CASE STUDY ON THE SYSTEM OF THE USE OF MODERN TECHNOLOGIES IN VOCATIONAL SCHOOLS

3D FOR VET

STRATEGIC PARTNERSHIP FOR THE DEVELOPMENT OF 3D COMPETENCES

Erasmus+

GENERAL INFO ABOUT THE PROJECT

Title: 3D FOR VET - Strategic partnership for development of 3D competences

Project duration: 3 years (09/2017 – 31/08/2020)

Budget: 250.585,00 EUR

Programme: ERASMUS+ program

Participating countries: Croatia, Lithuania, Austria, Poland

Project leader and coordinator: Region of Istria (Croatia)

Partners: Technical school Pula, METRIS Research Centre, Panevezio profesinio rengimo centras, Carinthia University of Applied Sciences, HTBLVA –Villach, Malopolska Voivodship, Zespół Szkół nr 2 im. Jana Pawła II w Miechowie

General objective: *put students from technical vocational high schools in a better position in the labor market through using 3D technologies in formal education, applying their knowledge in practice and working together with their peers from other EU countries.*

Participants: *students and teachers from VET schools participating in the project and 2 partner Regional authorities. Total number of students participating in granted activities is 480, and total number of teachers is 24.*

PROJECT PARTNERS

CROATIA

- **Region of Istria (LP)**
  Dršćevka 3, 52000 Pazin

- **Technical school Pula**
  Jurja Cvečića 7, 52100 Pula

- **METRIS - Material research center**
  Zagrebačka 30, 52100 Pula

LITHUNIA

- **Viesoji istaiga Panevezio profesinio rengimo centras**
  Staniunu g.68, LT-36143, Panevezys

AUSTRIA

- **Fachhochschule Karnten**
  Villacher Strasse 1, 000, 9800, Spittal an der Drau

POLAND

- **Malopolska Voivodship**
  Basztowa 22, PL-31-156, Krakow
- **Zespol Szkol nr 2 im. Jana Pawla w Miechowie**
  Ul.B.Prusa 2, 32-200 Miechow

INTRODUCTION

Vocational education and training in the EU are facing the need to constantly adapt to the modernization of technologies in global economy. Vocational professions must be in line with technological and digital progress in industry and economy, which requires the modernization of vocational schools using innovative methods and pedagogical approaches. This includes adapting school curricula according to labor market requirements, training teachers and educators to be able to transfer the knowledge and skills of new technologies, using new technologies and ICT in school laboratories and workshops, and education based on theoretical learning and practical knowledge.

The overall objective of the project is to place students from vocational technical schools in a better position in the labor market through the use of 3D technologies in formal education, applying their knowledge in practice and working with peers from other EU countries.

The specific objectives of the project include the use of modern technologies in vocational technical schools to improve the educational capacities of schools, increase students' competitiveness through the acquisition of knowledge on 3D technologies, based on practical training on workshops and exchange of practices with peers, and promoting the use of modern technologies based on experience in the regions covered by the project and disseminating project results in other schools.

The project involves teachers and students of vocational technical schools that are project partners, a research center and two regional self-government bodies from four countries: Croatia, Poland, Lithuania and Austria.
The leading partner of the project is the Istrian County, and the partners are Fachhochschule Karnten, Duchy of Malopolska, Technical School Pula, METRIS - Center for Material Research, Viesoji istaiga Panevezio profesinio rengimo centras, Zespol Szkol nr 2 im. Jana Pawla w Miechowie.

This project will modernize technical vocational schools that aim at educating quality staff and adapting to modern trends in science, education and profession. Students will have the opportunity to learn and work using modern equipment to keep up with the progress in technology and be ready for the labor market.

After professional training, teachers of vocational schools should implement their knowledge and skills in their classes and teach future generations of students new learning outcomes.
Regional authorities are already familiar with the need for modernization of vocational education and lead an active policy of introducing modern technologies into vocational education.

REGIONAL CASE STUDY TEMPLATE

1. Describe the country/region you are coming from (basic data, short history and economic situation). - 1.000 words;

2. Describe the institution where you are working (mission and vision of the institution, number of students, educational programs) – 1.500 words;

3. Shortly describe the vocational education system in your country (positive and negative aspects) – 1.500 words;

4. Please describe the organization of the school teaching system in your organisation (number of hours of vocational practice per week, time period/place when students are performing their vocational practice, share of practical exercises/practicum in the vocational curriculum etc.)?- 1.000 words;

5. Shortly describe the status of your vocational graduated students (number of students that continue their education/number of students who enter the labor market). – 300 words;

6. Describe the presence of STEM field of study (Science, Technology, Engineering and Mathematics) in the educational curriculum of your organization. – 500 words;

7. How do you provide new equipment and technologies for school practicums? (Specify the problems you are facing with, do you get any help from the ministries, local or regional authorities, private companies etc.) – 1.500 words;

8. Which vocational programs in your organization will use the 3D technologies and equipment and in what way? (Through regular curricular programs, extracurricular activities, optional or additional activities)? – 1.000 words;

9. Briefly describe the level of teachers and students knowledge about 3D technologies. - 1.000 words;

10. What are your expectations from participation in this project? Will the project contribute to the upgrade in the quality of practical teaching process in your school? – 2.000 words.

POLJSKA - Zespół Szkół Nr 2 w Miechowie

Poland is a country situated in Central Europe. It covers more than 320 thousands square kilometers and has population of over 38 million people. Poland's official language is Polish. The climate is moderate there, which means that summers are usually hot and sunny, winters cold and springs and autumns quite mild. Poland belongs to the European Union and has a great economic potential. There are many Universities and Academies which offer the highest level of education. Polish culture and art have a long history and are recognisable abroad. Although Poland is highly developed and influenced by contemporary trends, it also retains its own unique tradition. The country is divided into 16 regions. Among them, the region Malopolska.

Małopolska Region is located in the central-southern part of the country. It has the total area of 15,183 km^2 and over 3,300,000 inhabitants. The capital of the Malopolska Region is Kraków and other bigger cities are Tarnów, Nowy Sącz and Oświęcim. In terms of economic development, the region is one of the most diverse regions in Poland. Situated at the crossing point of communication routes between the West (Austria, Germany) and the East (Ukraine), the North (Scandinavian countries) and the South (Slovakia, Hungary), it has exceptional assets and each year attracts 10-12 million tourists, new investments and young people studying at regional universities. Małopolska is one of the leading Polish regions in terms of economic potential and investment attractiveness. Małopolska has a high potential for scientific research and higher education - Kraków is the second center for research - development in Poland. 32 higher education institutions and universities, representing 7.1% of all higher education institutions in Poland. Over 180 thousand students and more than 55 thousand graduates per year.

At a distance of 45 kilometers from Krakow on the international route no. 7 (E77), Miechów is the seat of the Miechów municipal-rural commune. The Miechów commune is located on the Miechowska Upland above the Miechówka stream. It has 11,497 inhabitants. The administrative structure is created by the city of Miechów and 34 village councils. The city of Miechów is the main service center of the commune, in which all public utilities are located, including commune office, poviat starosty, kindergarten, hospital, health centers, restaurants. The commune has a well-developed tourist infrastructure, which is one of the most attractive cities in Małopolska. Above all, it is worth paying attention to the Post-Brecon Monastery Complex with the Basilica of the Holy Sepulcher in Miechów, which is the central element of the city, visible from afar.

Miechów itself with a well-developed administrative and technical structure, education (also higher), health service, trade and services is well prepared for the challenges that time brings. There is no room for stagnation in the Miechów commune. It is inhabited by people which are full of passion and willingness to act. Therefore, year by year there are more institutions that deal with the promotion of the region, taking care of children, the elderly, as well as promoting sport and a healthy lifestyle.

Zespół Szkół Nr 2 w Miechowie, has its roots in the year 1920. At its beginning it has been founded as a basic vocational school, which then in 1965 has been transformed into technical college called "Technikum Mechaniczne" teaching future mechanics. Few years later, in 1972 the offer for students embraced additionally post-secondary school and electronic technical college – introducing new broader offer implicated the change in name of the school complex to "Zespół Szkół Mechanicznych". In early nineties with the development of technology the offer of school has been broaden again. As a result of this change, the informational technology subjects have been introduced.

The changes in offered courses over the years were mainly a consequence of labor market needs and education reforms. In 2001 in Poland was introduced an educational school reform. At that time was created primary school (lasting 6 years)and lower secondary school (lasting 3 years). In 2002 the name of school has been changed to "Zespół Szkół nr 2 w Miechowie". Moreover, additional courses were added too. In 2006 the name was slightly changed again by adding the patron's name – John Paul II. Constantly, we do our best to meet the needs of market economy and local labor market by implementing new technologies into teaching methods as well as including new specializations in our curriculum.

At the moment, the technical school educates 521 students (150 women). Additionally 124 adults attend courses offered by post-secondary school including such specializations as : hospitality technician, food technologist, agricultural engineering technician, mechanic technician, IT technician. At present, „Zespół Szkół nr 2 w Miechowie im. Jana Pawła II”, employs 61 teachers, who run the above mentioned courses. Looking back into the past, we can say that a lot of our graduates finished studies and succeeded in finding important job positions being valuable resources for Lesser Poland and Silesian labor market. We do our best to fulfill our mission and create conditions for comprehensive development of our students constantly encouraging them to acquire necessary knowledge. At the same time, we promote independence in thinking, creativity and efficiency.

We want to educate students in the field of cultural and technological aspects and provide them with innovative knowledge and skills. To fulfill this vision we take many steps by:

- continuing the appropriate staff policy, motivating teachers to their further professional development;
- Upgrading the school equipment
- participating in many different innovative programs

Between 1995 -1997 our school was chosen twice as a laureate of the „ My school - a school of entrepreneurship” program, run under the sponsorship of Educational Entrepreneurship Foundation and the Ministry of National Education. The prize in the program - quite large funds at that time, we used to enrich the workshop equipment for the education of students in new technologies i.e. IT and electronics technicians. In the years 1998-2004 we have implemented innovative pro market programs such as: "Young Entrepreneurs", "Youth Mini-Enterprise", "Road to Success", which imparted knowledge about the market economy in an interactive way . Another success of that program is, that many of our students have established their own companies and are currently operating in business. In 2005, we were awarded in the competition of the Polish Agency for Enterprise Development as part of the pre-accession program of the European Union "Phare II". Moreover, we have also gained some experience in the Socrates-Comenius programs during the years 2005-2008 in cooperation with schools in Italy, Belgium and Greece. Together with the above mentioned partners, we took part in the project "Agricultural economies, a meeting place for European nations". From the year 2010 to 2015, we have been participating in the program "Modernization of Vocational Training in Lesser Poland".

Our students took part in numerous industry courses, internships, study visits and workshops, improving key competences required by labor market. They have gained new professional qualifications and received certificates strengthening their position on the market. We also systematically develop the competences of our teaching staff. Our teachers participated in the project called "Diamond" - aimed at perceiving and stimulating talented youth to extensive activity. Operational Program Human Capital –which stands POKL, 9.2) and the project called "School of Champions" (POKL, 3.4), which beneficiaries were the teachers leading the courses in area of gastronomy and hospitality.

Additionally, teachers of non-IT subjects participated in the project called "Professional development of teachers in the field of the use of information technology" (POKL, implemented by the Voivodship Labor Office). Another project, in which the teachers took part, was "Modernization of the Vocational Personnel Education System in Lesser Poland "(POKL, 9.4). They also took part in the project called "Agro na 6- tkę " – aiming at the improvement of vocational education teachers of agricultural schools in Poland" (POKL, 3.4). Furthermore, our teachers participated in the project called "NEW-TECH" (POKL, 3.4) and in the program called "Motopraktyki - Competent teachers of vocational training in the automotive industry". Therefore, we could describe our organization as a school that is constantly strengthening its human resources.

In the area of internships we cooperate with almost 90 employers. These are car repair workshops, car diagnostic stations as well as service companies in the field of information technology, restaurants, catering establishments and hotels. The partners are medium and reputable companies. In didactics we use also cooperation with publishing houses and industry magazines in the area of innovative gastronomic didactics. Within the "Modernization of Vocational Training in Malopolska", our students participated in many study visits, including 5 foreign, in which they had the opportunity to observe the real working and education conditions.

In 2016, we promoted the profession of automotive technician at the Education Fair in Lyon. At the moment we are participating in the project "Establishment and development of the Professional Competence Center in Miechow County based on Zespół Szkół No. 1 and Zespół Szkół No. 2". Thanks to the project, students can undertake qualification courses, including innovative technologies of vehicles diagnostics, get scholarships for their further professional development and participate in internships held by local and regional employers.

The internships were the result of the projects - "European practices - the key to a professional career" realized in Germany (Erasmus+) . "Cooks on the European job market" and "Hoteliers of Europe" were fullfiled during the year 2017 in Greece in the Operational Program Knowledge, Education, Development. In 2018, the students of nutrition and catering services as well as hospitality and mechanic technicians (car mechanics) took part in another project "European mobility - our way to professional success" organized by Erasmus + . They have already completed internships in Italy.

Taking all that into consideration, we do believe that the experience of our students in the field of mobility on foreign labor markets is growing. Despite of constant development and participation in international programs, we are still aware of quite light experience in the international activity of students educated in the field of teleinformatic technician. As an answer to that, we wanted to move forward and take part in the program Erasmus + and the project Strategic Partnership for the development of 3D Competences"Our school systematically introduce the latest digital technologies to didactics as well as educate and cooperate in the project with foreign partners.

Although the Malopolska Region is not directly responsible for education, it supports schools and educational institutions in many ways. In 2010 The Marshall Office of the Malopolska Region was the leader of the project "Modernisation of vocational education in Malopolska. The project was carried out in partnership with 22 counties, 3 communes and 8 private governing authorities of vocational schools in the whole Malopolska Region. 3 schools run by the Ministry of Agriculture and the Rural Development also participated in the project. The aim of the project was to modernise and improve the quality of vocational education by supporting schools in 7 key industries (mechanics-mechatronics, construction, information technology and electronics, tourist and catering industry, agriculture and food processing, health-care and services) in cooperation with local entrepreneurs. The budget of the project was 154 000 000 PLN. In the international component the Malopolska Region cooperated with the regions of Thuringen in Germany, Rhone Alpes in France and Istria in Croatia. In addition, 5 universities cooperated with our region within the Malopolska Educational Cloud. 288 schools introduced development programs aimed at developing the additional skills desired by entrepreneurs in the labour market, the development of key competences, career guidance and reinforcement of cooperation with entrepreneurs. 77 301 students received various forms of support within the project, 39 024 obtained apprenticeships, internships or study visits to companies. 165 309 certificates were awarded. 223 schools were provided with modern equipment and10 schools cooperated with universities within the Malopolska Educational Cloud. 5 publications about the project were prepared. 1578 students took part in seminars and 327 students participated in study visits abroad within the international component of the project. But the most important result was the increase of the students choosing vocational education schools from 48% in 2011 to 60% in 2017.

The study of vocational career of graduates in Zespół Szkół Nr.2 in Miechów. It is carried out in two stages. The first stage covers the students of the last grades and consists of gathering students' contact data and being familiar with their educational and professional plans. In the second stage, using the telephone interview, the educational and vocational career of graduates after the school is examined. In the years 2014-2017, the study covered 316 graduates from all classes of Technical School in Miechów being educating in the profession of: motor vehicle technicians, teleinformatic technician, agriculture mechanization technician, hospitality technician, gastronomic service organization technician. The study of graduates showed that the largest group of people entered the labor market (186 people - 59%). People who only study are in the amount of 44 (14%), young people who both work and study are in the amount of 64 (20%). Only 22 people are unemployed (7%).

The Regional Labour Office carried out the survey concerning the career of vocational schools graduates in the Malopolska Region. The survey in 2016 covered 5 000 students. 48% of graduates were working, 24% both were working and studying and 9% were unenployed. The situation of graduates depends on the type of the school. 79% of graduates of basic vocational schools were working, among them 19% combined work with education. 76% of the post-secondary schools graduates were working (25% of them were additionally studying) and 70% of the technical schools graduates. As many as 48% of the technical schools graduates continued studying. The highest percentage of students continuing studying was among the IT and electronics graduates (61%) and the lowest among the agriculture and food processing graduates (28%).

AUSTRIJA - Carinthian University of Applied Sciences / FH-Kaernten

The Carinthian University of Applied Sciences (CUAS / Fachhochschule Kärnten) is located in 4 cities (Spittal, Villach, Feldkirchen and Klagenfurt) within Carinthia, which is the southernmost Austrian state. The state stretches about 180 km (110 mi) in east-west and 70 km (43 mi) in north-south direction. With 9,536 km2 (3,682 sq mi) it is the fifth largest Austrian state by area and the recent number in Population Counts 560.00 inhabitants. The capital city is Klagenfurt. The next important town is Villach , both strongly linked economically. The state is divided into eight rural and two urban districts , the latter being the statutory cities of Klagenfurt and Villach. There are 132 municipalities, of which 17 are incorporated as towns and 40 are of the lesser market towns. The settlement history of Carinthia dates back to the Paleolithic era. About 300 BC, several Illyrian and Celtic tribes joined together in the Kingdom of Noricum, centered on the capital Noreia, which latter become part of the Roman Empire. In the early Midle Ages both Bavarians from the North and Slavic tribes from south-east immigrated and formed what was called Carantania. In the 9th century it becomes the Duchy of Carinthia and in 1335 it was passed to the Habsburg brothers Albrecht II. and Otto IV, and was ruled by this dynasty until 1918. Since than Carinthia is part of the Republic Austria. Situated within the Eastern Alps, it is noted for its mountains and lakes. Carinthia's main industries are tourism, electronics, engineering, forestry, and agriculture. The multinational corporations Philips, Infineon and Siemens have large operations there.

Since its foundation in 1995, CUAS has made history. Back then we started with 2 programs and about 70 students; currently we offer 30 study programs that educate almost 2000 full- and part-time students. About the same number of CUAS graduates is impressive proof of the necessity and importance of this academic institution. Through ever growing acceptance of the programs as well as the high demand for our graduates in industry, the programs will be further developed in the coming years. CUAS has developed into a unique educational institution in Carinthia. Through constant further development of the degree programs at CUAS and intensive cooperation with the worlds of business and science, those studying at the university can be certain of a progressive education with its finger on the pulse of time.

CUAS lives the vision of direct practical experience. Full- and part-time lecturers, as well as guest speakers from industry and business ensure an interdisciplinary, internationally oriented education. Degree programs are offered in the fields of civil engineering and architecture, engineering, as well as management, healthcare and social issues. The quality of our education is emphasized through the development of innovative teaching and learning methods, such as, blended learning, which offers students and professors greater flexibility in the creation of a suitable learning environment.Furthermore, the CUAS library offers educational support through state of the art facilities. On all sites CUAS libraries administrate 33,000 media.

Austria has 70 higher education institutions. There are three types of higher education institutions (HEIs) in Austria. First, there are 35 public and private Universities. Second, 21 Fachhochschulen, universities of applied sciences, provide an education which focuses more on practical knowledge and training than universities do. Third, there are 14 Pädagogische Hochschulen, providing the country’s teacher training. In line with the Bologna process, the degree-structure is three-tiered: bachelor, master and doctoral degrees. In 2017 total enrolment was 308,700 students.

Austria is popular as a destination country, international students count for 16 % of all students. Almost 40 % of international students are coming from Germany. Other major countries of origin of international students in Austria are Italy, Bosnia-Herzegovina, Turkey, Hungary, and Serbia. The academic year in Austria, as a rule, begins on October 1st and ends on September 30thof the following year. It consists of two semesters: Winter semester (October 1st to January 30th), Summer semester (March 1st to September 30th) There are also periods during in which no lectures are held (Christmas, semester and summer breaks). In comparion to other countries the vast majority of Austria's HEIs performs particularly well in view of international orientation as well as research, whereas, based on the U-Multirank indicators, there is room for improvement in teaching and learning for a number of institutions.

A professional practical training lasting up to 15 week is an essential and obligatory part of the curriculas of universities of applied sciences in Austria. Furthermore training for the job is an intregrated essential element in the lectures, excercises and laboratory courses at CUAS.

According to our statistics a number of 100-120 students complete our technical Bachelor programmes per year (for CUAS about 400-450 in total per year). About half of them enter the consecutive Master programmes, which are also entered by other incoming students (national and international). Here about 120 finish there technical studies every year (for CUAS out of about 200 in total.). This results in a number of roughly 400-450 students entering the labor market every year.

About 20 of our study programmes are so-called technical studies such as Mechanical Engineering, Electrical Energy & Mobility Systems or Civil Engineering. Of course STEM related lectures form the main corpse of such study programmes.

At the CUAS there do exist a more or less regular budget for investment in laboratories. Furthermore, certain equipment can be purchase within the framework of national and international projects such as the national COIN programme. As usually this are competion based and therefore success is not guaranteed.

CROATIA - Technical School Pula

Croatia is a European country, and in geopolitical terms Central European and Mediterranean country, geographically located in the southern part of Central Europe and the northern part of the Mediterranean. Croats belong to some of the oldest European nations. They have been living in their present homeland, Croatia, situated between the Adriatic Sea in the south and the Drava and Danube rivers in the north, for more than thirteen and a half centuries. Since they occurred to be living in a space where the conquering aspirations of two great states clashed - Byzantine and Franciscan, Croats have had a very tumultuous history. In its near history, Croatia was part of Yugoslavia, and in 1991 declared its independence. The capital is Zagreb. It has a population of 4,284,889 people. According to the European Union's living standard indicators, Croatia stands almost at the bottom of the ranking. The Croatian territory is divided into 20 counties and the City of Zagreb. Our school is located in the Istrian County. It is one of the most developed counties of Croatia. The largest city of the county is Pula, and it’s exactly where our school is located.

Pula Technical School is a four-year secondary school in Pula established as a unique and independent educational institution. It was founded in 1959. As of today, 460 students attend educational programs diversified in six curricula – engineering computer technician, electrical technician, mechatronic technician, geodetic technician, shipbuilding technician and architectural technician. Classes are held in two locations. The school employs 57 employees, 49 of whom are professors. The mission of the Pula Technical School is to enable all students to acquire the necessary life competences in a positive environment, through quality education programs and curricula while nurturing collaborative relations. Quality education programs enable youth to properly look at the world around them, to make the right decisions and to make the best use of the opportunities that arise. For this reason, our mission is to train students for a competitive labor market, for further education, and encourage personal development and creativity of every single student. Our vision is the top-notch and safe school that follows and adapts to modern trends in science, education and the profession. A school where one can learn and work with ease, in which new ideas are born and the knowledge upgraded. A school where both students and staff behave responsibly, a school in which individual and collective abilities are created and developed. We want students, teachers, parents and the community to recognize us as a modern school - the school for the future.

The duration of vocational education in secondary schools depends primarily on the curriculum. After the completion of secondary vocational school, depending on the curriculum the student has completed, it is possible to start working and enter the labor market, provided that the conditions are fulfilled, or continue the education process at a secondary or higher education institution. In vocational education, students acquire knowledge, skills and competences necessary in the labor market with the aim of professional recognition of acquired qualifications which also offer the possibility to continue the education. Secondary vocational education programs are two: four-year programs (which terminate with the submission and defence of the final paper. After completing this education program, it is possible to start working or resume education at higher levels, which is subject to the state exit exam) or a three-year program preparing the student to work in industry, enterprises and crafts. The three-year programs also end up with the submission and defence of the final paper while the practical part of the program is realized mainly in the work process (with the employer) and a smaller part in the school premises. After completing the three-year vocational education program students have the possibility find employment or continue their education at a higher level of qualification, provided that complementary and/or bridging exams are taken, and provided that other necessary requirements of higher education institutions are met, it is also possible to continue the education at higher education levels. Reform of vocational education and the adoption of a new curriculum for vocational schools are ongoing in Croatia and hopefully, its implementation will start at the beginning of next school year.

Practical training at the Pula Technical School is included in the total weekly teaching hours. Electric technicians in first grade have two hours of practical training while in higher grades practical training occupies four hours weekly. Mechatronic technicians in all grades have two hours of workshop training and exercises per week. Mechanical technicians have three hours of practical training (mechanical technology) in the first two grades. Geodetic technicians in all grades except in the first grade have three hours of practical training (surveying). The other two curricula, shipbuilding technicians and architectural technicians, also have practical training within the subject exercises. In addition to the abovementioned practical training, the program comprises also laboratory exercises, which as well as practical training take place in groups (each grade is divided into two groups). In the curricula electrical technician and mechatronic technician, almost all teaching subjects comprise laboratory exercises. All subjects are correlated and thus the synergy of the program is achieved. Students themselves perform exercises in all curricula, there are exercises performed by the students themselves while the demonstration exercises are performed by the teachers.

Practical training is not provided during the winter holidays, while during the summer holidays practical training continues for the curricula electrical technician, shipbuilding technician and architectural technician. Summer practical training is performed in craftsmen laboratories and companies in the surrounding area.

Approximately 100 students complete the education at the Pula Technical School every year. Since the introduction of state secondary school exit exam, schools can track the number of students who enroll in study programs through the National Centre for External Evaluation of Education, which is approximately 80 students per year. The remaining students are hired right after completing the secondary education for which we don't have specific data.

Developing STEM areas which comprise mathematics, natural sciences, technology and engineering, are certainly the mission of the Pula Technical School. STEM areas are represented in all curricula in the school through general and professional subjects. The school systematically educates students about stem news and motivates and directs them towards the occupations of the future, i.e. occupations for which there will be high demand in the labor market.

In the modern, digital age, it is almost impossible to achieve almost any significant result without providing and integrating technology into teaching. Because we live in a poor country that doesn't have the money to equip schools with the latest technology and equipment, the school has to take care of the supply on its own. Therefore, a number of obstacles often hinder the provision, and therefore the development of the teaching programs. The State or the ministry invest very little or almost nothing in the purchase of new technologies. The county helps more, but on the other hand being active in European projects, such as this one, brings multiple benefits to the school – from the procurement of new technologies to the education of teachers and students. An important role in the procurement of new equipment is played by private and state companies that very often donate IT equipment because the school does not have the means to buy and adapt to professional laboratories. New equipment is very important for technical schools, which includes new technologies to keep up with modern developments and to prepare students for the labor market or study enrolments.

At technical school we already have a Wanhao 3D printer. Through this project 3DforVet our school will add another high-quality 3D printer and 3D scanner. In regular teaching 3D technology will be used in the following cases:

Electrical technician: Technical drawing and documentation, Electrical engineering materials
Engineering computer technician: Technical drawing, Machine elements, Technical materials, Designing products using a computer
Mechatronics technician: Technical drawing, Machine elements, Technical materials, Designing products using a computer
Geodetic technician: Geodetic graphics
Architectural technician: Technical drawing, Drawing, Architectural structures

Shipbuilding technician: Technical drawing and design geometry, Technical materials, Laboratory exercises and practical training
In addition to regular teaching, we use 3D technology and we will use it to create the final works and competitions.

Students and teachers are poorly educated about 3D technology, although some students show interest and perform their own search for more information on the Internet. Interest in 3D technology is high, both by teachers and students. Today, students and teachers use the Internet as a basic mean of collecting information about additive technologies. There is a lot of information available online about additive technology. Teachers and students are not often informed about the possibilities that additive technology offers and what it could be used for and that's the reason why it is very important to educate teachers who will pass on their knowledge to students. In addition to the advantages of additive technologies, it is also important to highlight shortcomings as well. 3D technology will be easily applied in practice, as it already is in many sectors. The same does not apply to mass production and serial production, but in specific areas such as medicine and similar, 3D technology is a new technology by adding materials, to the general public known as 3D printing. Day by day, as technology advances, there is an increasing number of materials that can be printed in 3D technology while machines produce finished products of large dimensions. Additive procedures are useful for the production of products with complicated geometry in a relatively short time frame simply based on a CAD computer model. Additive technologies are also used for the manufacture of products in various materials as polymers, metal and ceramic products for consumer goods, electronics, automotive, medicine, architecture, military industry, aerospace, mechanical engineering, etc. It is also challenging to use it to create tools and molds with large savings in production because it is possible to produce complicated tempering channels.

To summarize: additive procedures can be used for almost everything, the imagination is the only limit. Although there are no restrictions in designing, the boundaries are possibly represented by the materials available with which objects are made. As for now, polymeric materials (acrylic resins, epoxy resins, PMMA, PA, PS, PA, glass fiber reinforced PA, starch, plaster, sand, ABS, PC, PLA, PE, PP, wood-plastic composites, PVC, paper, silicone), metal (zinc, aluminium, bronze, stainless steel, titanium alloys, cobalt chromium, beryllium copper, carbon steel, high-alloy steel, tungsten) and ceramics. Even precious metals such as gold and silver can be used for printing. 3D technology should be an upgrade to the basic knowledge in specific areas, therefore the basic knowledge shall not be neglected but shall be transferred to students in equal measure. In this sense additive technology should be the "icing on the cake", on top of basic knowledge from specific areas.

We expect that the project will enable us to learn about the practical application of 3D technology (concrete examples in industry and economy), understand the benefits, but also the shortcomings of 3D technology (with real-life examples). The project is expected to contribute in some way to increase the quality of teaching, although teachers of vocational subjects strive to get students acquainted with this topic as much as possible. The project will for sure increase the interest of students and teachers towards additive technologies, and therefore increase competitiveness in the world market of today's students and future additive technology experts. It takes some time for the world to adopt new technology. This certainly boosts the belief that 3D printing has great potential to become one of the new and modern technologies. 3D printing is a technology that boosts design innovation in total freedom, while the process takes place at reduced costs and fast operation. Parts can be specially designed without the need for assembly, and despite the complexity of the geometric shape or the production effort requested, it won't increase the production costs. 3D printing is an energy-efficient technology that can reduce environmental pollution within the process itself using up to 90% of standard materials and shorter production time. In the future, the wide application of 3D printing can be expected to make major changes in our everyday life, which will greatly improve the accessibility of creating new items. The project is also expected to give a broader insight into additive technology materials and an insight into the latest updates of 3D technology sector from all around the world. Concrete examples of application in science, technology and industry are expected to be highlighted. One of the expected outcomes is to learn about additive manufacturing and DIY that will contribute to a more comfortable life and general awareness about all the things that can be produced at home. It is expected to stimulate the curiosity of young people and students about new technologies, to engage them and create an entrepreneurial climate in the industry sector.

The advantage of 3D technology is the availability of 3D printers (in the future perhaps 3D scanners) that can easily be bought on the Internet at a rather low cost. DIY 3D printer kits can also be easily found so students will be happy to learn how to build a 3D printer from scratch by themselves. The project also needs to provide an overview of the world's current technology and the possibilities of integration of 3D technology in significant manufacturing industries for the Croatian economy. The project is expected to raise the quality of practical training in the school, both in the field of mechanical engineering and in the fields of electrical engineering, mechatronics and architecture, as well as surveying with examples of specific applications. The project is expected to provide an example of areas in which 3D technology could be applied, in particular considering those areas which are important to our school. Furthermore, students expect that additive technologies can be used everywhere, which is true only if it presented this way. For this reason, it is important to familiarize teachers with the advantages, but also with disadvantages coming from this technology. At the same time, it is important to explain that modeling can be performed using various CAD programs available, from the simplest versions to the most advanced ones. Complex software gives students the opportunity to learn how to create objects of more demanding shapes and structures. In addition to designing, it is also necessary to teach them how to use the software for calculating (appropriately for secondary school students) the strength of materials used for items being modeled.

LITVA - Viešoji įstaiga Panevėžio profesinio rengimo centras/Public institution Panevėžys vocational education and training centre

Lithuania is a green area of the plains (75 per cent territory) in northern Europe on the Baltic Sea coast, one of the three Baltic States, with Latvia, Belarus, Poland and the Kaliningrad Region (Russia) in the neighborhood. It is a country that has preserved many natural landscapes, woods, lakes and rivers and has special seashore - not only beautiful sandy beaches, but also the Curonian Spit - a sand bar that separates the Curonian Lagoon from the Baltic Sea.

In 1009, the name of Lithuania was first written, but the first inhabitants are believed to have appeared here 10,000–9,000 years before our era, and after 7000 years the Baltic nations came to the Baltic Sea.

Lithuania is still a young country. Independence was restored only in 1990, but the history of Lithuanian statehood begins in the 13th century when the first ruler Mindaugas received the crown. The history of Lithuania is changeable, with great victories and painful experiences.
Key facts about Lithuania:

1. Area of the country: 65 200 sq. M. km.
2. Capital: Vilnius.
3. Population: 2 810 000 (2018).
4. The official language of the Republic of Lithuania is the Lithuanian language belonging to the Baltic language group (this group also includes the Latvian and the dead Prussian language). It is the most archaic of all Indo-European languages.
5. Lithuania is considered a religious country, 79% of Lithuanian people consider themselves as Roman Catholics.
6. The currency of the Republic of Lithuania is the euro.

7. The Republic of Lithuania is a parliamentary democracy. State ruler - President, Executive - Government (appointed President), Legislative Authority - Seimas (one-chamber parliament directly elected).

The biggest cities in Lithuania:
1. Vilnius - 622 500 (2018)
2. Kaunas –292 700 (2018)
3. Klaipėda - 154 300 (2018)

Panevėžys is a city in northern Lithuania, in the lowlands of central Lithuania, on both sides of the Nevėžis river. One of the largest cities in Lithuania (the fifth largest) located halfway between two Baltic capitals - Vilnius and Riga. The good geographical location with good road infrastructure, and the international highway Via Baltica provides opportunities for business.

At the beginning of 2018 there were 3655 economic entities operating in Panevėžys. Majority of the companies were wholesale and retail trade and repair of motor vehicles and motorcycles (24.8 %). Slightly less percentage of the number of registered and operating economic entities was collected by other service providers (20.3%), manufacturing (8.7%), transport and storage (8.5%). Small and medium business (operating entities with 20 to 49 employees (as of the beginning of 2018)) dominates in Panevėžys.

The largest share of gross value added was generated by industry (28.3%) and wholesale and retail trade, transport and storage, accommodation and catering (26.1%). Panevėžys county companies exported mainly their products to Norway, Italy, Latvia, Germany, Poland, Iran, Sweden, Finland and Saudi Arabia. The only Norwegian industrial park in Lithuania is operating in Panevėžys. It is worth mentioning that Panevėžys has set ambitious goal for the future – to become one of the strongest centers of robotics in the North East Europe region.

Vocational training programs target people of all ages and education. Initial vocational training starts at least 14 years old for the first-year-olds seeking a first qualification. Initial vocational training is implemented by:

• basic education (ISCED 2),
• secondary education (ISCED 3) and
• Levels of post-secondary non-tertiary education (ISCED 4).

Upon completion of the programs, the European Qualifications Framework (EQF) level 2-4 qualifications are acquired. Pupils have access to basic or secondary education along with their professional qualifications. Graduates of vocational training institutions who have obtained a maturity certificate may enter higher education institutions. Graduates of higher education study programs in the same field of education are awarded additional scores.

Vocational training in Lithuania is implemented in the form of a school, but practical training and in-company training forms a major part of the curriculum. 60% to 70% of the initial training is provided as practical training of which 8 to 15 weeks of practical training must be carried out in an enterprise or in a training institution base that meets real working conditions.

The purpose of continuing vocational training is to improve the person's qualifications, to acquire other qualifications or competencies required for the performance of a statutory job or function. Continuing formal vocational training programs are aimed at individuals with different educational backgrounds (from primary to post-secondary). Learners may be required to have practical experience or qualifications. The duration of the programs is up to 1 year, after which the state-recognized EQF level 1-3 qualification is acquired.

The Ministry of Education, Science and Sports of the Republic of Lithuania has the main responsibility for the development and implementation of vocational training policy.

The Center for the Development of Qualifications and Vocational Training (KPMPC) organizes the development of professional standards. KPMPC also collects and analyzes information on vocational training, develops methodologies for vocational training development, evaluates and develops the

quality of vocational training, carries out the National Quality Assurance Reference Point and the National Qualification Coordination Point.
Advisory bodies play an important role in the formulation and implementation of VET policy, the most important of which are Lithuanian Vocational Training

Council, the Central Professional Committee and the sectoral professional committees.

The social partners are mandated to initiate the development of new qualifications, standards and vocational training programs. Since 2003 the final qualification assessment is separate from the training process. From 2012 competences are assessed by institutions accredited for this function: social partners, companies, employers' associations.

Employers' representatives are involved in the content of VET programs, assessing the relevance of programs to labor market needs and organizing training. They can also participate in the management of VET institutions and become members of such institutions. Currently, the social partners, companies and municipalities are directly involved in the management of about a quarter of the initial vocational training institutions with the status of a public institution.

Initial vocational training is implemented by about 70 vocational training institutions. There are about 260 institutions involved in continuing vocational training. In total, about 450 qualifications are offered in the VET system.

Public institution Panevėžys vocational education and training center (hereinafter - PPRC) was founded in 2000 after joining three vocational schools. Currently, PPRC is one of the largest vocational training institutions in North and East of Lithuania.
PPRC educational process takes place in the following departments: centre of mechatronics; construction sectorial practical training centre; automotive mechanics; gymnasium; land and household activities; services; motor transport sectoral practical training centre; adult training and retraining; regional center for farmers‘ continuous vocational training centre; Panevėžys correction house.

There were 833 pupils studying under the initial and continuing vocational training programs in PPRC at the end of 2018. The pupils studying at PPRC are not only from Panevėžys city, but also from Panevėžys and surrounding districts. PPRC pupils learn specialities according to 26 initial and continuing vocational training programs which provide vocational, basic and secondary education to pupils. PPRC also runs adult continuing education and retraining courses under the 15 most popular adult continuing education programs. 175 apprentices attended adult education programs. Every year, about 300 qualified professionals under initial and continuing vocational training programs graduate PPRC, with an average of 45 pupils completing the basic curriculum, and about 160 pupils in secondary education.

PPRC has 5 departments: service vocational training department, mechatronics vocational training department, construction vocational training department, automotive vocational training department and agriculture and household services vocational training department. Pupils admission takes place through the centralised LAMA BPO information system.

Vocational training in PPRC is implemented through approved vocational training programs and vocational training plans for individual educational groups. For the first qualification modular program, each module (1 credit equals to 22 hours) is distributed for contact, consultancy and learning achievement assessment. 60-70 percent of the hours spent on vocational training are given for practical training and practice, and 30-40 percent for theory.
Educating the competencies required for the profession, together, develops pupils' general lifelong learning skills such as critical thinking, creativity, initiative, problem solving, decision-making and etc.
Practice is given in the final course of learning and is made in a company, institution, organization or farm.

PPRC offers a variety of meetings with college and university representatives. Also, in close cooperation with the social partners, various seminars and meetings related to the professions chosen by the students are organized. Pupils are encouraged to actively participate in professional excellence and skills competitions, mobility visits in foreign countries, specialized exhibitions and fairs. According to the possibilities, PPRC organizes study visits to companies and organizations.

In practical training workshops of PPRC general education schools pupils come to study technology subjects according to the agreements concluded with the schools and the activities proposed by PPRC.

According to in advance agreed timetable, students of Panevėžys College, progymnasium and other vocational schools of Panevėžys County study at Construction sectorial practical training centre of PPRC.

Service vocational training department of PPRC implements a hairdresser's modular vocational training program (90 credits), a hygienic cosmetic modular vocational training program (90 credits). The modules for acquiring the competencies that make up the qualification include 80 credits, optional modules 10 credits. At the end of the module, the final evaluation of the module is performed.

Agriculture and household services vocational training department of PPRC implements a modular vocational training program for technical maintenance business workers (90 credits). Each module has theoretical and practical classes.

A new modular curriculum is being implemented in construction vocational training department of PPRC: a finisher (builder) modular VET program (90 credits). Learners who have already acquired a specialty are studying here. In addition, this department also implements a modular training program for the construction worker (builder) with a volume of 100 credits. Learners who have completed 10 grades of basic education and want to aquire profession together with secondary education study here.
The modular vocational training program of the computer network adjuster is implemented in mechatronics vocational training department. It is a one-year program with 60 credits. The theoretical and practical hours for each module are

distinguished. Practical hours represent 60-70 percent of the total learning module. At the end of the module, the final evaluation of the module is performed.

From September 1, 2019, all programs will be modular. Existing modular programs will be supplemented with: modular vocational training program for computer adjusters, hairdressers, automated systems exploatation mechatronics, car mechanic, car electromechanic. Also new modular VET programs for welders, masonry workers and plumbers are also being prepared.

Every year a fairly large number of graduates complete our school. Some are joining the labor market (over 60 percent), others continue their education (about 15 percent) studying at colleges or universities. Also some percentage of graduates go to work abroad or choose other options in life such becoming parents or going to do military services.

The fourth industrial revolution comes to Lithuania. Robots, digital systems, and other advanced technologies are rapidly changing industrial processes and penetrating other areas of our lives.

In our school, from September1, 2018 there is robotic club and 3D printing club established for the pupils who are interested in improving their knowledge in these fields. Pupils learn the basics of programming to make the robot move, speak, draw and etc. In the robotic club. The center has four robots.

The biggest robotics center RoboLabas in Lithuania opened its doors in Panevėžys. It is expected that it will encourage children in the region to familiarize themselves with the latest technologies, learn to program, develop engineering solutions, develop creativity, critical thinking and other future competencies. At the same time, the opening of RoboLab

is an important step for Panevėžys towards the goal of becoming a North East European robotics center.

"Developing the city in the strategic direction of Industry 4.0, Robotics and Automation requires a complex approach that covers a wide range of areas - from robotics to kindergarten education to business cooperation. Pupils, teachers and enthusiasts from Panevėžys and other cities in RoboLab's space will find the best conditions to dive into the world of robotics. We hope that this will encourage young people to link their lives to this area, " said Rytis Mykolas Račkauskas, Mayor of Panevėžys City Council.
We hope that students of our school will join the world of robotics.
On the day of the opening, RoboLab, located at the Panevėžys Minties Gymnasium, was hit by dozens of schoolchildren intrerested in robots. From now on, they will have even more opportunities to enjoy their favorite activities in a colorful, up-to-date center. For nearly 650 square meters of space, formal education will take place in days - robotics will be integrated into information technology, math, even music and other lessons or taught as an selective subject. Meanwhile, robotics teams will be organized in the afternoon center.
In addition to RoboLab, it is planned to open a regional STEAM center in the autumn of 2020. He will expand the subject of the educational institution. Children will be able to learn not only robotics, but also information technology, artificial intelligence, biology, chemistry, physics and engineering laboratories.

Construction sectorial practical training centre was established in Panevėžys vocational and education centre. It is a practical training base equipped with modern training equipment and modern technologies, providing initial and continuous practical vocational training services to all residents of Lithuania.

The modern practical training base has been created after the implementation of the project "Establishment of Construction sectorial practical training center in Panevėžys vocational education and training centre". This centre provides conditions for the development of highly qualified construction specialists for the labour market. The Centre's base meets the requirements and expectations of construction sector.
During project implementation period, a new building was built, where the workshops of mechanized wood processing and assembly of a wooden building

were established. Reconstructed garage and utility building with new workshops: painting, mechanized painting, mechanized plastering and tile laying, plasterboard installation, finishing works, was built. Upgraded also former workshops that include: metal welding, electrical system installation, pipeline installation, water supply and sewage installation, heating system installation, building mechatronics and technology workshops.

Woodworking machines, welding and educational electrical installation equipment, various construction tools, appliances, equipment and equipment had been purchased for the construction sector practical training center. As well as computer equipment was also purchased.

The establishment of construction sectorial practical training centre encouraged cooperation, dissemination of experience, joint workshops and training with different educational institutions, enabled joint research in the field of construction and training programs for the labor market.

Pupils now could choose one of the fifteen professional training programs at Panevėžys vocational education and training centre such as: computer hardware adjuster, computer network ddjuster, automated system mechatronics, decorator (builder), building engineering equipment installer, car mechanic, car electormechanic, joiner, technical maintenance business worker, agroservice worker, environmental worker. All programs include an information technology module or information technology is integrated into individual modules of the programs. During these lessons, students learn how to draw different shapes, individual details according to the given dimensions. Students use the following programs: AutoCAD, TinkerCAD, SketchUp and etc.. Through various applications, students scan, layout and model 3D. EinScan-S is used for scanning. From September 1, 2018, there is a 3D printing club. The pupils from the 9th to 10th grade, computer equipment adjusters, mechanics and finishing (construction) students are attending the club. They are willingly constructing various shapes which they print with a 3D printer. They use the BCN3D_Cura program. Acquired knowledge will help them to get the right career path in the future.

During information technology lessons pupils carry out the following tasks: layout design, creation of various details, works in the field of advertising, creation of car parts, creation of tools, scanning and printing of broken parts.

We live in the age of information technology. Everything is constantly improving, changing. We see great achievements in the field of science, in the field of information communication technologies. Teachers take part in various courses, seminars and internships abroad.

Teachers of general education have an average of 21,817 days a year of improving their knowledge and qualification, and profession teachers have about 19.39 days a year of improving qualification.

At school work teachers with the following qualification: 1 expert, 20 methodologists, 42 senior teachers and 16 teachers and 4 unqualified teachers. Teachers' qualifications are high enough. Although the teachers' qualifications are high, 3D technology is only used by IT teachers. However, there is interest in 3D technologies also from teachers teaching other subjects.

There is one 3D printer and scanner at school. Pupils learn how to create spatial shapes during information technology lessons. Students in each profession learn to design figures and objects for 3D printing. All of these tasks are supported by six IT teachers.

Participation in this project contributed to the pupils and teachers who started using innovative technologies that are already used by companies operating in the market. 3D technology could be used in various sectors and increases opportunies for students who learnt about 3D technology in the labour market to get better jobs. Participation in the project also increased competences of the IT teachers and this lead to more qualitative teaching process. It is very important to have innovative technologies at educational institutions and present the newest knowledge to students.

3D printing technologies are important in the whole educational process because they encourage willingness to learn, try and create.

INTERVIEWS WITH MAIN STAKEHOLDERS TEMPLATE

The questionnaire was carried out in all four participating countries. The questionnaire gave a clearer picture of vocational education in the participant countries and of the significance of new ways of teaching in IT and STEM areas. The task was to survey ten companies from each country that use 3D technology or are planning to use it in the near future. Companies from four countries participated in the survey: Poland 11 companies, Lithuania 10, Austria 9 and Croatia 10. The purpose of this questionnaire was to find out what 3D technologies are used for and in which branches, what are the needs of 3D technologies, and of the companies interested in buying 3D printers and hiring experts in this field. The survey included 40 companies, from small to medium and large, from various areas of activity.

Company:	
Contact person:	
E-mail:	
Number of employees:	☐ up until 10 (if you are filling the questionnaire using PC, please select your choice with an X in front or after)
(please check the appropriate box)	☐ 10-49
	☐ more than 50
The company's main activity:	☐ production
(please check the appropriate box)	☐ tools manufacturing
	☐ design/construction

Answer the questions:	☐ other ....
Have you used products made by using a 3D printer so far (prototypes, models or prototype parts as final products...)?	☐ YES ☐ NO
If so, which technologies did you use (please specify the used technologies)?	☐ visualization ☐ manufacturing of presentation models ☐ manufacturing of functional models ☐ manufacturing of prototype molds ☐ manufacturing of models for casting molds ☐ direct manufacturing of tools and mold parts
If not, for which purposes would you use the products made by 3D printing for (please select up to three most important uses for your company)?	☐ visualization ☐ manufacturing of presentation models ☐ manufacturing of functional models ☐ manufacturing of prototype molds ☐ manufacturing of models for casting molds ☐ direct manufacturing of tools and mold parts
Do you intend to invest in the purchase of the 3D printing device in the next year?	☐ YES ☐ NO
Is there a lack of 3D printing specialists in your country?	

Will you have to hire 3D printing specialists in the near future?	☐ YES ☐ NO

Survey results

Figure 1: Number of employees

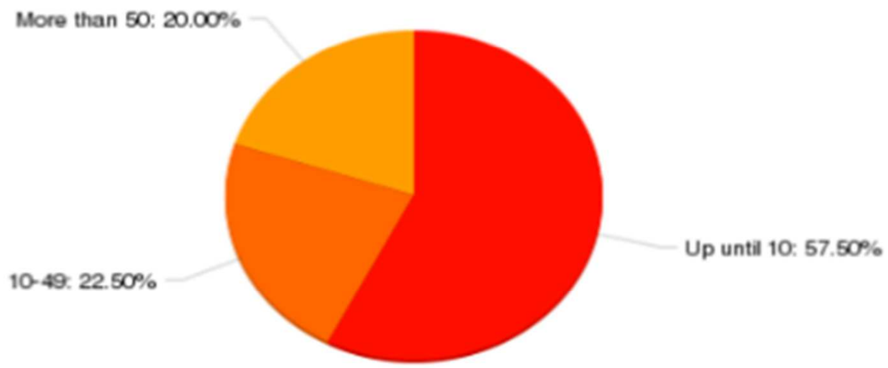

Figure 1

Figure 1 shows the size of the companies surveyed. A small company has up to ten employees, medium-size company 10-40, and a large company 50 or more. Therefore, the survey included 57.50% small enterprises, 22.50% medium-sized companies and 20% large companies.

Number of employees	Croatia	Poland	Austria	Lithuania
Up to 10	7	7	5	6
10 - 49	2	3	0	3
More than 50	1	1	4	1

Figure 2: The company's main activity

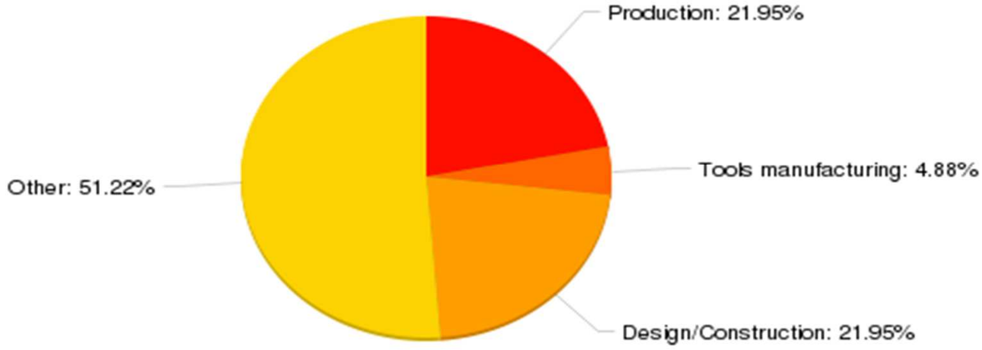

Figure 2

Figure 2 shows the core activity of the companies surveyed - 4.88% of companies are involved in tool manufacturing, 21.95% are engaged in manufacturing and design and 51.22% are engaged in other activity sectors.

Core activity	Croatia	Poland	Austria	Lithuania
Production	3	5	0	3
Tool manufacturing	0	1	1	1
Design/Manufacturing	3	1	5	0
Other	4	4	3	6

Figure 3: Have you used products made by using a 3D printer so far?

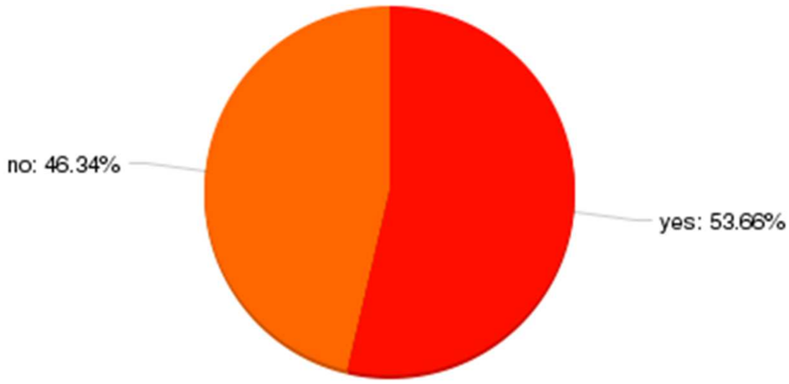

Figure 3

Figure 3 shows how many companies surveyed use 3D technologies in their work. Over half of the companies (53.66%) use 3D technology, while 46.34% have never used it. Austria certainly increased the obtained average, where all companies surveyed use 3D technology.

Technologies used	Croatia	Poland	Austria	Lithuania
Yes	6	3	9	4
No	4	8	0	6

Figure 4: If so, which technologies did you use?

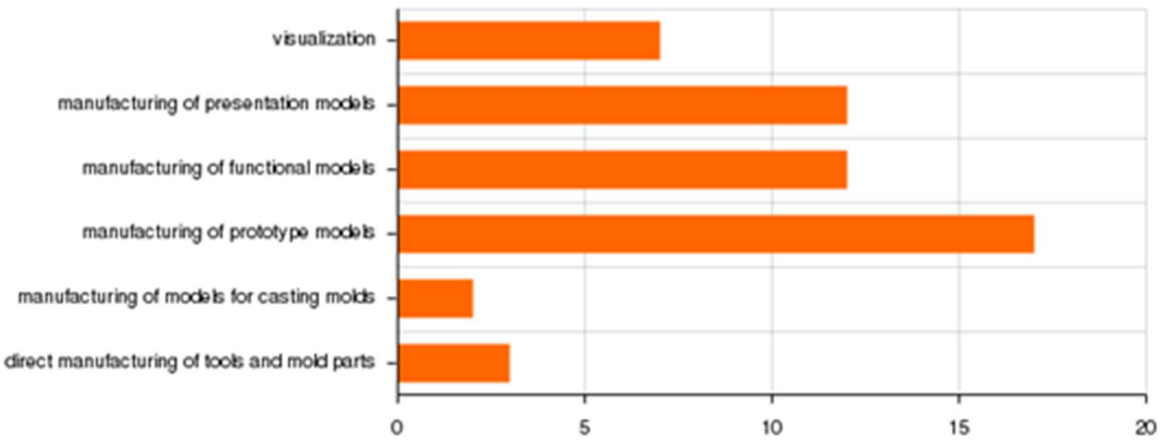

Figure 4

Figure 4 shows for what purposes the companies surveyed actually do use 3D technologies. Most are used for the manufacture of prototype molds, for manufacturing of presentation models, for the production of functional models, visualization, for direct production of tool parts and molds, while not as much for the production of models for casting molds.

Technologies used	Croatia	Poland	Austria	Lithuania
Visualization	3	2	3	2
creating presentation models	5	2	4	3
production of functional models	4	1	6	1
modeling for prototype molds	5	1	8	2
modeling for casting molds	1	0	1	0
direct production of tool parts and molds	0	1	2	1

Figure 5: If not, for which purposes would you use the products made by 3D printing for?

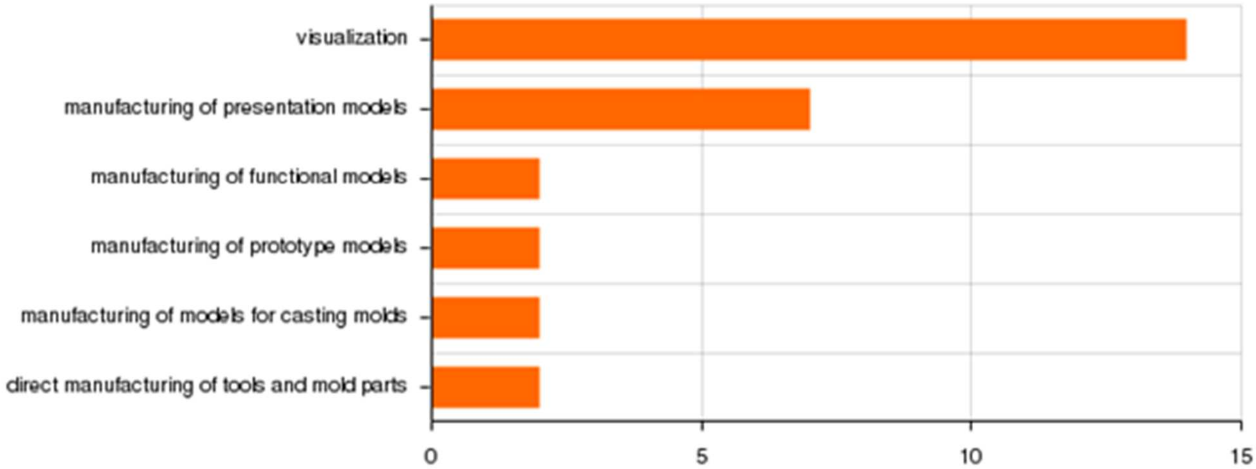

Figure 5

Figure 5 shows what purposes the companies surveyed would use 3D technology for. Most companies would use 3D technology for visualization and for creating presentation models. To a much lesser extent, companies would use 3D technologies to create prototype molds, to create functional models, to directly create tool parts and molds, and finally, models for casting molds.

Technologies used	Croatia	Poland	Lithuania
Visualization	3	6	4
creating presentation models	3	3	1
production of functional models	0	2	0
modeling for prototype molds	1	1	1
modeling for casting molds	1	1	0
direct production of tool parts and molds	0	0	1

Figure 6: Do you intend to invest in the purchase of the 3D printing device within the next year?

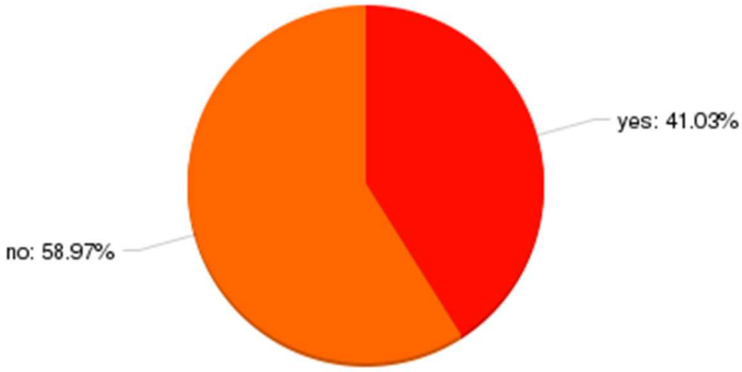

Figure 6

Figure 6 shows whether the companies surveyed intend to invest in 3D technologies within the next year - 41.03% of companies intend to invest in 3D technologies, while 54.97% of companies have no such intention.

Intention	Croatia	Poland	Austria	Lithuania
Yes	8	2	4	3
No	2	9	5	7

Figure 7: Is there a lack of 3D printing specialists in your country?

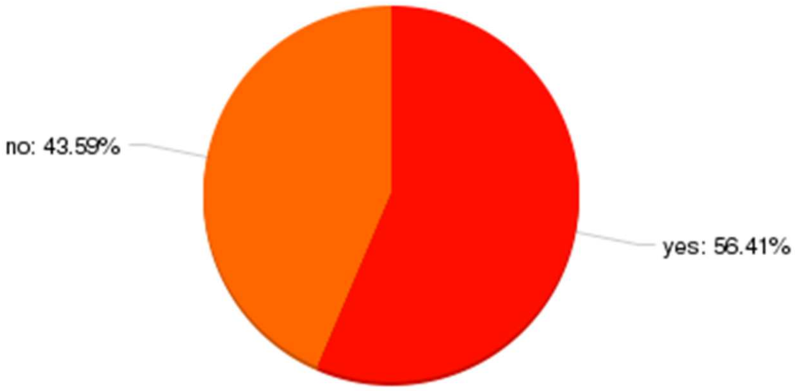

Figure 7

Figure 7 shows a graph where the companies surveyed expressed an opinion on whether there is a lack of 3D technology specialists in their countries. More than half of the companies said they lacked 3D technology specialists in their countries (56.41%), while 43.59% responded that there was no shortage of such professionals in their countries.

Lack	Croatia	Poland	Austria	Lithuania
Yes	9	6	3	4
No	1	5	9	6

Figure 8: Will you have the need to hire a 3D printing specialist in the near future

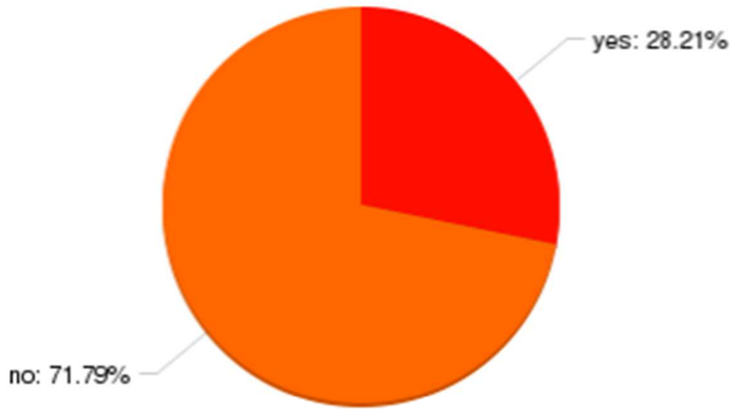

Figure 8

Figure 8 shows how interested companies surveyed are in recruiting professionals skilled in 3D technologies. As many as 71.79% said they would not employ 3D professionals in the next year, while 28.21% said their company was interested in hiring people with that profile.

Need	Croatia	Poland	Austria	Lithuania
Yes	4	2	2	2
No	6	9	7	8

Croatia

In Croatia, 10 companies were surveyed – seven of them are small businesses with up to 10 employees, two are medium sized companies with 10-49 employees, and one is a large company with more than fifty employees. Three companies operate in production, three deal with design and construction, while four companies have indicated that they are engaged in other activities. Six companies declared they use 3D technologies in their work for visualization (3), designing presentation models (5), making functional models (4), making models for prototype molds (5) and making models for casting molds (1). Neither one of the companies surveyed in Croatia uses 3D technology. Companies that do not already use 3D technologies would use 3D technology for visualization (3), designing presentation models (3), making models for prototype molds (1) and making models for casting molds (1). Out of 10 companies surveyed, eight intend to invest in a 3D printing device within the next year. Nine companies believe that Croatia lacks experts in this field, while four companies have expressed interest in hiring a 3D technology expert in the near future.

Poland

In Poland, 11 companies were surveyed – seven of them are small businesses up to 10 employees, three are medium sized with 10-49 employees, and one is a large company with more than fifty employees. Five companies are operating in manufacturing, one is engaged in tool manufacturing, one in designing and constructing, while four companies have indicated that they are engaged in other activities. Only three companies have indicated that they use 3D technologies in their work, and specifically: for visualization (2), making presentation models (2), making functional models (1), making models for prototype molds (1) and making tool parts and molds (1). Neither one of the companies surveyed in Croatia Poland uses 3D technology for creating models for casting molds. Companies that do not use 3D technologies would use 3D technology for visualization (6), designing presentation models (3), making functional models (2), making models for prototype molds (1), and making models for casting molds (1). Out of eleven companies surveyed, only two companies intend to invest in a 3D printing device within the next year. Six companies believe that Poland lacks experts in this field, while two companies have expressed interest in hiring a 3D technology expert in the near future.

Lithuania

In Lithuania, 10 companies were surveyed – six of which are small businesses up to 10 employees, three are medium sized companies with 10-49 employees, and one is a large company with more than fifty employees. Three companies operate in manufacturing, one is dealing with production of tools, and six companies have indicated that they are engaged in other activities. Four companies use 3D technologies in their work for visualization (2), designing presentation models (3), making functional models (1), making models for prototype molds (2) and making tool parts and molds (1). Neither one of companies surveyed in Lithuania uses 3D technology for creating tools and molds. Companies that do not use 3D technologies would use 3D technology for visualization (4), designing presentation models (1), making models for prototype molds (1), and making tool parts and molds (1). Out of 10 companies surveyed, three intend to invest in a 3D printing device within the next year. As many as six companies believe that Lithuania does not lack experts in this field, while only two companies have expressed interest in hiring 3D technology experts in the near future.

Austria

In Austria, 9 companies were surveyed – five of them are small businesses up to 10 employees, and four are large companies, therefore with more than fifty employees. Five companies are operating in design and manufacturing sector, one company produces tools, while three companies have indicated that they are engaged in other activities. All nine companies surveyed indicated that they use 3D technologies in their work for visualization (3), making presentation models (4), making functional models (6), making models for prototype molds (8), making models for casting molds (1), making models for casting molds (1) and making tool parts and molds (2). Out of nine companies surveyed, four companies intend to invest in a 3D printing device within the next year. Six companies believe that Austria does not lack experts in this field, while only two companies have expressed interest in hiring 3D technology experts in the near future.

SUMMARY

The results of the survey showed that 3D technology, one of the greatest technological trends of today, is increasingly used in all branches of human activity from architecture, construction, electrical engineering, mechanical engineering to medicine. Today, 3D technology plays an irreplaceable role in the development of the entire industry. What is very important to mention is that with the help of 3D printers and scanners we can also build prototypes of the model, which significantly speeds up the process which then leads to the final solution, considering that until recently it was a very time-consuming and expensive process. What was once a very expensive technology, today has become available to wider masses. Current problems are the lack of information and communication technology (ICT) specialists. Therefore, there will be an increase of demand for experts in 3D technologies on the labor market. This is why educational institutions need to adapt and further develop their offer, which must be tailor made to fit labor market needs. This project aims to implement 3D technologies in schools so that future generations are ready and up against time with a competitive market and further higher education.