



Executive Agency, Education, Audiovisual and Culture



TECRINO: Teaching Creativity in Engineering

Final Report

Public Part

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Executive Summary

In a dynamic and highly competitive world, knowledge is intrinsically linked to learning and innovation. In this context the TECRINO project assumes that innovation and creativity can be taught. Based on this assumption the overall project aimed to develop the appropriate courseware to improve the awareness of teachers and students in the field of engineering about the mental process and educational techniques required by the concept of "education for creativity".

Unlike the vast majority of other projects dedicated to lifelong education, the TECRINO project attempted not just to develop new skills and competence in the audience, but to produce a major change in the way of thinking about problem solving. The outcomes of this project help the training professionals to improve the transparency, visibility and the development of their students' competences linked to innovation, acquired through informal learning. In this respect the project created a methodology for the design, development and validation through a transnational group of pedagogic itineraries and didactic resources to qualify in valorisation, development and mobilisation of competences linked to innovation (creativity, social and emotional knowledge, work team, leadership, etc.) learned informally.

Driven by the principle that a purely national or regional approach would not provide a comprehensive response to the European problems, TECRINO based on a transnational approach. The project consortium includes eight partners from six European countries coming from the academic, research, VET education and business, all having a rich experience in the field of the Project, and complimentary competences. It combines proficiencies related to information analysis, ICT expertise in the area of education services and e-learning. These competences enabled the consortium to investigate, analyse, develop the appropriate methodologies, and created new educational content, in order to produce tangible results.

Among the tangible results produced we count:

- The TECRINO website www.tecrino-project.eu/
- The analysis of the needs and problems faced by learners and teachers to promote the innovation skills in learning processes.
- The development of the educational content of the course as reusable digital objects in 7 languages (English, Greek, Croatian, Romanian, Polish, Spanish and Portuguese)
- The TECRINO e-learning platform <http://tecrino-project.eu/elearning>
- The creativity assessment tool <http://dev.ugal.ro/creativity/>
- Scientific publications in scholarly journals
- The TECRINO textbook on creativity



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1. Project Objectives

TECRINO main objective was to provide the training professionals (trainers, managers, guiders) with the necessary tools to face the challenges of a new society, defined by the Renewed Lisbon Strategy and the Communication SEC (2008) 3058 "*New skills for new jobs anticipating and matching labour market and skills needs*", in which lifelong learning, constant change and innovation are basic premises both for personal and professional success. With TECRINO courses the training professionals have the opportunity to develop the competences linked to innovation in their daily work with their students. On the other hand, learners and students have the opportunity to develop all the competences linked to innovation and creativity. These competences are the ones that will allow them to obtain new and better professional opportunities and improve their situation in the labour market.

Considering these facts, the TECRINO project aimed to:

- Analyse the needs and problems faced by students and teachers linked innovation and creativity skills in learning processes.
- Approach the problem of the education for creativity from both the perspective of tutors and students.
- Focus on the understanding of the mental process that lead to creativity.
- Create a comprehensive educational content, covering all known methods for enhancing creativity, and making it freely available in seven European languages.
- Deliver the courses for tutors and students in face to face and e-learning sessions.
- Develop a creativity assessment tool.

TECRINO determines that "Competences for Innovation" and "Constructivism" are key concepts in the objectives and in the pedagogic model to implement. Based on the transnational consortium research was carried out for the identification of the needs of the target audience, the definition of the learning objectives and course content and sequence. In this context, the project partners organised focus groups and interviews with all the target groups involved in the project in order to identify and analyse the needs, trends and problems linked to innovation promotion in the VET context.

TECRINO main objective was to develop a training tool allowing improving, fitting and encouraging the development of innovation in learning processes. TECRINO e-learning platform is accessible online at <http://tecrino-project.eu/elearning>, allowing all stakeholders to promote innovation and creative solutions of problems in VET environment. In order to develop this platform partners were in close collaboration with the two main target groups the teachers and students in the field of engineering. From the beginning of the project partners developed a strategy on how to reach the two target groups and how to establish communication channels to increase their active participation in the project. For TECRINO, the active participation of target groups was the key aspect that ensured the suitability of the e-learning platform and TECRINO tools.

2. Project Approach

TECRINO project brought together European public and private institutes, universities and SMEs on a project that, for the first time, used a common working model to conduct research on the topic of creativity as a mental way of thinking. During the kick-off meeting a long discussion was held around creativity and innovation. All partners agreed that tools for fostering creativity and innovation are needed that focus on individuals within modernized, excellent and high quality VET systems. Moreover, it was agreed that the main objective for the education development is to match the requirements of the labour market. To make this possible, it is necessary to develop innovative teaching tools that can be implemented within traditional education systems at Universities or on any other level of education. To save time, costs and make education more available for students, e-learning tools should be used in learning processes. In this context the TECRINO assumed that innovation and creativity can be taught, and developed appropriate courseware for improving the awareness of teachers and students about the mental processes and educational techniques required by the concept of “education for creativity”.

From the beginning of the project all partners were informed about the project’s technical and dissemination planning strategies. All work-package leaders developed clear guidelines and tasks which were then included in the project’s Task Planning Document. A quality assurance plan was proposed at the kick off meeting with indicators for monitoring and evaluating the quality of the project which was served as guidelines for all partners. Another important document prepared at the beginning of the project was the dissemination planning document. Within this document the main target groups were identified and the communication channels chosen were set. In addition within this document all the objectives to be achieved through dissemination were highlighted and addressed.

In order to meet the research objectives set in WP2: Research on trends and processes to promote innovation in VET processes, the research methodology and approach was outlined by the WP leader. The research undertaken for the state of art recognition showed that there have been big gaps and needs concerning innovation in VET processes. Teachers and students were contacted in order to participate in focus groups organised by all partner organisations and to answer structured questionnaires concerning innovation. The fruitful discussion with students and teachers identifies gaps in existing training provisions as well as suggestions for improving current courses by making use of skills and knowledge defined. The results of the analysis lead to the definition of the training programme and its subsequent testing.

During WP3: Content definition, partners defined the content and the structure of the courseware deliver to both teachers and students in both formal and non-formal system. The content definition and requirements were drafted and circulated to partners in the planned timeframe. The e-learning platform proposed is Moodle platform, an Open Source Course Management System also known as a Learning Management System (LMS). The Moodle platform was installed on TECRINO website server and it can be found at <http://tecrino-project.eu/elearning>. The structure of the e-learning platform was adapted to the methodology and results of WP3. The LMS was continuously reviewed, revised, upgraded and developed throughout the lifetime of TECRINO as a result of continuous feedback from the participants concerning its structure, design, usability and stakeholder’s requirements. This took place during the installation of the platform and subsequently as the courseware were drafted and piloted.

The design of the TECRINO courses followed the generic ADDIE model (Analysis, Design, Development, Implementation and Evaluation). The educational courses were organised according to principles of SCROM, and installed on a Moodle e-learning platform. These training courses are available as open access learning materials in English, Greek, Spanish, Portuguese, Romanian, Polish and Croatian. The TECRINO courses can be found at <http://tecrino-project.eu/elearning>. The research undertaken in WP2 showed that there are not so many accepted tools for assessing the levels of creativity. In this context the TECRINO developed a creativity assessment tool as a result of selecting and adapting one of the existing divergent thinking test. The test can be found at <http://dev.ugal.ro/creativity/>.

TECRINO and its results are directly addresses the objective of creating the educational resources for teaching creativity on a large scale. The project introduces new tools, usable in formal and non-formal education, aimed to increase the awareness of teachers and students on the cognitive processes and social communication that enable innovation. All training materials as well as trainings developed and conducted in line with Vocational Competence Certificate system (VCC) which is compliance with European Union strategy and European Qualification Framework.

The quality assurance and the certification process as part of WP6 had the objective of establishing an internal operational framework which allows maximum flexibility while maintaining a clear distinction of roles and responsibilities of all partners involved. The monitoring and assessment process took into consideration:

- the project in its whole
- the implementation phase including innovation developed
- the impact of the ICT tools and contents developed on the target groups

The project website was launched in February 2014 and can be found at www.tecrino-project.eu/. The website evolved into a comprehensive dissemination and exploitation tool. The TECRINO website is the entry point to the project and has a dual function: first, it contains information on the project objectives anyone who is interested in the project and second, it offers access to the e-learning platform upon registration.

Various news and social media editorial articles distributes throughout the project. Raise awareness of the project to both the direct target group of trainers and students in engineering and creative industries and also the wider group of stakeholders in the non-formal learning sector.

The transfer of the project results as well as their sustainability has been also ensured through the following actions:

- TECRINO courses will be offered as an online courses through the learning platforms of University of Galati, University of Zagreb, University of Sevilla, University of Huelva, Open University of Cyprus, Cyprus University of Technology and as an offline courses through seminars organised by the Cyprus Human Resource Development Authority.
- TECRINO authors Dr Bihar and Dr Susnea are regularly invited as a keynote speakers on many workshops and are expected to promote the TECRINO courses.
- TECRINO course will be promoted via the Enterprise Europe Network and other business networks such as BNI and SMEs forums.
- TECRINO courses will be promoted to the Open Community Universities and to VET providers.

3. Project Outcomes & Results

TECRINO has met its key objectives and produced the results that were anticipated at the start of the project. **Table 1** lists the main project results.

D	Title	Description	Nature
1.1	Task Planning Document	The task planning document is a document in which the distribution of tasks among the partners, the work programme and the time schedule are described in a clear way. It includes a clear enumeration of the tasks of each partner, the deadlines for each task, a list of all the tasks of the project by starting date, a list of all the deliverables of the project by delivery date etc. It also includes the communication plan (communication flows, communication procedures etc.) This document serves as a guide during the development of the project since it is used for the monitoring of the work progress and monitoring of the tasks that have to be done by all the partners.	Report
2.1	European Report on the trends and performance proposal to facilitate the promotion and development of innovation in VET processes	This report summarizes and analyses comparatively the findings of the national reports from each partner country.	Report
3.1	Technical requirements for the content definition and realization	Report on the technical aspects such as educational model definition with detail description, LMS (Learning Management System) requirements and definition of meta data content description according to Accessible instructional materials (AIM) standards.	Report
3.2	Content definition	Report on the selection of content of educational materials	Report
3.3	Definition of program for tutors and face to face teachers	Report on the program for tutors, the selection of the teaching materials for tutors (online and offline tutoring).	Report
3.4	Review parameters definition	Report on the parameters reviewing plan.	Report
4.1	Report covering the technical requirements for the content definition	The Report covers the technical requirements for the content	Report
4.2	TECRINO	The e-learning platform is Moodle, an Open Source	Product

	eLearning Platform	Course Management System (CMS)	
4.4	Report describing the learning program for tutors and face to face teachers together with a description of the teaching materials	The report describes the learning program for tutors and face to face teachers together with a description of the teaching materials.	Report
4.6	Operation Guide for the platform (for teachers and students)	This document is a Guide that explain how a teacher or a student can use the platform.	Report
5.1	Tutor's manual	The tutor's manual focuses on explaining, from a didactic perspective, the basic psychological mechanisms of creative thinking. It contains a detailed description of the aims of the lessons and exercises included in the main course for students, as well as a brief description of the e-learning tools.	Report
5.2/ 5.3	Courseware for students	Learning material in EN/ EL/ PO/PT/ RO/ ES/ HR	Product
5.4	Creativity assessment tools	A tool for assessing the levels of creativity	Product
6.4	Vocational Competence Certificate Guidelines	Vocational Competence Certificate Guidelines - gathers all rules published by VCC Institute to accredit the training material, develop online examination system to assure the highest quality of the project.	Report
7.1	Project website	The project's website operates throughout the entire implementation period of the project and will be updated at least monthly.	Product
7.2	Promotional materials, written or video materials	Newsletters, Press Releases, Brochure, CD-ROM, textbook on creativity, scientific papers	Product
8.2	Exploitation agreement	Agreement (signed from all partners) on issues regarding the intellectual property and post-project exploitation results.	Report

Table 1: List of Deliverables produced.

4. Partnerships

The TECRINO project brought together a consortium of eight partners with a wide range of VET experience and IT sectors from six European countries. Five of the partners were experienced in European funded projects with the Lifelong Learning Program which provided further benefits with regard to project management, quality, execution, evaluation and dissemination. Although each partner was given responsibility to perform a range of tasks, certain partner were selected because of their expertise in national level qualifications in the academic sector and were therefore tasked to perform specific roles based on that expertise.

RTD Talos Ltd was established in 2000. Ever since the company has strategically positioned itself between the academia, SME' and the government, benefiting from dissemination and training most importantly. Previous experience in the area under investigation, in EU level can be illustrated by a number of projects RTD Talos Ltd has taken part. Having been the National Point of Contact for SME's in FP5 and FP6 we have acquired significant experience in disseminating information regarding European programmes. RTD Talos has been involved in a number of Leonardo da Vinci projects, a full list of them as well as the services of the organization can be found at www.talos-rtd.com. In TECRINO project RTD Talos (P1) was responsible for the overall management of the project.

The **University of Zagreb** (UniZg) is the oldest Croatian university and also the oldest university in South East Europe was officially founded 23 September 1669 by Emperor and King Leopold I Habsburg. According to decree granting the status and privileges of a university the study of philosophy in Zagreb acquired a formal and legal status as *Neoacademia Zagrabensis* and officially became a public institution of higher education. UniZg now consists of 29 faculties, three art academies and the Centre for Croatian Studies and at number of university study programs study about 50 000 students. UniZg is a strongly research-oriented institution, contributing with over 50 percent to the total research output of the country. University of Zagreb has been the coordinator of the number of the EU projects and has the experience in their management. University of Zagreb is member of Rector's Conferences of the Danube Region, UNICA and Coimbra Group. In TECRINO project the University of Zagreb (P2) was the WP3 leader. (WP3-Content definition)

The University "Dunarea de Jos" of Galati, Romania – UDJG is a higher education institution, the most important in the South-East area of Romania. UDJG offers study programs from bachelor to PhD in engineering, and social sciences, through seventeen faculties that provide a wide range of undergraduate and graduate programs for over 17,000 enrolled students. Providing Continued education is also a major mission of the University. Specific post-graduate programs are also available for employees, job-seekers or other persons willing to acquire new skills in order to become more competitive on the labor market. UDJG is coordinator or partner in many national and European research or educational projects including Socrates/Erasmus, PHARE and Leonardo da Vinci. In TECRINO project the UDJG (P3) was responsible for the development of the educational content (WP5 Leader).

SYNTEA S.A. provides comprehensive educational and consulting support in the field of information technologies and related (business, vocational, language) competences for individuals as well as for companies, public institutions and education sector. The company

provides the following services which support the entire process of formal education competency and the "learning for life" strategy: 1) the trainings and certification of competences adapted to the needs of specific target groups that meet global standards in education and labour market. 2) internships and placements, implemented in Poland and abroad, both for students and adults. With an extensive partner's network Syntea organizes placements in companies with high growth potential and a high degree of innovation. 3) Employment consulting. All our activities are focused on our main goal which is proving highly skilled and qualified personnel. Moreover we help our Clients to obtaining the satisfactory educational employment. The company monitors the labour market changes and cooperates with labour market institutions and employers not only polish, but also from other European countries. By supporting the development of a new model of training and certification in the area of vocational competencies VCC, Syntea launches out the promotion of validation the standard of professional qualifications and increase mobility. In TECRINO project Syntea (P4) was the WP6 Leader. (WP6-Quality assurance and certification process).

Epralima Vocational Training School was incorporated by public a deed on January 7th, 1999, with promoting institutions that are deeply solidified within the social, economic, cultural and local levels, namely, the Municipal Councils of Arcos de Valdevez and Ponte da Barca, the Northwestern Agricultural Mutual Credit Bank, the Commercial and Industrial Association of Arcos de Valdevez and Ponte da Barca, Artelima_Alto Lima's Academy of Arts and the Arcuense Heritage Study Group, based on a cooperative regime, which defined the Lima Valley as its geographical area of influence. It is a Private and Cooperative School, which focuses on vocational education, while offering Youth Education Training Courses, Adult Education Training Courses, and Specialized Technology Level V Courses (Post-secondary Training, not University Courses). In TECRINO project Epralima (P5) was the dissemination leader. (WP7-Leader)

Inercia Digital S.L. is a young company, established in 2010 in Andalucía (Spain) which provides e-learning. Inercia Digital offers specialized training of e-business with more than 15 courses in the areas of marketing in internet, online entrepreneurship, e-commerce and SME 2.0.

The company Inercia Digital is eLearning experts in online training courses. We developed educational platforms and all online content for the delivery of online training courses. These courses and e-learning platform are been certified and approved by the Andalucía regional public service (Andalusian Employment Service-SAE). In TECRINO project, Inercia Digital (P6) was responsible for the project's website and the e-learning platform (WP4 Leader).

FONDO FORMACION EUSKADI S.L.L. (FFE) is a human capital organization whose mission is the development of people and improvement of organizations. Nowadays, FFE has about 160 professional workers (25 worker partners, 30 management and administration professionals, 110 trainers) with different profiles. Activity areas: occupational and continuous vocational training, consultancy and advisory to companies, management by competences, selection and evaluation of human resources, employment training plans, local development projects, professional guidance and advisory and support to learning. FFE has a wide experience as a coordinator of transnational cooperation projects for the research, development and innovation in the improvement of competences: Leonardo II (Automove II, Navaltech, EVA, Diprocu, Matrifer, Automove I, Competences in knowledge society-CKS, TRAINING LINKS for SME, Chemitech, Agora, Ecotrama, Metalcert) Socrates (Tools, Tools Training, SPPAE, Namal) e learning (ELIFO) EquAL. In

TECRINO project FFE (P7) was the leader of the research in WP2. (WP2: Research on trends and processes to promote innovation in VET processes).

The Business Innovation Centre of Croatia – **HAMAC BICRO Ltd.** was established by the Government of the Republic of Croatia in 1998 for the purpose of implementing the Government's incentive program for technological development and is the main institution for the development and advancement of the innovation and technology system.

The ability to transform scientific results into successful commercial products is of key importance for the future economic development of our country. The Ministry of Science, Education and Sport has initiated the Croatian Science and Technology Project (STP) providing incentives to Croatian industry through various programs whose purpose is to modernize the system of science, improve scientific infrastructure, encourage academic entrepreneurship and develop a environment for development and growth of knowledge-based companies. In 2010 by the Government directive a new innovation agency has been established. This directive was amended in 2012 in 2012 by merging BICRO and Croatian Institute of Technology (HIT) into one Business Innovation Agency of the Republic of Croatia – BICRO. The main reason for merger was to ensure the efficient investments in areas of research, development and innovation. The Agency is now a central institution in the National Innovation System for supporting innovation and technology advancement. In TECRINO project Bicro (P8) was responsible for the sustainability and exploitation of the project's results. (WP8 Leader).

5. Plans for the Future

The products developed within the project in terms of tools, training materials, as well as the feedback received during the events of dissemination and during the pilot phase are a clear sign of the high interest and quality achieved both locally and internationally.

It is therefore the intention of the partners to strengthen future exploitation of results first of all using the tools that are already available such as the website, the e-learning platform and the creativity assessment tool. Also the partners will promote the results of the project to forthcoming conferences and events that are planned every year.

The TECRINO products will also be promoted through Universities and National Authorities such as the Cyprus Human Resource and Development Authority. At local level the exploitation of the results by partners, in association with those organisations who have supported the project activities, can be conducted as follow:

- Creation and implementation of training courses for students and teachers based on the courses developed by TECRINO project.
- Update of academic programmes through the introduction of innovative contents/ or the adaption of the whole courseware developed by the project.

The existing website will be therefore maintained and implemented with news related to TECRINO project.

An exploitation agreement has been signed from all partners on issues regarding the intellectual property and post-project exploitation results. This agreement describes the terms and conditions based on which partners define their role in the post-project period for promoting the e-learning platform nationally or cross-nationally. The exploitation of results agreement covers aspects like the identification of the market and pre-agreements with potential users.

6. Contribution to EU policies

For the creation and elaboration of this project, we have been inspired by the Europe 2020 strategy where it is stressed that *“E&T systems should focus their curricula on creativity, innovation and entrepreneurship. In order to fulfill its role, vocational education and training has to reflect changes in the economy and in society. A vision of fostering creativity and innovation is needed that focuses on individuals within modernized, excellent and high quality VET systems. VET providers, in partnership with authorities and enterprises, should foster creativity and an innovation-conducive framework which encourages risk-taking and experimentation”* (A new impetus for European cooperation in Vocational Education and Training to support the Europe 2020 strategy - Brussels, 9.6.2010 COM(2010) 296 final”.

The project, by its nature, attracts a diverse range of interest and consequently, the application of a number of relevant EU policies.

Educational and Training 2020 Work Program

- Ensuring that the educational experience provided will be attractive and relevant. Student-centered activities which are highly interactive and involve a lot of external input are greatly appreciated by students.
- Creating an open learning environment where young people are free to pursue their education and personal development in creative ways.

The **Helsinki Communiqué on Enhanced European Cooperation in Vocational Education and Training (2006)** states that the education and training systems of the Member-States should focus on improving its attractiveness, image and prestige, which can be enhanced through an increase in vocational guidance devices, connecting training facilities with employers, greater qualification of educational agents, in addition to reinforcing partnership practices and cooperation. Through this, and considering the certainty of the predominant role of the educational and training agents to improve the attractiveness and quality of training systems, TECRINO project gives an important contribution in the sense that it relies on the upgrade the qualifications as an action strategy. The issues relating to education and training have taken on a new focal point in public policy, in favour of the promotion of employability by the high qualified workforce. Currently, taking into account the new challenges posed by the economic downturn that Europe faces, the Agenda for New Skills for New Jobs, will have a decisive role in increasing employability, both quantitatively and qualitatively. In a dynamic and highly competitive world, knowledge is intrinsically linked to learning and innovation.

In this regard, the main objective for the education development is to match the requirements of the labour market. To make this possible, it is necessary to develop innovative teaching tools that can be implemented within traditional education systems at Universities or on any other level of education. To save time, costs and make education more available for students, new e-learning tools should be invented. In this context, the TECRINO project was based on the Community principles, since its central objective was the improvement of the educational performance. It assumed that innovation and creativity can be taught, and aims to develop appropriate courseware for improving the awareness of teachers and students about the mental processes and educational techniques required by the concept of “education for creativity”.

As stated in the Communication from the Commission “**Rethinking Education: Investing in skills for better socio-economic outcomes**” (Strasbourg, 20.11.2012 COM (2012) 669) “*Modern, knowledge-based economies require people with higher and more relevant skills. Transversal skills such as the ability to think critically, take initiative, problem solve and work collaboratively will prepare individuals for today's varied and unpredictable career paths*”. Based on the above statement and driven by the concept that innovation and creativity can be taught the TECRINO project aimed to foster these skills through new and creative ways of teaching and learning. At the same time the demand for a qualified workforce in technology and research intensive sectors is and will remain at a high level, with an impact on the demand for science, technology, engineering and mathematics (STEM) related skills targeted investment in VET, namely initial and continuous training, is vital for innovation, growth and competitiveness

Agenda for new skills and job's initiative

- Improve the identification of training needs: through activities and consultation with target user groups, shortcomings in training provision has been identified. The identification reflects the interests and challenges of different target groups thus enhancing the approach of mutual cooperation for needs recognition.
- Move towards learning outcome-based qualification systems: the training programme was built around specific learning outcomes and units granting major flexibility to the qualification systems

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- To help promote creativity, competitiveness, employability and the growth of an entrepreneurial spirit. Through this project, several students from VET as well as academic schools have already gained skills, which cut horizontally across all industries and vertically across all jobs.

Strategic Framework for European Cooperation in Education and Training

- Develop qualifications linked to European Qualification Framework: in line with the descriptors of the EQF, the qualification was built around a set of knowledge, competences and skills. Moreover the qualification has been assessed against the levels established by the EQF.
- Modernize curricula: the training program took into consideration needs and expectations thus offering a range of knowledge that are in step with the market evolutions.

Credit system for Vocational Education and Training (ECVET)

- Describe qualifications in terms of units of learning outcomes: the project provided for learning outcomes-based program in order to facilitate credits allocation and effective assessment of results in line with the ECVET standard.

