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Intellectual Output 1:
BENCHMARK SURVEY ON INTEGRATING DIGITAL, CODING AND ROBOTICS
SKILLS IN VET SCHOOLS: FROM THEORY TO PRACTICE
February 2017
Partner Organisation 2 EK Peiraia (P2)



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1.Introduction

This survey is implemented within the framework of the Erasmus+ KA2 project entitled “Bridging the Skills Gap: Strategies for the Promotion of Digital, Coding and Robotic Skills for Social Inclusion, Equality and Access (RoboVET4All)“. The project is coordinated by the Leibniz University from Hanover/Germany. Participants of this project are our school 2 EK Peiraia from Greece, the IT educational institute Emphasys Center and the Cyprus Computer Society from Cyprus, the IT software house Civic from Edinburgh/UK, the NGO CDIMM from Baia Mare/Romania, the NGO Women in Digital Initiatives from Luxembourg and the VET-school IES Maria Moliner from Segovia/Spain.

RoboVET4All started in 2018 to introduce coding and robotics VETschools as an innovative way to address deficits, social exclusion, prejudice and learning disparities. The project aims to create a complete toolkit and an educational pack for VET-teachers to support them in developing, imple-menting and monitoring various strategies to promote coding/robotics skills in VET schools. Robotics is an effective, fascinating and motivating way to introduce students to coding which integrates all STEM fields. At the same time it promotes other emplo-yability skills such as: problem solving, group work, leadership, creativity and initiative.

Greece is suffering from a very high unemployment rate, especially in younger ages. There are stil job opportunities, especially in the ICT Sector, but need qualified personnel. Coding and Algorithmics are always a needed qualification in the ICT labor market. VET Schools have ICT Section, which interests many students each year. So it is an important help to introduce educational material and methods in the area of Robotics, which will be a valuable addon in the educational process.

Over the past years, many qualified people (with batchelor degree and higher level of education) departed Greece for countries mostly in Europe (Germany, Great Britain etc.), but also Australia and America, in seek for better job opportunities and a higher living status. This lead to a connection of the greek workers to the european labour market. So graduates from the greek educational system address in the labor market to both local and european level.

The puprose of this survey is to expose the current situation of the VET Education of ICT and Robotics in Greece, to point out the importance of the implementation of this project for the VET Education System in local and european level, and to show the will of the VET Teachers to participate and exploit our projects outcomes.

The outcomes of this survey will be important for the succesfull implementation of the upcoming ouputs of the project. The particular situation in each participating country and the particular needs of the labour market will define the competence framework for the creation of the toolkit and the educational pack for VET-teachers.

2. VET-Education of ICT and Robotics in Greece

2.1 Political and educational framework

In the Greek educational system, VET education is considered as an option for low level students. Although many efforts were made over the years, the situation has not changed.

Last effort was a big change and renewal of the curriculums of almost every sector of the VET educational system during the last educational reform, 2 years ago.

Coding was introduced in the curriculum of the VET schools (especially the ICT Sector) from the early years of modern VET Education (1985). In the Technical Professional Lyceums (TEL) first Programming languages to be included in VET curriculum were COBOL and Fortran. In the educational reform of 1999, in the curriculum of the Technical Professional Training Centers (TEE), the programming languages which were included, were Pascal and Visual Basic. This changed in the last reform in 2015, and Python was introduced as a modern Programming Language. There are also some subjects about Mobile programming (in the Software Engineers specialty), in which AppInventor is mostly used. Robotics was also introduced as subject, but only in the Electronics department and without a proper book to help the teaching process. Instead a book about Mechatronics is used.

About ICT training for teachers, Greece has organized some initiatives over the last two decades. The outcomes though were not so promising. The ICT training a two-step approach during the years 2000-2017.

From 2000 to 2006, the Operational Program "Information Society" was founded by EU. One of its aims was: "Equipping, networking, training teachers and preparing digital material for the creation of an educational system for the 21st century, using new technologies for the documentation and promotion of Greek culture".

The most relevant action was the A-Level training basic ICT skills program. The liable Ministry of Education trained 84,360 Primary and Secondary School teachers in the use of computers. By the end of 2005, almost half of the teachers in Greek schools had been officially certified computer literate for the first time in their career.

From 2007 – 2013 a new Operational Program was launched, called 'Digital Convergence', taking into consideration strategic guidelines both at national and European level for the Greek Digital Strategy 2006-2013. One of the priorities of the OP was: Enhancement of new technologies contribution to the Educational process (Tele-education – Education with digital content – 'Life Long Learning' Digital Programs).

According to national sources, training was provided to 760 teacher trainers and 27500 teachers in Greek primary and secondary schools. . The aim was in-class use of ICT according to the "In-service training of teachers in the utilisation and application of

ICTs in the teaching practice” project of the Operational Program “Education and Lifelong Learning”, NSRF (2007-2013) which was co-funded by the EU and the ESF. The teachers training program had 96 hours duration and took place in addition to the school schedule, in specially equipped centers – the Training Support Centers- which were schools throughout the country, using specialized (B-Level) teacher trainers, who had undergone an appropriate training in University Teacher Training Centers. This training is known also as B-Level training, since it constitutes the normal continuation of the A-Level training in basic ICT skills carried out in the framework of the previous O.P. In the “B-Level” training participated literature teachers, math teachers, physical/natural science teachers, French, English and German language teachers, primary school teachers, kindergarten teachers and computer science teachers.

This program was repeated for more specialties (even ICT teachers) after 2015 and is still implemented for teachers who did not participate in the previous phase.

Regarding Robotics trainings, there are no official trainings in this specific field. Only efforts from some individuals (e.g. school councilors) are made through short period seminars in after school hours, which teachers participate on voluntarily level.

There are though some competitions, which can be motivating for both teachers and students, as they are implemented on national and international level. So winners on national level can participate in an international level (European and in some competitions even worldwide level). For example there is the WRO Robotics in Education competition (organized by WRO Greece Organisation), which has many entries. But the hardware which is used is very expensive and the competition is very demanding (10-12 hours per week needed in the final phase, which can be done after school hours), so mostly private schools and schools with a good financial background can afford the participation.

2.2 Needs of the Labour Market in the Sector of ICT and Robotics

In this chapter, we will describe the current situation in the Greek labour market, especially the ICT and Robotics Sector.

Greece has a population of 10,75 millions (2016, Data: World Bank). The political situation is steady, with a 2 party government since the last elections in September 2015, so next elections will normally take place at 2019 (or sooner).

The GDP of Greece is estimated at 180 Billion € (2016, Data- World Bank – ΕΛΣΤΑΤ-Greek Statistic Agency). During the financial crisis since 2009, the economy of Greece suffered from deflation for 7 contiguous years (Figure 1.). The tax rates increased, many companies had to stop their operation and this caused a dramatical decrease in the incomes of the state and so the continuity of the crisis.

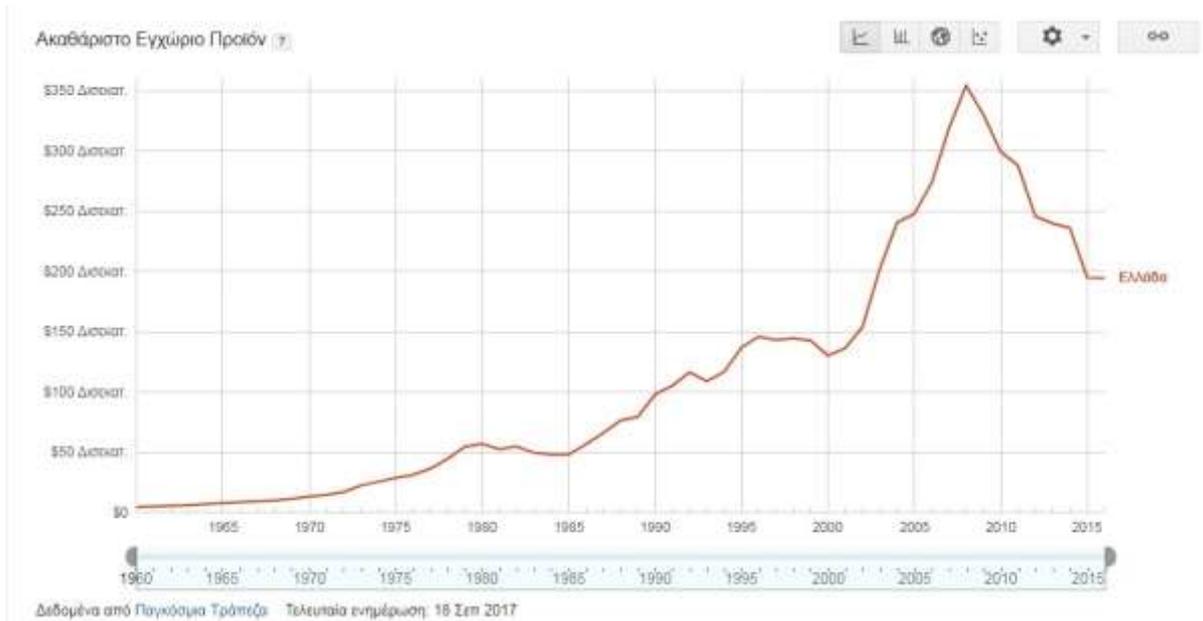


Figure 1. Development of GDP of Greece

The Debt of the Greece is estimated at 318,6 Billion Euros (2017). This is 176% of the estimated GDP. In total numbers, last year it was the first year that it had a small decrease.

The unemployment Rate in Greece is estimated at 20.7% (October 2017, Data: ΕΛΣΤΑΤ), see Figure 2. The highest rate was in 2013 (over 26%). Since then it seems to be decreasing, but this is due to:

- Many employees work part time with a very low wage (some of them are only declared as part time for avoiding the payment of the insurance funds).
- There is a high percentage of 'black' work, employees who work without being declared.
- Workforce, especially high level and with excellent qualifications, departed Greece to work abroad, especially countries in Europe (Germany, Great Britain, Cyprus), America (U.S.A. Canada) and Australia.
- Many unemployed people are very disappointed with the situation, so they stop searching for a job. These people are not included when estimating the unemployment rate.

The most upsetting issue is that the unemployment rate in the case of younger people (aged under 25), is increasing to 43,3%.

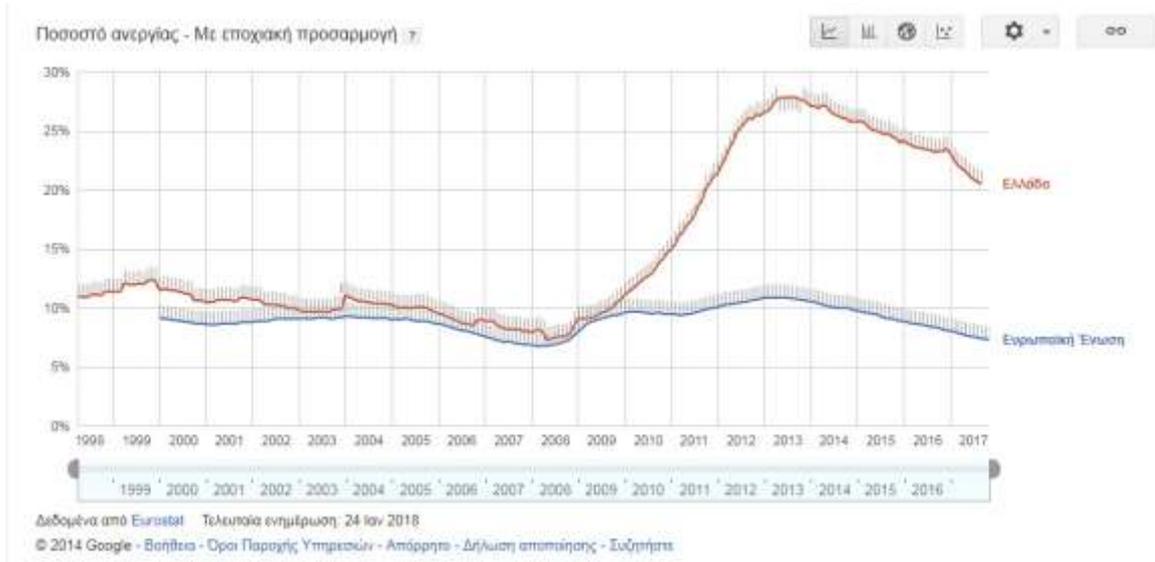


Figure 2. Development of unemployment Rate of Greece

In this difficult situation of the Greek labor market, it is a pleasant detection that the Greek ICT Market was not affected by the crisis for the past 5 years.

In some areas, especially Services and Software, it the market budget had a increase since 2014. The Communications sector had also a steady course these years. These facts are shown in Figure 3.

	2013	2014	2015	2016	2017	2018	2014/2013	2015/2014	2016/2015	2017*/2016	2018*/20171
Hardware	548	677	598	521	489	478	23.5%	-11.6%	-12.0%	-6.1%	-2.2%
Services	762	895	895	909	932	965	17.5%	0.0%	1.5%	2.5%	3.6%
Software	283	268	264	250	254	259	10.4%	-1.8%	-5.0%	1.4%	2.0%
Total IT	1,553	1,84	1,757	1,68	1,675	1,702	18.5%	-4.5%	-4.4%	-0.3%	1.6%
Com/fin hardware	570	494	573	572	574	565	-13.3%	16.0%	-0.3%	0.4%	-1.5%
Com/fin Software	3,847	3,666	3,524	3,448	3,407	3,382	-4.7%	-3.9%	-2.1%	-1.2%	-0.7%
Total Communication	4,417	4,16	4,097	4,02	3,981	3,947	-5.8%	-1.5%	-1.9%	-1.0%	-0.9%
Total ICT Market	5,97	6	5,854	5,7	5,655	5,649	0.5%	-2.4%	-2.0%	-0.8%	-0.1%

Figure 3. Development of Greek ICT Market 2013-2017

For the current year, the estimations are that there will be more development in these specific sectors (see Figure 4).

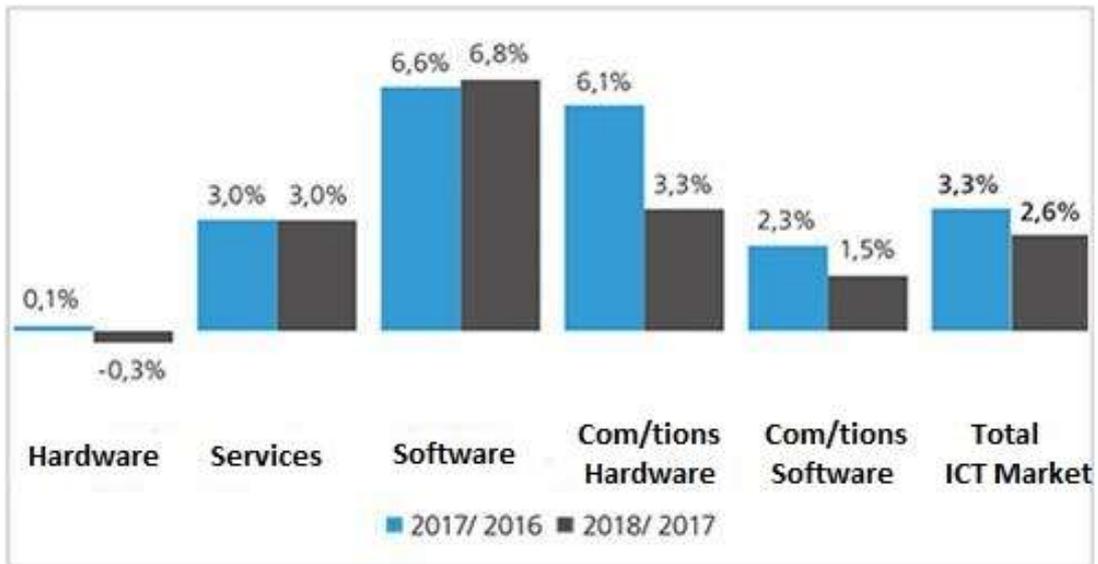


Figure 4. Development of Greek ICT Market 2017-2018 (estimation)

This has the result that there are needs for specialized personnel. Areas like programming, web development and communications have demands above the labour average. We can see in figure 5, that there are many adds regarding positions that require coding skills.

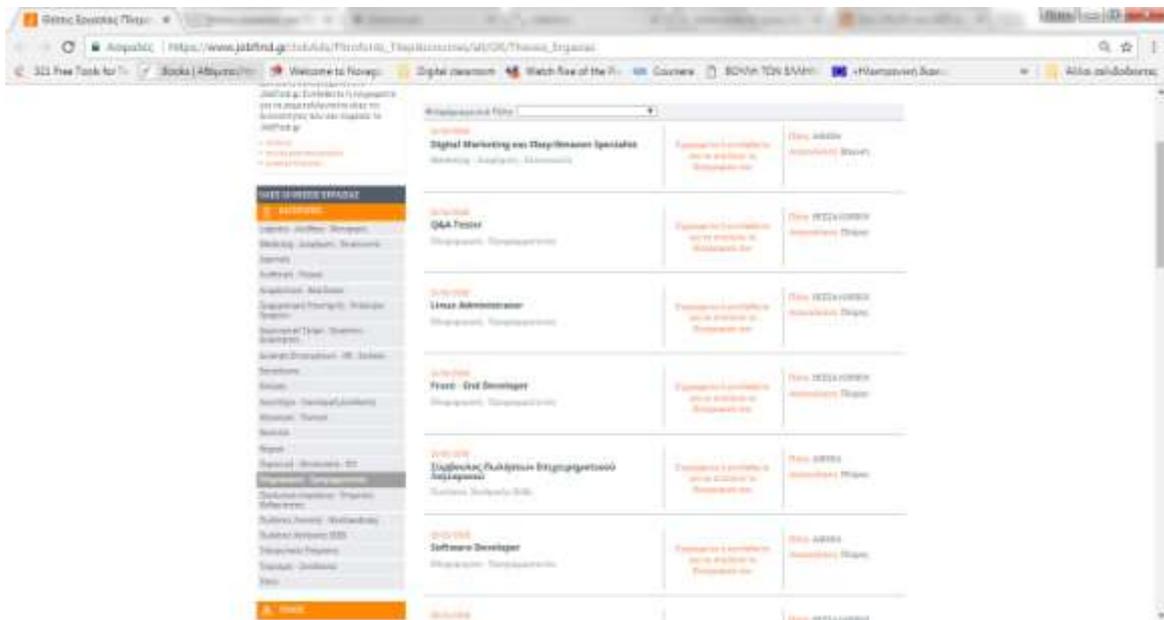


Figure 5. Adds requiring coding skills (January 2018)

3. Empirical Research

The empirical research was organized and concluded in two stages in January – February 2018.

In the first phase 2 EK Peiraia organized a group interview with VET teachers. The group interview – discussion took place in the school ICT Laboratory at 17 January 2018, moderated by the coordinator of the project Mr. KaraisarlisThrasylvoulos.

The second phase included the sampling and data mining of on-line answers to the two questionnaires we prepared. The questionnaires were prepared from the Romanian Partner (CDIMM) with the help of all members of the consortium.

3.1 Sampling and Method

The participants of the group interview – discussion were all ICT teachers, working in the school units who share the same building, 1st EPAL of Piraeus and 2nd EK of Piraeus. The interview lasted about 90 minutes. The interview was moderated by the project coordinator, Head of ICT Sector of our school Mr. KaraisarlisThrasylvoulos. The participants were:

- Ms. Arapaki Stella
- Mr. Saratsiotis Georgios
- Ms. NikoloudakiParaskevi
- Ms. Karelia Vasiliki
- Mr. Vidalis Ioannis

The subjects of the group interview – discussion were:

- The facilities ICT facilities at their school
- What does the schools curriculum include on training for digital skills/coding/robotics
- Their participation in any kind of training for digital skills/coding/robotics
- More information about their training (Subject, Institution, obligation, voluntariness, duration etc.)
- Personal demand for further training of digital skills/coding/robotics (Subject, type of training etc.)
- Further comments, problems etc.

The results of the group interview will be described in the next chapter.

The questionnaires were addressing to teachers and students of VET schools. We prepared 2 separate questionnaires, one for students and one for teachers. The

questionnaires were posted on line, using Google Docs, and links were sent to the target groups.

The questionnaires for the teachers contained 3 sections:

- Personal characteristics (like Gender, Age, School type, Position within the school. Level of confidence in various subjects, situation of the school and the curriculum etc.)
- Existing training opportunities
- Training needs identification

9 teachers answered our questions. Most of them (78%) were teachers in VET schools, 5 of them (55.6%) of them were female, the majority of them (88.9%) aged from 41-50.

The questionnaires for the students contained 3 sections:

- Personal characteristics (like Gender, Age, School type, Level of confidence in various subjects, personal goals etc.)
- Existing education / training opportunities
- Training / education needs identification

We received 10 answers. All of them were students in VET schools, almost all of them aged 16-18 (90%), which means senior or pre-senior students, most of them males (60%).

The outcomes from the questionnaires will be shown in the next chapter.

3.2 Results

We present the summary of the group interview.

The coordinator of the interview was Karaisarlis Thrasyvoulos. The interview was held in the facilities of 2nd EK Peiraia in 17/01/2018. The participants are all ICT teachers, working in the school units who share the same building, 1st EPAL of Piraeus and 2nd EK of Piraeus.

The 2nd EK of Piraeus, which participates in the ROBOVET4all project, has 2 ICT Laboratories. The first one is at satisfactory level, the second one has computers from the previous decade, so needs renewing. The 1st EPAL of Piraeus has a renewed, fully equipped and operational ICT Laboratory.

The Greek VET educational system consists of three grades, the last three classes of the higher second level education. The first grade is an entry level class, the second level is defined as Sector level (e.g. ICT) and at the last level the students can choose their specialty. In the case of ICT there are 2 specialties, Software engineer and Hardware-Network engineer. Both schools, which cooperate on a regular basis, have both specialties.

All participants agreed that the Greek educational curriculum of the VET ICT Sector includes several subjects about coding. The most important ones are the subject of programming, Python coding lessons are given, which are also part of the final national level exams for entering the University.

The first (entry) class and the non ICT Sectors have also a general ICT subject, but it does not include coding or robotics.

About Robotics, unfortunately the teachers described a lack of a relevant subject.

There are though some competitions, which a school can participate (like CANSAT, the WRO Educational Robotics Competition on National and Global Level), but this is extra work for the teachers and must be implemented on hours after work. As a result, there is not much interest from both teachers and students.

All teachers agreed that the demand of the ICT Sector on improving the coding skills of the students is a very important factor.

Ms Arapaki, Ms Karelia and Ms Nikoloudaki did participate in the past in many seminars about coding (Python, Scratch etc.). They have also participated in a few seminars about Robotics, including mostly Arduino and one about Lego EV3. These seminars were organized by the councilor of the ICT Sector on peripheral level, Mr Ladias Anastasios. Never the less they agreed that it is difficult to implement Robotics lessons in the school, because they are irrelevant with the curriculum. Another important obstacle is, that there is a lack of financing the buying of the necessary hardware.

Mr Karaisarlis informed the group about the aims and outcomes of the project. The participating teachers were enthusiastic about having the opportunity to use innovating teaching methods and new tools in their lessons. They claimed that it will be very helpful and motivating for the students to learn coding through robotics. It will also bring a new methodology to our schools. Robotics can be used with group tasks, with project method, with learning by game method, so in many ways it can change the learning climate within a classroom.

The final conclusion is that there is much interest on the outcomes of our project. Having participated also in some seminars about Robotics and noting the interest of teachers of other schools in this area, we are sure that our project will be well accepted and successful, not only on school level, but also at regional and national level. We will also ask (and have) the help of the ICT councilor for the spreading of our project.

The outcomes of the data mining of the questionnaires are:

The teachers, who answered our questionnaires were mostly teachers in VET schools (78%), women (55.6%) and almost all of them aged 41-50. Our target group are VET teachers, so this explains why we addressed more VET specialties. They feel confident in subjects like Mathematics, Physics, Electronics, but their main specialty is ICT and Coding. But they feel average confident in Robotics.

About the schools facilities, all schools have ICT Laboratories equipped with scanners and printers, especially for students (but only half of the schools give access to teachers) with

both wired and wireless network. Most of the schools have Laboratories for Mechanics and Electronics (something expected, as teachers work in VET schools), but only half of the schools have Physics Laboratory. Unfortunately, only half of the schools have interactive teaching tools and robotics kits and software. And there is no robotics laboratory.

The reason is that Robotics is not in the regular curriculum, as 78% of the teachers claim, and only half of them consider it a part of the optional or alternative curriculum. There is also no Robotics Club in a school of teacher who answered our questionnaires.

How are robotics taught through the curriculum in your school?

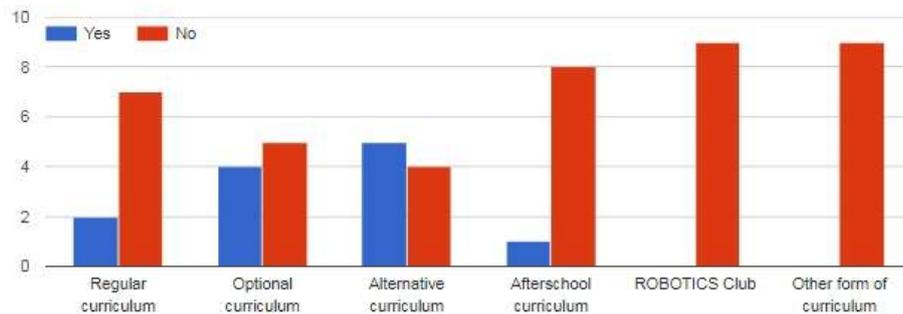


Figure 6. Robotics in schools curriculum

Almost all teachers participated in IT related subject trainings. Like programming languages and methods, Dynamic programming structures, Operating Systems, Web programming, Office automation. Some of them participated in database related training, less in Theory of combination and Graphs. But all teachers showed in the past a will to participate in trainings sessions. Most of them even participated in Robotics related seminars, like Introduction to Robotics, Robots control etc. These trainings were voluntarily.

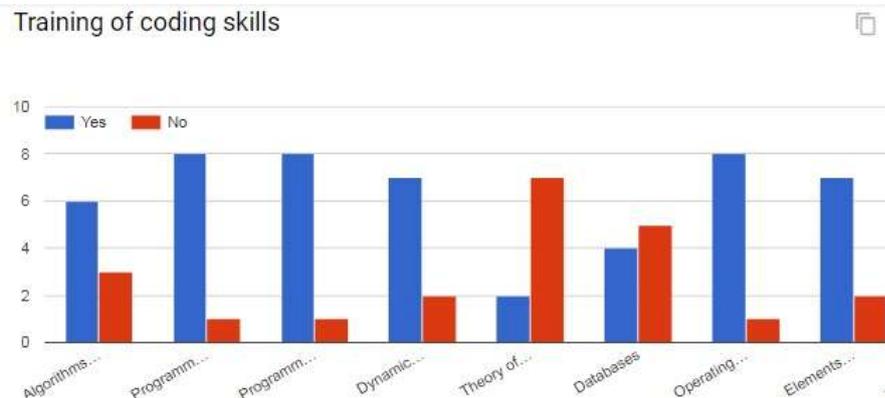


Figure 7. Teachers training participation

Identifying their training needs, they prefer subjects in their area, like Internet and Networks, Algorithms and logical frames, Programming languages and methods etc.

They also ask for training in the Robotics field, especially in Robots structure and coding, targeting the creation of a Robotics club at school.

Training of robotic skills

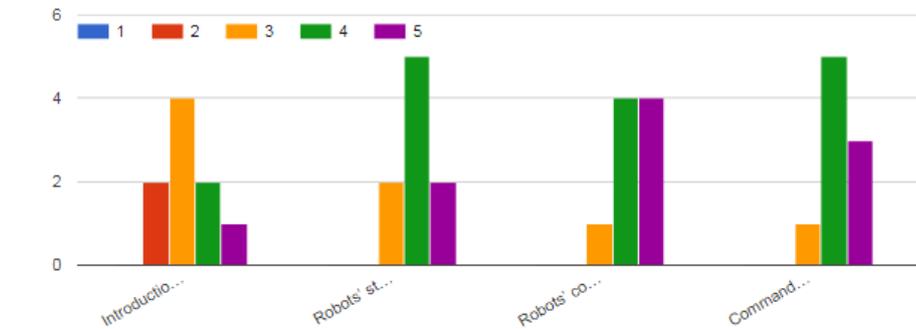


Figure 8. Teachers needs for robotics training

About the students who answered our questionnaires, they were all VET students, almost everybody aged from 16-18, which means they are in the last 2 senior years of second level VET education. Most of them are male (60%), which is typical in the greek VET educational system.

They are IT students, so they are feeling fine with IT related subjects, good about mathematics, but Electronics, Physics and Mechanics are their week points. They have also some experience in Robotics.

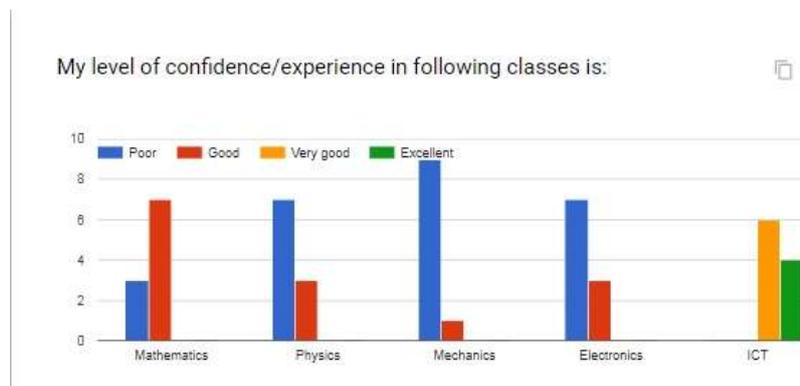


Figure 9. Students level of confidence

In their free time, they are interested in sports, but also in internet and computing. And some of them see ICT as their future job subject.

They had already training in Programming languages and tools, Operating systems, office tools and Operating systems, which are in their curriculum. But not in dynamic

programming, databases and theory of graphs. But only a few of them had a basic training about Robotics (introduction and robots structure) .

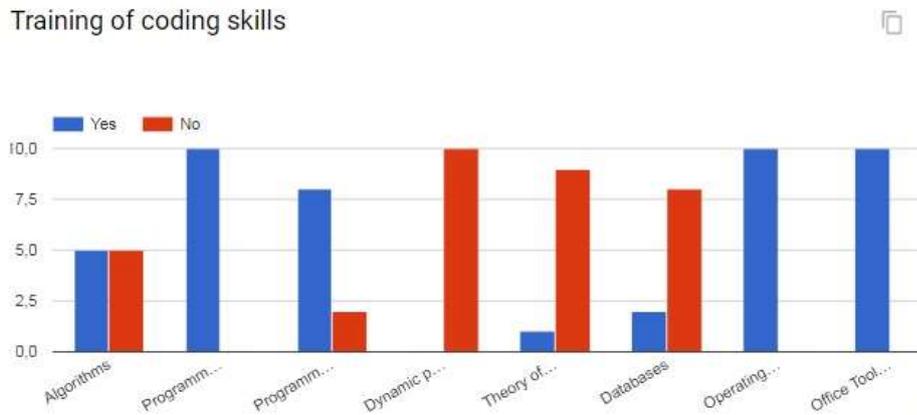


Figure 10. Students training of coding skills

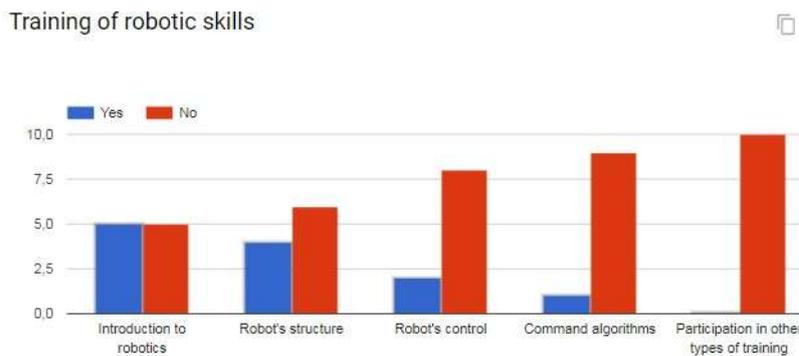


Figure 11. Students training of robotic skills

They all feel that they need more training in the subjects of their specialty (especially programming and internet). And almost everybody is enthusiastic about robotics training.

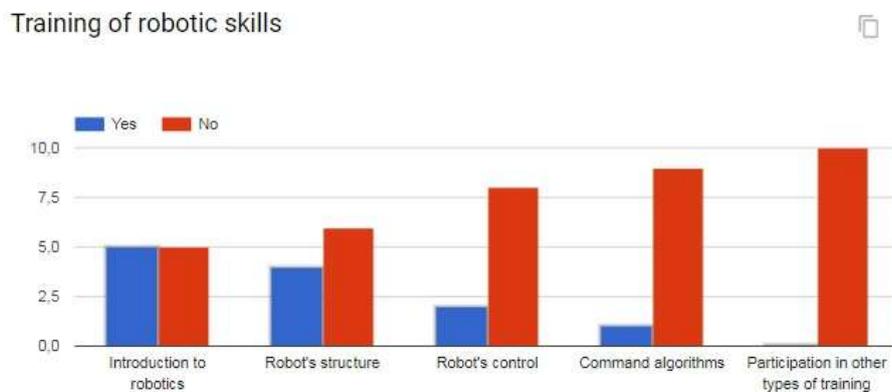


Figure 12. Students needs in training of coding skills

4. Conclusion

Programming and coding skills are already as useful as knowledge of foreign languages. In the upcoming years, it will become a skill essential to the majority of workers. Already in the Greek labour market, but also the European labor market, which is an alternative solution for Greek workers seeking a better future, there is an increasing demand on programming skilled specialized personnel.

However, most students either completely ignore the possibilities offered by coding skills, and the education system in many countries (as in Greece) does not integrate IT training into teaching practice in an appropriate way. Though Algorithmics and Coding is considered an important subject for both VET and general education, there is no official training policy in these issues. Seminars organized by school counselors and other individual initiatives try to fill the the lack of training in this areas.

The group interview and the data mining from the questionnaires demonstrate that both teachers and students are willing to be trained to use robotics for the learning of algorithmics and coding. Students that want to proceed to a ICT related job, did show more interest in robotics.

Our projects outcomes, especially the creation of the toolkit and the educational pack for VET-teachers, will be a usefull aid in the educational proccess. With the help of educational robotics, students will also have the opportunity to learn how to use advanced tecnology, which is common in other more developed countries. Educational Robotics has positive effects not only tot he cognitive field, but also in the emotional field (self-esteem, self-confidence) and social field (socialization, demystification).