

Teaching creativity in engineering

TECRINO

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WP3 Report 3.2. Content definition

3.2.1. Introduction

In WP3, reports a set of actions are reported in relation to the content definition, covering the technical aspects and the methodology based on which content will be defined, organised and maintained. It also covers the definition of the required materials for the tutor and teacher education.

In report **Content definition** from wide professional field Innovation and Creativity chapters from the TRIZ theory, lateral thinking along with other techniques to stimulate creativity for the Tecrino course are selected. Topics included in the course are covering scientific approach to innovation and creativity and are supported by introduction to management of innovative solutions.

Content of educational materials is divided into modules and lessons based on tools and procedures justified from the methodological point of view for a systematic approach through invention process. Places and ways of assessment are defined.

In preparation of this report major contribution was from The "Dunarea de Jos" University of Galati, Syntea SA and University of Zagreb with comments of others partners.

3.2.2. Content organisation

Content of the Tecrino course includes chapters from TRIZ theory, lateral thinking along with other techniques to stimulate creativity covering scientific approach to innovation and creativity and will be supported by introduction to management of innovative solutions.

Content of educational materials is divided into 7 chapters and lessons based on tools and procedures justified from the methodological point of view for a systematic approach through invention process.

Chapter 1. Understand and recognize creativity in creative products

In this chapter the proposed definition of creativity is : “creativity is the capacity to generate ideas that are simultaneously novel (original) and useful”. With this definition for the creativity, focus is on analysing several creative products with the aim to uncover and emphasize what makes them creative.

- 1.1. Main concepts related to creativity, as well as the main theoretical approaches used for explaining the creativity.
- 1.2. This chapter contains a number of exercises consisting in images and/or texts and asking the students to recognize the elements of creativity.
- 1.3. Why is creativity important?
- 1.4. Could be creativity learned?
- 1.5. Creativity as a SoftSkill.

Chapter 2. Recognize creative persons and assess your own creativity

This chapter explores creative persons. With starting idea that “the best way to have a good idea is to have a lot of ideas”, it could be defined – in a first approximation – a creative person as someone capable to produce a large number of ideas on a given topic.

Once creative person is identified, how creative they are? Is there any connection between creativity and IQ? How can we assess our own creativity?

- 2.1. The main traits of creative persons.

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- 2.2. The concept of divergent thinking.
- 2.3. Overview of the key factors influencing the creativity in education.

Chapter 3. Simple techniques to stimulate creativity.

Creativity is not a natural process and creative thinking is different from normal thinking in many aspects. Several popular methods to stimulate creative thinking at individual or group level: the six thinking hats technique, brainstorming, SCAMPER, PO (Provocative Operation), attribute listing, etc. are presented.

- 3.1. The techniques for stimulating the creative thinking
- 3.2. Brainstorming, attribute listing, SCAMPER, lateral thinking, serendipity, etc.

Chapter 4. The TRIZ/TIPS fundamentals (Теория Решения Изобретательских Задач)/(Theory of Inventive Problem Solving)

This chapter is a synthetic and simplified presentation of the main ideas of TRIZ along with several examples and exercises.

Based on discovery that the creative ideas found in a large database with patent applications follow surprisingly stable patterns of evolution, Genrich Altshuller, a consultant of the Patent Office of the Soviet Navy, developed ТРИЗ/TIPS.

According to TRIZ, all technical systems can be reduced to a simple model wherein a *tool* takes substance and energy from the environment and uses them to exert a certain *action* on an *object*.

TRIZ, postulates that all the material systems are in a dynamic equilibrium resulting from the interaction of opposite elements. In the context of TRIZ, contradictions are either conflictual requirements regarding a certain parameter (these are called “physical” or inherent contradictions), or conflicts generated when the requirement to adjust one parameter produces unacceptable negative effects on other parameters of the system (these are called “technical contradictions”).

Altshuller constructed contradiction matrix that involve pairs of parameters or features interlinked so that when one is improved, the other degrades.

For each contradiction, Altshuller suggests several “recipes” of possible solutions.

- 4.1. What is TRIZ (history, organizational principles and applications)
- 4.2. ARIZ approach
- 4.3. Altshullers principles
- 4.4. Contradiction matrix

Chapter 5 Individual and group creativity software tools

As compounds of images and texts, the mind maps require the participation of both brain hemispheres, and combine detail oriented analytical thinking of the left-brain, with the holistic, intuitive thinking style, specific to right brain. As a result, mind maps are simple, yet powerful instruments to foster creativity. According to research systematic use of video games (regardless of their type and complexity) correlates with an increased creativity.

- 5.1. Mind mapping, creative games etc.

Chapter 6 Intellectual property (IP)

Innovation and creativity, when properly exercised, increase intangible asset to company. Corporate intellectual property (IP); items such as patents, trademarks, copyrights, business methodologies i.e. trade secrets; goodwill and brand recognition are all common intangible assets in today's marketplace.

- 6.1. Intellectual property in general

Chapter 7 From idea to protection

Two important classes of intellectual properties exist. One for which applicant should apply to obtain protection are patents, trademarks, designs, topography of semiconductor products, geographical indications and appellations of origin. Another category contains copyright and related rights where the creator of such IP should only establish or declare the link with creation, i.e. to declare authorship - and the date of creation if possible. By definition, trade secret is another form of IP rights that is not protected via filing before the patent offices.

- 7.1. Patents, trademark protection, design protection, trade secret and copyright linked properties.
- 7.2. Tools to check
- 7.3. Cost / Effectiveness approach to IP protection
- 7.4. Disadvantages
- 7.5. And the wisest err

Chapter 8 Glossary

Professional terminology glossary and a literature (links) will be developed as separate chapters.

3.2.3. Chapter organisation

Each chapter will start with Introduction (presenting specific goals/objectives to be attained) and ends with a Summary (e.g. specific information on completing a given module).

All chapters will be supported by multimedia contents, mostly as a links to online resources.

Course will have questions/tasks for selfassessment.

3.2.4. Realization scenario

Realization scenario will follow procedure for developing e-learning courses within the Vocational Competence Certificate (VCC) - system of education and certification. The VCC ideas are in accordance with strategic documents and directives in the European Union within the vocational range of education. The VCC is based on strategic documents such as the European Credit System for Vocational Education, the European Professional Card (implemented by the European Commission to give employees the same level of rights in all EU Countries and the European Qualifications Framework. The separation between the education process and education results, implemented in the VCC structure, is in accordance with the ISO17000-024.

Content will be evaluated on peer/review basis by competent authorities in the field. Considering the multidisciplinary content approach, a group of reviewers should be organized. Methodological review of e-learning scenario should be provided.

Course realization will be organized in three steps; first mock-up of screen will be made with general layout of all elements recurring throughout the course. They must include elements such as logo, colour scheme and related images. As a second step, a working prototype will be developed including all types of slides/screens used in the course as well as all file formats and course interactions that are planned to be used. The prototype needs to be fully functional including test questions that pass SCORM parameters to the platform.

Finally once the prototype has been accepted, production of modules/lessons will start.