

Could creativity be taught and evaluated in a nuclear engineering course?

Kevin Fernández-Cosials

Gonzalo Jiménez

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"The ability of generating ideas or products that are new, appropriate and that have impact"

Creativity = Intelligence ?

Creativity = Personality ?

Creativity is



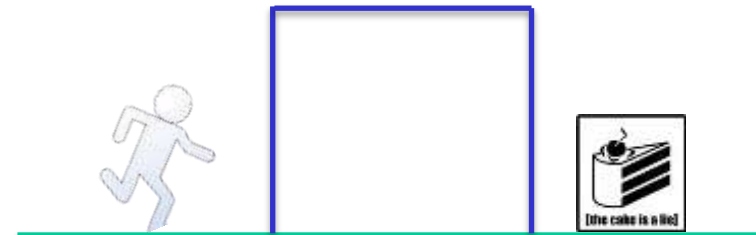
or learned.

How do people teach or train creativity?

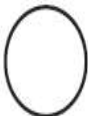



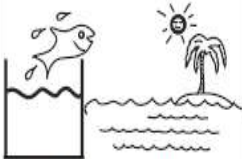

- Making specific exercises and training.

- Teaching creatively (sneaking creative exercises as technical exercises)

¿How can this person take the cake?



Evaluation Method: **Torrance Test of Creative Thinking**

Torrance Test	Starting Shapes	Completed Drawing	
		More Creative	Less Creative
<p>In a standardized Torrance Test of Creative Thinking, subjects are given simple shapes (<i>left column</i>) and are asked to use them (<i>top row</i>) or combine them (<i>middle row</i>) in a picture or to complete a partial picture (<i>bottom row</i>). Evaluators judge whether the results are more or less creative.</p>	Use	 Mickey Mouse	 Chain
	Combine	 King	 Face
	Complete	 A fish on vacation	 Pot

TTCT → Consensual Assessment Technique

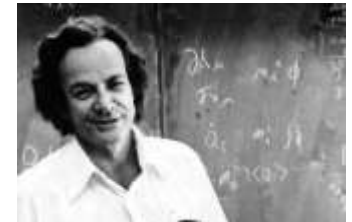
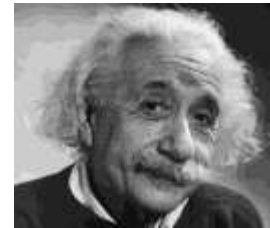
Several methods invented to save time.

Evaluation Method: **Interview**

Common characteristics among creative people:

- ☐ Introversion
- ☐ Autonomy
- ☐ Confidence in themselves
- ☐ Ambition
- ☐ Critic attitude against rules
- ☐ Impulsivity
- ☐ Others...

Creativity can be Inferred



Evaluation Method: **Open task measured with Fluency, Flexibility and Originality.**

In contrast to expert evaluation methods →
More objective

Fluency A: 6

Fluency B: 8

Flexibility A: 6

Flexibility B: 3

Creative Quotient A: 5.98

Creative Quotient B: 5.31

Open task: Uses of a piece of paper.

Student A	Student B
Drawing	Drawing
Making a paper plane	Writing
Burning for heat	Paper for the printer
To dry something	To make a paper plane
As a ruler to draw 90 ° lines	To make a paper bird
To make noise	To make a paper boat
-	To level a table
-	To make a ball to throw

To implement Originality, there will be a factor that multiplies the CQ for each completely original response in the group.

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Developing Creativity in class

•**Role-Play activity1:**

- Radio-waste management:
 - 1st Small Group discussion
 - 2nd Exposition
 - 3rd Debate



•**Role Play activity 2:**

- New Reactors construction:
 - 1st Group discussion
 - 2nd Work assignement
 - 3rd Exposition & Questions



•**Open Questions (AWYT):**

- Answer whatever you think

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"It is not possible to evaluate creativity isolated":
→ **Take this as an advantage**

Evaluation: Mix of Creativity and Technical content.

Implementation 1: *Describing the plant evolution to an accident that has never been thought in class.*

To answer properly both creativity and technical content is needed

Implementation 2: (In progress): Make a open-question "histories task" about a plant status. Evaluation through Flexibility, Fluency and Originality.

Example of Implementation 2: *A Safety Relief Valve of the pressurizer is now open, what are the possible causes for this situation? Try to be creative.*

Student Answers:

- Hypothesis A: The plant is under a SBO situation and the pressure has to be decreased
- Hypothesis B: The plant is stopped because is on recharge and there are maintenance duty being carried on.
- Hypothesis C: The plant is under an SGTR situation and the valve has been opened manually
- Hypothesis D: This is an spurious opening of the valve
- Hypothesis E: The plant has been taken by terrorists that plan to melt the core.
- Hypothesis F: The plant is in a LOCA situation.

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- I. Creativity is a **desirable skill** in engineers for companies or institutions.
- II. Creativity is a skill that **can be trained** and enhanced.
- III. To develop creativity a **creative teaching method** is suitable for this purpose. In this aspect in UPM Role Play activities and open questions in every class are made.
- IV. Creativity cannot be evaluated isolated from other skills. Taking this in our advantage Creativity can be **evaluated at the same time as technical content**. In UPM, accidents never explained in class are used as evaluation method, and a multi-answer question of “histories” is planned to be implemented.
- V. Students in general have very **good opinions** about this initiatives.

Thanks for your attention.

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