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Possibilities of Electronics Engineering Studies in University and College

N. Bagdanavicius, D. Andriukaitis, A. Valinevicius
Department of Electronics Engineering, Kaunas University of Technology,
Studentu str. 50-438, LT-51368 Kaunas, Lithuania, e-mails: n.bagdanavicius@gmail.com, darius.andriukaitis@ktu.lt

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Introduction

At the present time the citizens of Lithuania are free to study both in Lithuania and abroad. During last years due to relatively difficult economic living conditions quite a large part of youth chooses the studies in the foreign countries with the aim to join foreign job market. However many of them do not manage to achieve that. Reasons can be various here. Firstly, most of them do not manage to evaluate and foresee cultural and psychological problems in advance. The second very important factor which should be evaluated is the difference of the education systems between Lithuania and most of foreign countries. Education systems in many foreign countries are oriented to the education of a narrow-profile specialist. This means that after decision is made to pursuit some certain speciality it is possible to choose the institution of education in which all the conditions (good methodical and material provision) necessary to acquire desired speciality would be provided. The best specialists in the field would conduct lectures here, a modern laboratory equipment necessary for the studies would be provided and only the subjects needed to acquire a particular speciality would be taught. This fact stipulates that in the foreign institutions of education it is possible to become a very good specialist of a narrow field. But the disadvantage is such that later when the economic conditions may change and a need to change the occupation would emerge it is very difficult for such people to reorient themselves from one field to another. In this aspect the Lithuanian system of education is much more convenient. Here the basics of various areas are often provided and only then a more narrow approach to a particular field is taken. In the most Lithuanian institutions of education the material basis is not adequate for the thorough studies of particular major but this disadvantage is often compensated by the cooperation with various public and commercial companies in which the practical part of studies is carried out. In many cases it is even better since in this way it is possible to get familiar with the real market conditions. When learning in the environment of our system of education the essential things are to learn to select, process (systematize) and use the relevant information. As it was already mentioned our system provides us with the possibility to obtain the basic knowledge of various subjects, teaches us how to learn, i.e. at first to pick out useful bits of information and shows how to find the missing additional information easily, when there is such a need. Thus when the studies are completed in some Lithuanian institution of education in most cases it is possible to become a universal specialist who has fundamental understanding about various areas of life and wider understanding about some particular area. Due to this reason Lithuanian specialist are very valued abroad since such people, firstly, are able to adapt to the current situation rapidly and, secondly, are able to reorient themselves after the conditions change. So if you are born in Lithuania and have grown up here it is advisable to acquire the desired or required education in Lithuania and then it will be possible to choose where to apply your knowledge in the global-scale.

Higher schools in Lithuania

When you select the speciality from the field of electronics and make a decision to study in Lithuania still another question emerges: in which Lithuanian institution of education it is worth to study? There is no unambiguous answer here. We can only present the recommendations for one case and another. The fact is that the Lithuania is quite a small country (approximately 3,2 million people) and the number of the institutions of education is obviously too high due to the incorrectly implemented policy of education from the government side (available but quite limited intellectual, material and financial resources of the small state are scattered and the higher schools do not have enough of these resources in order to provide quality learning and teaching). In the Lithuanian public higher schools the number of the students is not matched neither to the financial reserves of the state nor to the intellectual and material resources of the higher schools. According to the statistics Lithuania leads in the Europe according to the number of the students per thousand population; however

it strictly falls behind according to the state budget assignations per student. According to the data of the Ministry of Education and Science of the Republic of Lithuania [1], currently 45 higher schools operate in Lithuania legally. From them 22 universities (14 public and 8 private) and 23 colleges (13 public and 10 private).

In these institutions of education there are available 486 registered university study programs of the I tier, from them 93 programs from the study field of the Technology sciences (8 study programs from the branch of Electronics engineering) and 368 college study programs, from them – 100 programs from the study field of the Technology sciences (7 study programs from the branch of Electronics engineering) [2]. Knowing the area of Lithuania and the number of its population these numbers are unrealistic. Then a question arises: what is the distribution of the institutions of education over the territory of Lithuania? In Fig. 1 the locations of colleges in the territory of Lithuania are indicated; the distribution of universities is quite similar.

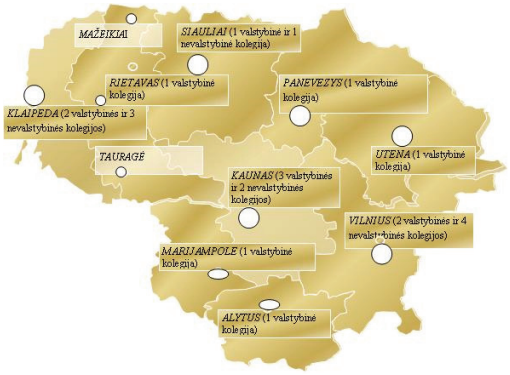

Fig. 1. Distribution of colleges in the territory of Lithuania [3]

After analyzing this situation it is obvious that the institutions of higher education are located in the centers of the districts; this should be logical and convenient. Nonetheless the largest part of institutions of education in which the largest number of the study programs is available is concentrated in three largest cities of Lithuania: Vilnius, Kaunas and Klaipėda. More regional institutions of educations are established in other cities and the specialities more typical to the local character of professions are dominant there and consequently the specialists more useful to the particular region are being educated there.

When we decide to select the speciality of electronics, let's look where it is most convenient to study it from the geographical perspective. From the earlier presented data is seen that Kaunas (the second largest city of Lithuania) is closest to the center of Lithuania and one of the highest concentrations of higher schools is characteristic to this city. Here we can also mention the fact that from the old times Kaunas is one of the cities around which various industrial companies are being concentrated. So it is possible to say, that it is most convenient to study in Kaunas. Therefore it is possible to select on of the higher schools in Kaunas, however a question remains – university or college?

Comparison of the study programs of university and college

When speaking about the electronics speciality Kaunas University of Technology (KTU) and Kaunas Technical College (KTK) are similar according to the range of their study programs. Therefore let's try to analyze and compare the study programs of these institutions: Electronics engineering and management (KTU) and Electronics equipment (KTK). In Table 1 main data related to the full-time studies of these study programs is presented.

Table 1. Main data of the study programs "Electronics engineering and management" (KTU) and "Electronics equipment" (KTK) [4, 5]

Item	Study program	
	„Electronics engineering and management" (KTU)	***„Electronics equipment" (KTK)***
National code	612H61005 (61201T204)	653H61002 (65301T203)
Code according to ISCED	51152	52152
Title of the program branch (specialization)	–	Manufacture of electronics equipment; Exploitation of the electronic household equipment
Minimal required education	Secondary education	Secondary education
Duration of studies (years)	4,5	3
Scope of the program (credits)	160	120
Objective of the program	To provide the general university education, theoretical knowledge of electronics, to provide the opportunities to master the methods of analysis and design and manufacture technologies of electronics, to teach to utilize, improve and develop new information technologies, to foster skills of the independent self-improvement.	To prepare qualified engineers of electronics of the higher education who would be able to perform various tasks of electronics equipment design, installation, maintenance manufacture planning and organization.
Provided qualification	Bachelor of sciences of Electronics engineering	Degree of profession bachelor of Electronics engineering and profession qualification of electronics engineer.
Studied subjects	*Subjects of general education*: Foreign language; Philosophy; Basics of communication; Physical education. *Subjects of the study basics*: Basics of information technologies; Engineering graphics; Computer graphics; Theoretical mechanics; Strength of materials; Electronics; Electrical engineering; Basics of ergonomics; Mathematics; Chemistry; Physics; Probability theory and statistics; Micro-	*Subjects of general education*: Foreign language; Philosophy; Professional communication; Physical education. *Subjects of the engineering branch study basics*: Mathematics; Physics; Information technologies; Engineering graphics; Environmental and human safety; Material science; Electrical engineering; Mechanics;

Item	Study program	
	„Electronics engineering and management“ (KTU)	***„Electronics equipment“ (KTK)***
	and macroeconomics; Basics of management; Basics of the law; Material science and engineering; Circuit theory; Electrodynamics; Measurements and basics of metrology; Microprocessors. *Subjects of the special education*: Signals and systems; Analog devices; Micro- and nanotechnologies in electronics; Electronic imaging technologies; Electronic equipment construction and technologies; Design of electronic systems; Reliability of electronic systems; Personnel management; Planning; Economics of the international business and management. *Practices of the professional occupation*: Educational practice; Practice (accomplished at the companies and organizations – 10 weeks). *Optional subjects*: Fundamentals of finances; Work organization, rating and payment; MATLAB in electronics; Technical aesthetics; Modern electronics; Marketing of the development of new products; Electronic security systems; Manufacture in small electronic companies. *In total 50 subjects are studied.*	Electronics; Digital devices; Electronics measurements; Signals and circuits; Microprocessors; Digital signal processing; Law; Business economics and management. *Subjects of the special education*: Methodology of the applied sciences; Analog circuits; Computer drawing; Programming of the computer equipment; Instrumental design tools; Power sources. *Subjects of the study program branch „Manufacture of the electronics equipment“*: Manufacture technology of the radio electronic equipment; Assembly of the radio electronic equipment; TV systems; Automation and controllers. *Subjects of the study program branch „Exploitation of the household electronics equipment“*: Tuning, testing and repair of the radio electronic equipment; Electroacoustics; Audio and video equipment; Household electronic devices. *Practices of the professional occupation*: Practice of the measurement basics; Practice of the radio assembly; Professional practice; Practice of radiotechnical measurements; Final practice. *Optional subjects*: Devices of radio systems; Computer communications; Social psychology; Second foreign language (German); Embedded systems; Basics of telematics. *In total 32 subjects are studied.*
Employment opportunities	Graduate can work in Lithuanian or foreign companies and organizations which develop and implement the electronic systems; can work as an engineer, manufacture supervisor in the companies manufacturing or using the electronic measures and systems; in the logistics and management divisions of the electronics companies; in the scientific research institutes and development laboratories and universities. Is eligible to join the post-graduate studies.	Engineer of electronics equipment will be able to supervise the design and installation works of electronics devices and equipment, organize the technical maintenance and exploitation works, supervise the activities of the company or its subdivision.

When analyzing and trying to compare the study programs „Electronics engineering and management“ and „Electronics equipment“, at first we notice that it is possible to study according to those programs only after the secondary education is accomplished, since both those programs belong to the higher studies of science. This means that only the persons who are correctly educated and able to reason logically are eligible to pursue the higher education in the field of Technologies. Here we have in mind the following human qualities such as: self-containment, responsibility, ability to reason and present own thoughts clearly, etc. It is pointless to pursue higher education without those qualities since the higher education essentially differs from the general education. During the years of the general education the personal qualities are being formed and it is taught until the person learns the subject completely. Meanwhile when studying at the higher education level the required fundamental knowledge is provided and ways to acquire the additional needed knowledge and skills are indicated; a lot of attention is given to the self-contained studies. Therefore we can summarize that the studies of Electronics engineering are intended for the independent and reasoning persons.

Further analyzing the similar programs it is seen from the data presented in Table 1 that studies of this field last 4,5 years in the university (160 credits) and 3 years in the college (120 credits). The study credit is defined as the unit of the study extent equal to the 40 hours of student work (in classes, laboratories, independent work, etc.), or one academic week [4–6]. This means that with the purpose to obtain the higher education and desired qualification as quickly as possible and to obtain the opportunity to work according to the speciality right away after the studies, the studies at the college should be selected. At the same time the standard duration of the studies at the university is 4 years. In the considered case the duration of studies at the university is 4,5 years for the reason that the fundamentals of the higher education itself are being taught almost for two years (one year in the college). A little bit more than two years remain for studies of the major subjects (two years in college). In this case a half of a year is added since this is a double speciality. When the studies of this program are finished, the graduate has a possibility to work not only in the electronics companies, to organize his own business and to continue studies in the field of Electronics Engineering, but also to continue studies in the field of Management. In summary we can say that the university is a place to acquire the higher education the aim of which is to develop personal qualities, such as creativity, logical reasoning and similar, i.e. creative specialists are being prepared in the university. Meanwhile in the college the higher studies are shorter and more simple and more attention is given to the studies of the speciality here.

When continuing our discussion about the studies we should overview the studied subjects. When we look at the university list of the program subjects we notice that there are many subjects of a small scope here among which two practices are present. One of them (Educational) is accomplished using the university basis, and other, which lasts 10 weeks, is accomplished in the companies. If we venture even deeper, i.e. look into the contents of the subjects we will see that the most part of the subjects here is more of theoretical character and intended to provide the

fundamentals of the higher education and speciality, i.e. they promote the independent development and creativity. At the same time significantly less studied subjects are present in the college program and most of them are of the larger scope and contain a large part of practical classes. Three practices are also available here; one is implemented using college basis and two others with the overall duration of 12 weeks are carried out in companies. This means that the college studies are have more practical orientation. When speaking about the freedom of choice for students and possibilities to form study plans independently we should note that complete freedom is not possible here due to lower economical level of our country and incorrectly implemented policy of education. But if we take a look at the university study program we will see that there are a lot of optional subjects and a lot of opportunities to select them. At the same time there are less of optional subjects in the college study program but there is a possibility to select a branch of study program, i.e. the specialization. In summary we can say that there is enough of freedom for rationally thinking people to implement and correct the study plan according to their own priorities.

The main question is what do the studies according to these programs provide or what occupation can be taken after graduation? When the studies at the university are over the degree of bachelor of science in the field of Electronics engineering is granted. That allows to continue studies at the master level and to pursue the career of the scientist or simply to deepen one's knowledge in this area. The other variant of choice which is selected by the majority is to work at some company according to the acquired speciality. Thus the graduates of the university are able to work at the electronics companies as supervisors of various levels, as designers (creators) of electronic products or to start own business. Meanwhile when the studies at the college are finished the profession bachelor title of Electronics engineering is granted and the professional engineer qualification is obtained. When the college is graduated there is no possibility to continue studies at the university right away after the graduation. In order to do that the additional equalizing studies have to be finished at the university. At the first glance this could seem as a disadvantage although a positive aspect can be found here. Since there are more practical subjects at the college (what provides the better understanding of the subjects), for this reason the college studies seem easier for many people. Therefore after graduating the college it is more simple to pursue the higher levels of the scientific education. For college graduates the search for a job according to the speciality is easier because they have more practical experience. Such persons can supervise the electronic product design and installation works, organize technical maintenance and exploitation activities or manage the activities of the company (subdivision).

This is a short comparison of two higher-education schools of different level and opportunities of studies implemented there. The aim of this work wasn't to create the rules according to which everyone could select what and where to study for him or her. To devise such rules is nearly impossible since all we are different and our needs and potential is also different. For this reason we briefly analyzed two study programs of different level but from the same branch here and tried to present recommendations in which case which one should be selected. We suppose that after reading this paper everyone should have some understanding about this area and the choice should become easier to make. In summary we can say that in order to become a good specialist of electronics (as also of any other area) it is best to start everything from the beginning and continuously improve yourself, since if any of the stages is skipped, it could be difficult to understand the following areas for most people. Therefore for those who do not like to study very much but who is eager to acquire a good profession with higher education and then to find a job quickly with a better than average salary then studies in the college should be selected. And for those who pursue the highest level of education, who want to have a best-paid job and who are able to learn according to a higher level of studies at once then the studies at the university should be selected. In general the best variant could be selected by those who have enough time and patience to graduate the college at first and then the university. In this way the professional knowledge could be mastered best and highest levels of education could be achieved.

Conclusions

Since at the present time in Lithuania it is possible to obtain the electronics speciality with the higher education not only at the university but also at the college, a question often emerges: so what is better to choose, university or college? With this in mind two study programs of the same type – Electronics – from two higher education institutions of different level and form the same city of mid-Lithuania were compared.

The objective of the college study programs is to prepare qualified engineers of electronics of the higher education who would be able to perform various tasks of electronics equipment design, installation, maintenance manufacture planning and organization. And in case of the university study program the objective is to provide the general university education, theoretical knowledge of electronics, to provide the opportunities to master the methods of analysis and design and manufacture technologies of electronics, to teach to utilize, improve and develop new information technologies, to foster skills of the independent self-improvement. From this it can be seen that the college study program is dedicated to prepare electronics specialists with high practical skills which allow them to find well-paid job. At the same time the university study program is dedicated to the people who pursue a comprehensive and highest-level education which allows them to find a best-paid job and fosters self-sufficient improvement. Such people become the creators of new technologies.

After analyzing the lists of the subjects of both programs we notice that largest part of the subjects from the university program are more related to theory and are intended to provide the fundamentals of higher education and speciality, i.e. they promote the self-sufficient improvement and creativity. Meanwhile in the college program there are significantly less of the studied subject, most of them have a larger extent and contain a large part

of practical classes. This means that the college education is more oriented to practical areas and university education is more oriented to comprehensive and creative improvement. When speaking about the student's freedom of choice and the possibility to create study plans by themselves it is possible to state that there is enough of freedom for rationally thinking people to implement and correct the study plan according to their own priorities.

When speaking about the employment of the graduates is has to be noted that currently employers value the graduates of colleges more since they have more practical experience and are able to adapt to the work conditions more quickly; in this way it is possible to save money and time needed for the training of employees. A suitable work place and an adequate salary is provided to such people at once but the career opportunities are less. And in case of the university graduates some time is needed to adapt to the work conditions but later they may become good specialists who are able easily adapt from one field to another and are able to work and improve themselves independently. Therefore the career opportunities of such people are better.

In summary we can say that in order to become a good electronics specialists the best variant could be to start everything from the beginning and continuously improve yourself, i.e. to graduate the college at first and then the university. In this way the professional knowledge could be mastered best and a possibility to become a creator of new technologies could be ensured.

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N. Bagdanavicius, D. Andriukaitis, A. Valinevicius. Possibilities of Electronics Engineering Studies in University and College // Electronics and Electrical Engineering. – Kaunas: Technologija, 2011. – No. 7(113). – P. 32–36.

A natural question often comes to a mind of young people: what to do when studies in the general education schools are over? For this reason in this paper a possible variants of choices are discussed, from which it is obvious that it's the best to continue studies at once and to acquire a good speciality and only then to look for a job. When selecting a speciality it is recommended to become an electronics specialist, because electronics is one of the most advanced areas in our life. Today we find various electronics products in almost every our step, different and increasingly complex and more "intelligent" electronics systems are being created which facilitate our life. Therefore today there is a great need for specialists who would understand electronics very well and who would be able to design, install and maintain such systems. In the future there will be a need for even more of such specialists. Since in Lithuania at the present time it is possible to acquire electronics speciality of higher education not only in the university but also in the college a question often emerges: so what is better to choose – university or college? Therefore in this paper study programs of the same type – Electronics – from two higher education institutions of different level and form the same city of mid-Lithuania are compared. Ill. 1, bibl. 6, tabl. 1 (in English; abstracts in English and Lithuanian).

N. Bagdanavičius, D. Andriukaitis, A. Valinevičius. Elektronikos inžinerijos studijų galimybės universitete ir kolegijoje // Elektronika ir elektrotechnika. – Kaunas: Technologija, 2011. – Nr. 7(113). – P. 32–36.

Aptarti galimi studijų pasirinkimo variantai, iš kurių matyti, kad geriausia yra iš karto tęsti mokslus bei įgyti gerą specialybę, o paskui ieškotis darbo. Rekomenduojama rinktis elektronikos specialybę, nes elektronika yra viena iš labiausiai besiplėtojančių mūsų gyvenimo sričių. Šiandien beveik kiekviename žingsnyje mus lydi vienoks ar kitoks elektronikos gaminys, nuolat kuriamos vis sudėtingesnės ir „protingesnės" elektroninės sistemos, palengvinančios mūsų gyvenimą. Todėl jau šiandien labai trūksta specialistų, gerai išmanančių elektroniką ir galinčių kurti, diegti ir prižiūrėti tokias sistemas. Ateityje tokių specialistų reikės dar daugiau. Kadangi dabartiniu metu Lietuvoje galima įgyti elektronikos specialybę ne tik universitete, bet ir kolegijoje, todėl dažnai kyla klausimas: ką geriau rinktis – universitetą ar kolegiją. šiame darbe lyginamos dvi vieno vidurio Lietuvos miesto skirtingo lygio aukštųjų mokyklų tos pačios krypties – elektronikos studijų programos. Il. 1, bibl. 6, lent. 1 (anglų kalba; santraukos anglų ir lietuvių k.).