

The Importance of Elective Courses for IT Students in the Function of Professional Guidance

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Abstract — Contemporary higher education is developing on the basis of Bologna declaration and the concept of „lifelong learning“. Characteristics of the previously mentioned are visible in the joint efforts of all the participants involved (teaching staff and students) to improve quality of education and create content adequate for the needs of the market. Burgeoning usage of technology in day-to-day life increased demand for Information Technology (IT) engineers, which resulted in many universities accrediting IT study programs. Versatile usage of technology initiated the development of multidisciplinary programs so that engineers could apply their field of studies to any area, moreover, they become competitive experts in the labor market. Provided numerous directions of business and diverse needs and aspirations of students, universities introduced elective courses. Not only do they enable students to further specialize in desired fields, but to acquire new skills from different branches of business as well. IT engineers should, beside their primary knowledge, acquire managing and organizational skills, learn basics of economy, law or other fields in regard to particular kind of job they do. Key question being asked when discussing students' preference and elective classes is whether classes are being chosen based on the desired job specialization or there are other factors which influence final decision making. This paper analyzes elective courses of the Department of Applied Information Technology at the Faculty for Management, Economics and Finance, Belgrade, followed by the results obtained from survey taken by students in regard to their preference when choosing elective courses.

Study shows that, besides personal interests for certain course, teachers also play an important role, as well as, passing rate of the very course, other students' experience and if the course is centered around currently popular topics. Elective classes are of great importance for students, however, they are frequently being chosen based on other factors rather than personal interests. Through discussion with students and by taking their opinions and suggestions into account we could render such elective classes which students would be more interested in and significantly more motivated to take, whereas choice would be more often made on the grounds of very desires of the students rather than on their sympathy for the teachers or higher passing rate.

Keywords — *Bologna declaration, lifelong education, elective classes, Information Technology engineer, job specialization*

I. INTRODUCTION

Elective courses play a significant role in higher education, providing students with the opportunity to expand their skills and knowledge in specific areas and according to their personal

preferences. When it comes to information technology students, elective courses have an additional importance in their professional guidance and acquiring relevant skills for future careers in the IT sector.

Student preferences in choosing courses play a key role because their choice directly affects motivation, engagement and ease of achieving professional knowledge and goals. Studies have shown that students oriented towards information technology often have different interests and desires when it comes to choosing courses, and therefore the focus of their interest can go in several directions such as programming, computer networks, IT management, system design, databases, web design or artificial intelligence.

The importance of elective courses in the professional guidance of information technology students was observed in a study conducted at a university in the USA. Research participants highlighted that their electives were of great importance for specializing in certain knowledge that sets them apart in the job market. They also highlighted that they are of crucial importance for discovering their own interests in the world of information technology [1].

Some researchers indicate that electives provide IT students with the opportunity to specialize in a particular area and to acquire broader knowledge and skills needed for specific careers in the industry [2]. Others emphasize that electives can help students develop transferable skills, such as teamwork, creativity, resourcefulness, and problem-solving, which are very important in the dynamic and innovative environments of the IT sector [3].

In order to provide adequate support to IT students in the elective course process, universities and higher education institutions should provide relevant information about elective courses, their objectives and outcomes, as well as provide counseling and mentoring to help students make the right decision [4]. According to a survey conducted in Australia, IT students expressed the need for a wider choice of elective courses that would allow them to expand their knowledge in certain areas. They find it important that the courses are adapted to modern technological trends and have practical application, in order to gain relevant experience for work in the industry [5].

Considering all these facts, the process of choosing courses can be improved by working together with students and higher education institutions. Through active student participation in the



development of elective courses and the provision of relevant information about potential career paths that can be achieved by choosing certain courses by professors [3]. Based on all this, students are allowed to tailor their education according to their own interests and goals, which can result in greater satisfaction, engagement, and success in their careers in information technology.

II. METHODOLOGICAL AND HYPOTHETICAL RESEARCH FRAMEWORK

The subject of the research that initiated the preparation of this paper are the preferences of students when choosing elective courses, how they depend on the previous experiences of students, and how they can help in their professional development after completing their studies.

Two main goals of this research have been identified. The first goal is aimed at analyzing elective courses in the field of applied information technology, their syllabi and the knowledge that students acquire when they pass the selected courses. While the second goal is related to examining the connection between the choice of courses and students' preferences. The main goal is based on the above and is aimed at showing how and why students choose certain courses and how they are connected to previously acquired knowledge and skills, as well as their future professional preferences. In addition to the above, the research will be aimed at finding answers to the question of whether these electives are actually chosen based on preferences or whether there are other methods of selection, how they affect the further orientation of students and whether there is a possibility of adapting the subject to the labor market and future requirements set by the engineering industry.

The main hypothesis on which the master's thesis is based is:

X0: If, based on the selection of a certain set of electives by students of the information technology major based on the survey method, the selected subjects will be considered more relevant to the students' own preferences with greater precision.

The main hypothesis is supported by the auxiliary hypotheses:

X1: If, based on a presentation focused on the defined reasons of students when choosing certain electives, the way in which they are connected to previously acquired knowledge and skills will be more competent.

X2: If elective courses are selected based on the survey method of preferences during selection, there will be a precise and defined possibility of adapting the course to the labor market and future requirements set by the engineering industry.

In order to obtain adequate scientific research results, the following methods will be applied:

- Analytical method - an analysis of adequate scientific literature dealing with the topic of higher education, the Bologna Declaration, permanent education, engineering education, information technology in university education will be performed.
- Empirical method - available theoretical knowledge will be compared with the state of practice.
- Induction and deduction method - the above methods will enable conclusions to be drawn about the importance and success of elective courses for information technology students in the function of professional guidance.
- Statistical method - applied in order to present statistical data presented by surveyed students of the third and fourth (final) years of studies on preferences during the process of choosing elective subjects.

III. SURVEY ANALYSIS

A. Research methodology

From a large number of methods for examining the environment on certain attitudes, the survey method was chosen for the purposes of this work. The survey was compiled using the Google Forms application, and the respondents filled it out online. Given that a group from one higher education institution was selected, the survey was distributed via QR codes that could be scanned in the institution's premises, via email addresses and student groups on certain applications.

The questionnaire consists of 13 questions, with the aim of gaining insight into the views of third and fourth (completed) year students on their preferences in the process of choosing elective courses at the Faculty of Applied Management, Economics and Finance in Belgrade (hereinafter MEF). The questions are closed-ended, with several suggested answers, based on which quantitative and qualitative research results are obtained. The survey conducts research on the way students choose elective courses through questions related to the reason for choosing information technology as a direction in the study process, areas of interest in the world of IT, the list of selected courses, and grades obtained in certain courses.

B. Research sample

The research was conducted on a sample of 120 students at the MEF Faculty in Belgrade. Of the total number of respondents, 57.1% were male, and 42.9% were female. Given that the survey was conducted only on third and fourth year students, 58.9% were fourth or final year students, while 41.1% were third year students. The average age of the respondents was 26 years old, with the youngest respondents being 21 years old, the oldest 40 years old, and the largest number of respondents being 22 years old.

C. Analysis of research results

The following paper will present the data collected through the survey and the conclusions reached during the research. The questions are presented individually and then followed by a graphic display and the results obtained.

The first two questions refer to the gender and age of the respondents, and the information is provided in the description of the research sample.

The next question refers to the acquired level of secondary education, i.e. which secondary school the students attended before enrolling at the faculty:

Which type of high school did you graduate from?

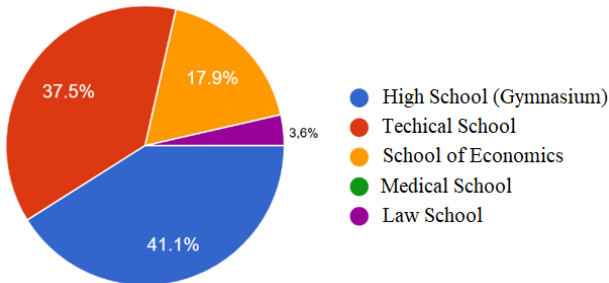


Chart 1. - Display of acquired level of secondary education

The largest number of students, almost half of the respondents (41.1%), graduated from high schools (Gymnasium), and the second largest group are students who graduated from one of the technical schools. Schools of Economics make up 17.9% and the rest, which makes up less than 4%, are law schools. Such results are expected, students with a technical school degree by the nature of their secondary education continue their studies and training in the field of IT, while other respondents, in addition to the acquired general knowledge, most often choose information technology as the currently most popular field of study and business.

Since the survey is related to elective courses, and they can only be chosen during the third and fourth years of study, for the purposes of sample validity and further questions and results, the next question was related to the respondent's current year of study:

What year of study are you in?

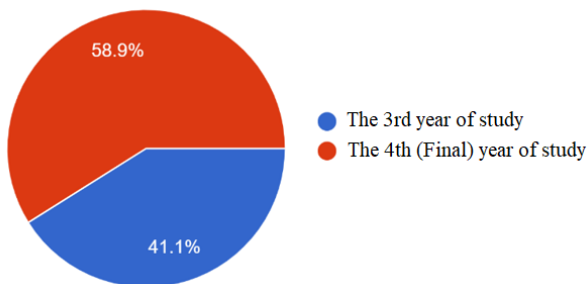


Chart 2. - Display of the respondent's year of study

A slightly larger number are students in their final, i.e. fourth year of study (58.9%), while the rest are third-year students. An interesting fact is that among the respondents there are no students who have transferred from another higher education institution, which means that the respondents are students who have completed all years of study at a given higher education

institution and can most honestly provide opinions and information for the subject of this research.

The following question shows the reasons why respondents decided to enroll in an applied IT major:

Why did you choose to study IT?

Table I - Reasons for choosing to study IT

Interesting	58,9%
Possibility of finding a job quickly	30,3%
Financial security	41,1%
Relevance of the profession	28,6%
Environmental influence (family, etc.)	21,4%
Wide range of different opportunities in IT	39,3%
Possibility of working from home	39,3%
Work for an employer from abroad	23,2%
I don't know	1,8%

Respondents were offered 8 answers and the possibility of adding an answer if their answer did not include any of the above. Interest and financial security are the most common reasons for enrolling in IT. After that, a large number of different professions, i.e. the directions that technology offers, as well as working from home, play an important role. Considering the development of technology and science, the possibility of quick employment is also one of the important factors in choosing a career, and then the relevance of the profession itself, because today it permeates all areas of life and business. Working for a foreign employer is today an increasingly present and decisive factor in choosing a job, both because of higher incomes, and because of the possibility of working from home or some other place, but also because of going abroad, which is today the "dream" of a large number of young people. If certain family members or friends are students of information technology or already work in that field, often, as we can see from the survey, they are the reason why individuals decide for the same thing. Slightly less than 2% of respondents said they did not know why they chose information technology.

Since the respondents are final year students, the next question should provide insight into how many of them are currently employed in the field of information and communication technologies and whether this may have influenced their further choice of subjects and major:

Are you employed in the IT field while studying?

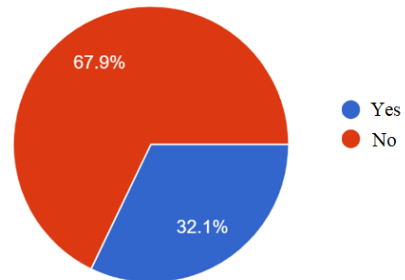


Chart 3. - Percentage of respondents employed in the IT

The graph shows that 32.1% of students are currently employed in the IT field, while almost 70% are unemployed.

Since information technology has many branches and directions, respondents were offered the 5 most common areas that could be of interest for elective exams, and in addition to those 5, they could also add others if they were not listed.

Table II - Areas of interest in IT

Programming	44,6%
Web Design	50%
IT Management	33,9%
IT Security	25%
IT Administration	25%
Technical system support & Networks	1,8%

WEB design and programming are at the very top of interest, which is expected considering the development of technologies and the demand for the creation of WEB as well as various applications, whether for computers, mobile or other devices. These two areas are also what represents the most common association with information technology, as well as the basis for the development of other branches. The third very popular area is IT management, probably due to its multidisciplinary nature, because they relate to knowledge of business processes, management of people, time and money, project management, organization and motivation, and monitoring trends and new technologies in IT itself. IT security and IT administration are somewhat less interesting areas, and if they seem not so important, both branches are present and necessary in all spheres of business. Given the increasing expansion of the network and easy access to all data, system security is very important, in order to prevent unauthorized access, theft and misuse of data. The job of an IT administrator is often underestimated in the IT world and refers to a large number of jobs and tasks that often go beyond the boundaries of administering a system, and in addition, they are underpaid, which may be the reason for the small number of people who would deal with it. One respondent added the area of Technical Support of Systems and Networks, which refers to network monitoring, system maintenance, and ensuring continuous operation, in addition to the answers offered.

The next four questions refer to blocks of elective courses, two blocks in each year, i.e. one block for each semester of the third and fourth years of study. Each block is separated into one question, students are offered 4 courses in the block, and they have the option of choosing two courses.

The first block consists of the following subjects: Business Law, Financial and Actuarial Mathematics, Analysis and Logical Design and Decision Theory. All elective courses with their objectives and outcomes are in the field of Applied Information Technologies.

Table III – The first block of elective courses

Business Law	10,7%
Financial and Actuarial Mathematics	85,7%
Analysis and Logical Design	12,5%
Decision Theory	87,5%

The majority of respondents, over 85%, chose *Financial and Actuarial Mathematics* and *Decision Theory*. While the remaining 10-12% chose the subjects *Business Law* and *Analysis and Logical Design*. The large number of students who chose the subject Financial and Actuarial Mathematics can be correlated with the data on the large number of high grades achieved in the subject Quantitative Methods, given that these are subjects that basically have mathematical and economic characteristics. As for the subject Business Law, the smaller number of students who chose the subject are probably students of economic or law high schools who have already encountered law as a subject, while students from technical high schools mostly chose Analysis or Logical Design or Decision Theory.

The second block consists of the following subjects: Information Systems Management (IS Management), Project Management, Mobile Communications Programming, Accounting Information System (Accounting IS).

Table IV – The second block of elective courses

Information Systems Management	21,4%
Project Management	78,6%
Mobile Communications Programming	28,6%
Accounting Information System	67,9%

Almost 80% of students chose the subject *Project Management*, slightly less than 70% chose the subject *Accounting IS*. *Programming with mobile communications* was chosen by about 28% of respondents, and this number can be compared with the low passing rate of students in subjects related to programming and various programming languages. The fewest students, slightly more than 20%, chose the subject *IS Management*, such results are not exactly expected given the large number of students who indicated IT management as an area of interest. As the development of technology increasingly leads to competitions for various types of projects and StartUps that give young people the opportunity to develop their ideas and start various businesses, project management is a subject that can give them a good foundation for writing projects and managing them.

The third block consists of the following subjects: Software Patterns, Human Resource Management, Organizational Behavior and Corporate Security, and Security and Protection of Information Systems.

Table V – The third block of elective courses (Final year)

Software Patterns	18,4%
Human Resource Management	76,3%
Organizational Behavior and Corporate Security	10,5%
Security and Protection of Information Systems	89,5%

The vast majority of respondents, 89.5% of the total number, chose the subject *Security and Protection of IS*, given that we are talking about a subject in the fourth year of study, students, in addition to developing projects and programming applications, saw the need to protect the systems and data they work with. Various hacker attacks, data misuse are quite common today, so online security is very important. In contrast

to technology, a very important component of every business are people, *Human Resource Management* is the second subject with the most choices, 76.3% of students, because in addition to application development and project management, it is important to manage human resources well. A small number of students chose the subjects *Software Patterns* and *Organizational Behavior and Corporate Security*.

The fourth and final block of classes consists of the following subjects: Virtual Enterprise, Intelligent Systems, Media Management, and Internet Marketing.

Table VI – *The fourth block of elective courses (Final year)*

Virtual Enterprise	78,9%
Intelligent Systems	18,4%
Media Management	10,5%
Internet Marketing	89,5%

Almost 90% of respondents chose the subject *Internet Marketing*, which can be linked to the increasing demand for digital marketing services, a large number of internet services, shops, companies that need marketing on the internet and social networks. In the era of obtaining information via the Internet, the classic principles of marketing and sales have changed and adapted to the Internet. Also, with the development of startup companies in the era of digitalization and innovation, various virtual companies are developing, which is of great interest and we can see from the survey that as many as 78% of respondents decided on this subject (*Virtual Enterprise*). In addition to technological knowledge, running a company requires knowledge of the basics of various fields of economics, law, management, etc. A very small number of students chose subjects such as *Intelligent Systems* (18.4%) and *Media Management* (10.5%).

IV. THE DISCUSSION OF THE RESULTS OF THE RESEARCH

It is not widely known from research why students choose particular modules and/or subjects, which is unusual given that most academics recognize that module choice can have a significant impact on student engagement, learning, individual and group success, and post-graduation labour market outcomes [6]. Understanding the motivations behind student choice could enable universities to improve their module and/or subject offerings, provide information and advice to students to improve their decision-making processes, and thereby improve retention, engagement and success rates for all students. Better success rates in subject choices inherently lead to better completion rates, an important potential positive outcome given the increasing number of students who do not complete their studies. Improved knowledge about the mechanisms of module selection should produce information that could help shape and improve the relevance of electives and allow for greater flexibility for students within the program.

The research in this paper is based on a survey that presents the experience of students and their preferences regarding the selection of elective courses in the third and fourth years of

study, the applied information technology major at the Faculty of Applied Management, Economics and Finance in Belgrade. The aim of the research is to determine the principles of choosing alternative courses at the faculty and to determine the role of elective courses in the professional development of students and how their choices are related to previously acquired knowledge and skills [7]. In addition to preferences, the aim is to show whether there are other methods of selection, how elective courses influence further direction and whether there is a possibility of adapting the course to the needs of the market and future requirements set by the engineering industry [8]. At the center of the study is the factor of student motivation when choosing elective courses, as well as the role of elective courses in the professional development of students. Each question in the conducted survey represents one of the potential reasons or motives why students choose certain elective courses. Through questions about completed high school, reasons for choosing IT as a field of study, and achievements in certain subjects, the goal is to show which factors were most important for the choice and how the choice can be improved, so that the institution follows market trends and student desires, and students have fewer and fewer problems when choosing [9].

Information technology is most associated with programming, web design, information systems design and management, or system administration [10]. According to the survey results, the largest number of respondents are interested in areas such as Programming, Web Design, and IT Management, and in this regard, we can say that the largest number of them will probably choose subjects that are closely related to these areas. However, the survey results show that subjects such as *Mobile Communications Programming, Analysis and Logic Design, and Software Patterns* are not often chosen, and the grades achieved in subjects related to programming (for example, *Object-Oriented Programming*) are slightly lower than others. The question arises whether students then choose other subjects contrary to their areas of interest because they will pass them more easily or achieve a higher grade [11]. On the other hand, *IT Security* is not among the most popular areas, but the subjects *IS Security* and *IS Protection* are often chosen among respondents. Perhaps the subject is easier to take or students' preferences have changed over the years. Also, data and system protection is a very important segment in every business today, which may increase interest in this course.

A common selection criterion is personal affinities, which can be linked to interests and the aforementioned employment, improving old skills and learning new ones, etc. Another important criterion is recommendations from colleagues who have taken the chosen course [12]. Information that students can get first-hand and from colleagues who have the same or similar interests is the most important for the choice. Students then feel that they are better acquainted with the course and the professor, the course content and the examination method. The experiences of others are always highly valued and can easily help in making decisions. Given that there is a certain number of students in the survey who decided to study because of individual family members or friends who were or are currently students of information technology, they could also have received a recommendation from them for choosing a course.

However, the most common criterion is subject professors and/or associates in the course [13]. When we look at the survey results showing the passing rate of certain subjects, we can conclude that students choose or avoid subjects taught by professors they have already taken because of their grades or the way they work. If they like the work of the professors and their assistants or associates, it is very likely that they will choose that subject, even if it is not their area of interest [14]. On the other hand, they will not choose subjects of interest if they do not like the work of the professors or if they have had difficulties in one of their previous subjects.

Current educational strategies emphasize the use of course-taking history as inputs to design curricula and propose electives to each student based on it [15]. In fact, research shows that bridging academia and industry through joint courses makes students choose electives for themselves by giving them insights into how they can practically apply what they will learn later on [8]. They may be more focused in their choices since their counselor guidance provides them with better guidance in relating their choices to their long-term career goals rather than temporary ones [9].

V. CONCLUSION

Elective courses can have an impact on students' preferences in professional development, i.e. the choice of course may depend on the student's interests, their professional orientation and other personal affinities. However, what can also be concluded is that decisions in this case depend much more on the professor and/or associates. Through some answers, the respondents said that the professor's approach did not suit them, the possibility of taking the exam and achieving the desired grade was sometimes quite difficult, or they were not satisfied with the given elective course proposals, so they chose the courses that most students take.

The introduction of a wider range of elective courses at universities will provide academic freedom to participants in the educational process. Firstly, the student thus has a chance to show his own aspirations. Secondly, elective courses enable the development of students' goals, motivation for learning and shaping their professional image. Thirdly, elective courses contribute to the realization of the principles of the organization of education such as equal conditions for everyone to develop their talents and abilities. In addition, elective courses also contribute to the mobility of students because they expand the amount of educational content. The last thing that is rarely mentioned when compiling curricula for universities: elective courses help students understand other specific subjects such as human resource and project management, Internet marketing, organizational behavior and corporate security, business law, security and system protection, management in the field of information technologies and the like. They help develop communicative competence, which includes the ability to listen to other people, understand their opinions, participate in discussions, maintain opinions, understand the needs of other people, persuade, encourage and work in a team. Based on the analysis of the literature and our own experience, we can argue that the introduction of elective courses has helped students to increase motivation and to follow the selected courses well, stimulate professional and personal development and adapt their professional portfolio. At the same time, involving students in the development of the curriculum will help them on the path to their improvement,

finding new approaches in future work, while making higher education institutions more attractive to both domestic and international students and expanding the scope of education. Further research on this topic can focus on evaluating the effects of elective courses on the career development of information technology students, as well as on the development of effective strategies and support programs in the process of choosing elective courses.

Authors did not include the current elective courses available to third- and fourth-year students due to new accreditation and possibly new courses. In this sense, the authors cannot currently propose a potential new program for the next academic year based on the research conducted, so this task will be left for future work.

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