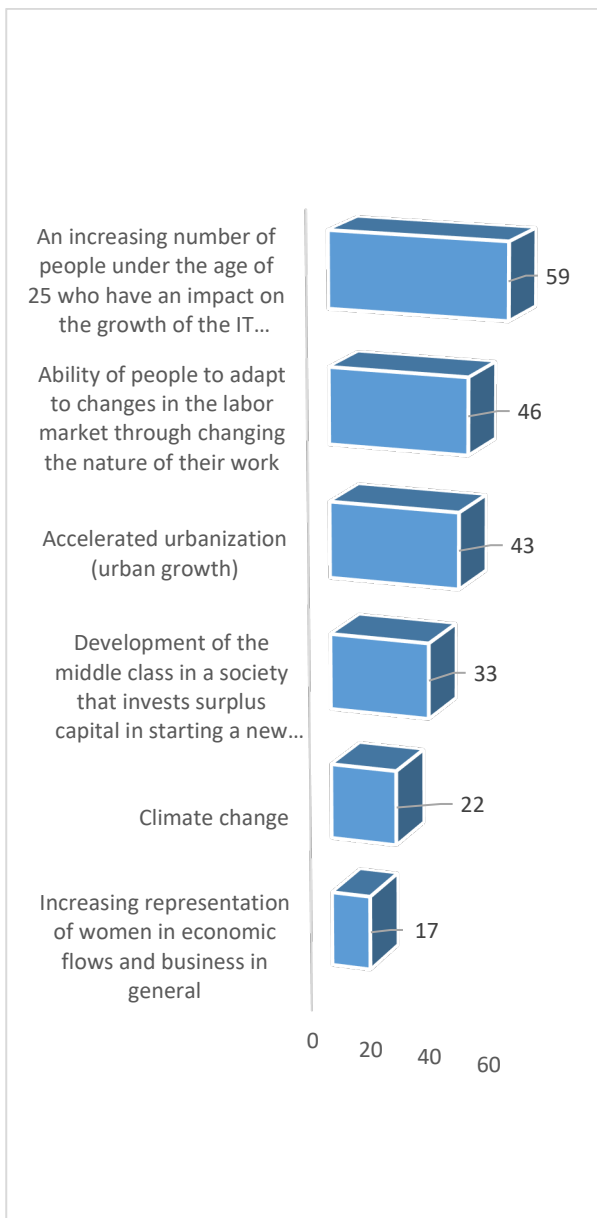


Figure 1. Drivers of change in the world

As seen in the Figure 1. Above, the majority of students (59 of them) think that the increasing numbers of young people under the age of 25 who have an impact on the growth of the IT market are the main drivers of change in the world. Given that this is the opinion of students belonging to this group, we can conclude that they recognize the importance and potential of technologies they use every day, as well as the way in which they can reshape the world.

When asked what are the technologically and economic factors that drive change in society, students selected one or more answers shown in Figure 2.

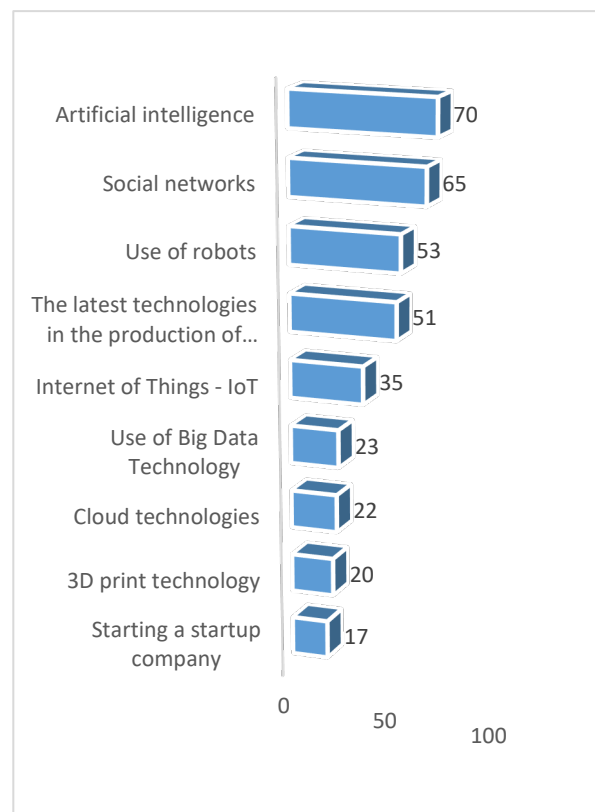


Figure 2. Technological and economic factors

Most students think that artificial intelligence and social networks are the technological areas that have the greatest impact on changing the world and society today. Social networks have already stabilized as a factor affecting all strata of society. As for artificial intelligence, Teselios and Sava in [16], state: "For companies that adopt technology efficiently, Artificial Intelligence brings cost savings, improving efficiency and increasing competitive advantage."

The second set of questions aimed to examine students' opinions on future trends.

When asked which of these areas is a decisive factor in the future development of the IT market, respondents gave the following answers shown in Figure 3:

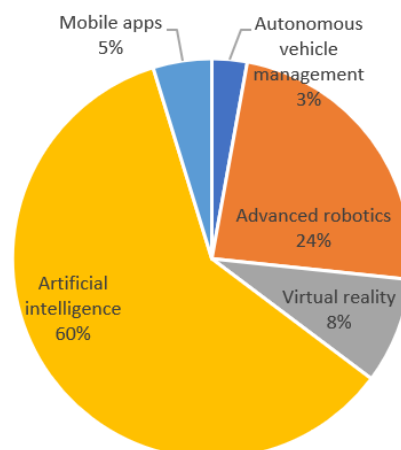


Figure 3. Future development of the IT market

Finally, after analyzing the previous areas, authors came to the final question in this questionnaire, and it asks about the areas of IT professional skills which are essential in the future professional work within the next five years.

Participant responses are shown in Figure 4.

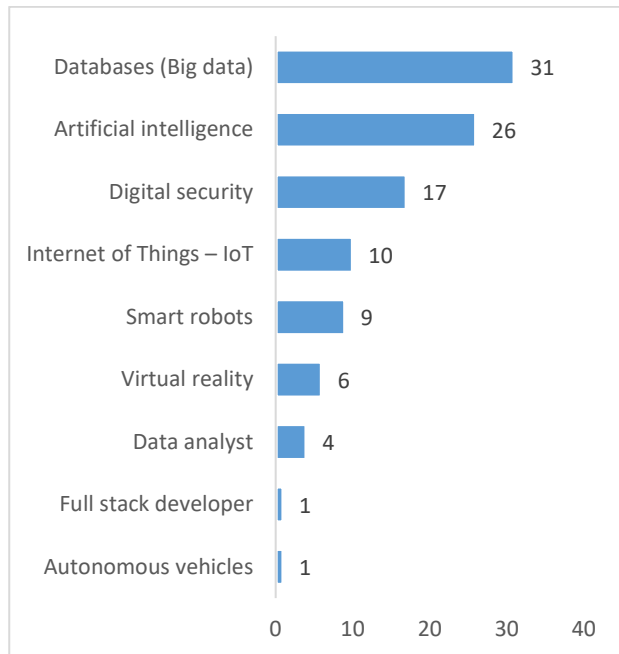


Figure 4. IT skills perspective in next five years

By analyzing the data in Figure 4, it is visible that, according to the answer of the respondents, Most respondents think that Big Data is the area that will be most in demand in the labour market. Kumari agrees with this in [17], stating, “The Big Data impact poses a competitive threat to businesses that ignore the trend.”, and “... understanding how you can help companies and clients use Big Data will eventually be (if not already) an important element of your professional and marketplace skill set.” According to the respondents, future employers will also expect knowledge from engineers in the field of artificial intelligence, which is in line with the importance that respondents gave to artificial intelligence in answering the previous questions.

Through data analysis, authors were able to identify eighth (8) new IT area for improvement IT skills that are presented in Table 1 as a direct result of the responses of the participants given in Figure 1,2,3 and 4.

Table 1. Proposal of IT skills to be included in curricula of existing courses in ETF

No.	IT skills
1.	Working and developing practical knowledge in Artificial intelligence
2.	Working and developing practical knowledge in social Networks
3.	Learning practical skills of server-side languages in robotics
4.	Learning practical skills about latest technologies in the production of electricity from renewable energy sources
5.	Usage of Databases (Big data) and analytics in integration of different sets of data
6.	Programing with Mobile application in area of IT
7.	Learning practical skills in Digital security area
8.	Installing, configuring, testing and maintaining cloud computing

4. CONCLUSION AND FUTURE WORK

The constant improvement of the IT skills of the target group, i.e. ETF students, is of very crucial importance in the teaching and pedagogical process of the Faculty. Through this research, the systematic approach to the process mentioned above is presented. Using a systematic approach in improving the knowledge of students, authors achieved the goal, which is to identify eight areas in IT skills and provide suggestions for reinforcement of quality of the study programs at the ETF. These eight areas should be incorporated in the curriculum of the courses which are an integral part of the ETF curriculum in order to increase the competitiveness on the market of graduate engineers. Given the current state of student workload within existing courses, it is recommended to introduce certain new optional courses that would cover eight areas of IT skills identified in Section 3.

This approach would contribute to the competitiveness of graduate electrical engineers on the labor market and contribute to their better starting position in their future professional work.

With the lessons learned and the areas identified for the improvement of teaching process oriented to target group, and it is the students themselves, the next generation of students would be able to adopt new IT skills in a simpler and faster way.

This approach will allow them to have simpler and faster mechanisms for acquiring IT skills as a basis for upgrading from some other areas not covered by the research in this paper.

This research work can be extended to more participants with more tools and different comparative parameters as i.e. survey should be executed on students of the second and third cycle of studies at the ETF.

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