

Teaching creativity in engineering

TECRINO

538710-LLP-1-2013-1-CY-LEONARDO-LMP

LEONARDO DA VINCI Multilateral Projects for Development of Innovation

**WP3 Report 3.5. _V2
Content updating program**

3.5.1. 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 updating program** planning and its realisation of updating is presented.

Project evaluation results and comments have provided data for content update, as well as suggestion for course revision.

Plan include selection of content modules revisions and ways of its realization.

In preparation of this report major contribution was from The "Dunarea de Jos" University of Galati, Syntea SA, Inercia Digital S.L., Fondo Formación Euskadi and University of Zagreb with comments of others partners.

3.5.2. Content organization revisions

During development, Tecrino course was regularly updated according to reviewers recommendations.

Starting from a first version Content changed through more steps to it's final version.

Courses on intellectual property protection

Chapter 1. Recognizing Creativity

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.

Some researchers believe that the most important aspect in the study of creativity is *the creative person*, and describe several important traits thereof: having extensive domain knowledge, a strong (intrinsic) motivation, and some special creative thinking skills.

Other researchers focus on *the creative product*, which should be simultaneously novel (original), and useful.

In another approach, the central element is *the creative process*, which is seen in some cases as a linear sequence of phases (preparation, incubation, illumination, and evaluation), or may be an iterative process wherein the creative person or group is prompted to generate as many ideas as possible, but only the ideas that match specific selection criteria are retained (just like in the Darwinian model of the evolution).

Further studies emphasize the importance of the environment on the outcome of the creative process, argue that this should be non-prescriptive, simulative, and – if possible – offer access to specific ICT instruments to facilitate the idea exchange. These 4 facets of the creativity have been called – for didactic reasons – “the 4 P’s of creativity (Person, Product, Process, and Place).

1.1. The blind men, the elephant, and the creativity

1.2. What makes creative products be creative

1.3. Exercises

Chapter 2. Creative Persons

This chapter explores creative persons. We should first try to answer another question: “How do you recognize Leonardo da Vinci, and – in general – how do you recognize a creative person?”

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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.

This is equivalent to saying that creative persons are those capable of *divergent thinking*. Divergent thinking is spontaneous, nonlinear, based on free associations and – apparently – random

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

Obviously, divergent thinking is not the only exterior sign of creativity. The intelligence, measured with the famous IQ index is not necessarily a sign of creativity.

This is the core idea of the most famous and widely used test for the assessment of creativity, the TTCT (Torrance Test of Creative Thinking).

- 2.1. ***What do you say when you meet Leonardo da Vinci?***
- 2.2. ***Beyond “right” and “wrong”***
- 2.3. ***Exercises***

Chapter 3. On Creative Thinking

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.

Edward de Bono proposed a technique called PO (**P**rovocative **O**peration), which aims to stimulate creative thinking exactly by temporarily focusing on absurd or exaggerated ideas. There is also a name for these happy findings: serendipity.

Obviously, learning these and other heuristics will not turn you overnight into little creative geniuses,

- 3.1. **Introduction**
- 3.2. **What is opposite to creative thinking?**
- 3.3. **How NOT to be creative?**
- 3.4. **What if we could change our thinking style like hats?**
- 3.5. **Further challenges to Logic**
- 3.6. **SCAMPER – The metamorphose of ideas**
- 3.7. **What happens when you invite the accountant into brainstorming?**
- 3.8. **Exercises**

Chapter 4. TRIZ – Towards systematic creativity

This chapter is a synthetic and simplified presentation of the main ideas of TRIZ along with several examples and exercises. “Systematic creativity” may seem a contradiction in terms, the idea is of extracting the patterns of thinking and the methods used by tens of thousands inventors, and make all this available in an easy to use knowledge base.

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, which involve pairs of parameters or features interlinked so that when one is improved, the other degrades. Such examples are far more frequent in practice, and at the first sight, they cannot be treated uniformly.

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

4.1. Introduction

4.2. Basic concepts of TRIZ

4.3. Methods to eliminate the contradictions in TRIZ

4.3.1. Eliminating physical contradictions

4.3.2. Eliminating technical contradictions. The contradiction matrix

4.4. Patterns of evolution

4.5. Can TRIZ be used to solve non-technical problems?

4.6. Conclusions

4.8. Exercises

Chapter 5. The material dimension of creativity

The influence of the environment on creativity is important and an “ideal environment” is capable to stimulate the creative behaviour.

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.

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According to research systematic use of video games (regardless of their type and complexity) correlates with an increased creativity.

5.1. Place

5.2. Innovation Laboratories (iLabs)

5.3. Creative toys

5.4. Software tools to stimulate creativity

5.4.1. Mind mapping software

5.5. Exercises

Chapter 6. Intellectual property protection

This chapter is formed only for the educational purpose and cannot serve as a guide for obtaining any kind of legal IP protection, or advice how to start the protection. The registered patent attorney for help having in mind that the errors are extremely costly and dangerous for the business.

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.

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

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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, patent is a set of exclusive rights granted by a sovereign state to an inventor or assignee for a limited period in exchange for detailed public disclosure of an invention.

By definition, trade secret is another form of IP rights that is not protected via filing before the patent offices.

- 6.1. Preface**
- 6.2. Intellectual property behind the innovation and creativity**
- 6.3. Patent, design, trademark, copyright, trade secret... what to choose?**
- 6.4. Patent protection**
 - 6.4.1. Novelty and inventive step**
 - 6.4.2. Patent application and filing strategy**
- 6.5. Design protection**
 - 6.5.1. Filing strategy**
- 6.6. Trademark protection**
 - 6.6.1. Filing strategy**
- 6.7. Copyright**
- 6.8. Trade secret**

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6.9. Conclusion



3.5.3. Methodical review recommendations

Methodical review was also provided and following recommendations have been provided



- To reduce the graphics resolution to remove the horizontal scroll bar. It does not look good even at high resolutions.
- To change structure of the introduction. Suggestion is to stick the list of chapters with links leading to them. Page: (<http://tecrino-project.eu/elearning/mod/page/view.php?id=25>)
- In Glossary to put links to the "See also: ..." the words. Pictures little to reduce so the horizontal scroll bar does not appear.
- For each of the SCORM course:
 - The proposal is to open the "pop-up" in order to avoid the opening of the left blocks that take a large portion of the screen.
 - All images slightly reduce that does not display a horizontal slider.
- Inside SCORM and when selecting the last link in the list of chapters, the whole SCORM package is a little slower to open and close all the choices on the left side.

3.5.4. Face to face course review recommendations

After face-to-face course test implementation, tutors and students have provided project evaluation. Comments and opinions were by a margin positive. It could be underlined objections from students to have more exercises, but this could be corrected in the course implementation.

3.5.5. Tutors and teachers course review recommendations

In its final version tutors is composed of two manuals, first one for Course content and other one with technical details.