Everyday Creativity and Playfulness in Science Education

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Motivation

The Story is from
PhD Study on Group Creativity in PBL
(2008-2012)

A Talk with a Student in Computer Science

Creativity = Crazy !

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In Between Ha-Ha and Aha!: Technology Designers' Humor as a Way of Creativity in Group Innovation Experience

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Abstract
This paper will explore how the technology designers perceive roles of humor in developing creativity in their group innovation experience; a particular focus on the interplay between Ha-Ha and Aha! and a creative climate will be highlighted. Theoretically, it will take a departure of social-cultural theories regarding creativity as a situated-based activity that also brings together humor and technology design in one framework. Empirically, interviews were carried out with a total of 26 young designers in two cultures of China and Denmark (n=13 from each culture). The data analysis leads to the following findings that the designers think: 1) all humorous people are creative and they are welcome in design project groups; and 2) humor as not only a personality or communication tool but also the outcome of applying creative ideas to design practice. Meanwhile, this study also reveals cultural differences of humor: Danish designers think being humorous aids individual involvement in group work and that humor itself can be a kind of creativity, while Chinese designers think humor is mainly used to maintain harmonious individual relationships with the group and that humor is instantaneous, a one-off ability of using language creatively in ongoing communication contexts. The findings contribute to unpack the black box of humor from a designers' perspective, cross-culturally, and as a contribution to joint studies on humor, innovation, creativity and design in the future.

Keywords: *creativity, humor, design, group innovation, cross-cultural study*

Motivation

2019:
Creativity + Playfulness (Humor)+ Formal Learning

A Project on STEM Teacher Professional Development (2018-2019)

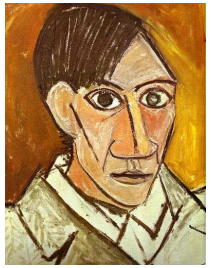
- ➢ **Creativity + Playfulness + Everyday Science?**

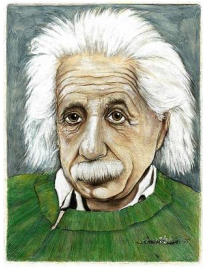
Creativity is Complex

- Creativity has been defined differently
- Being Complex in Practice & Multi-Faceted in Nature
  - Psychologists: intelligence, emotion, memory
  - Sociologists: group, social movement, institution
  - Innovation / Entrepreneurship / Business
  - Arts / Media / Performance
  - …

'We cannot tell you what it is, but we know it when we see it' (Wands, 2002).

'Big-C' Creativity: Mozart, Picasso, Einstein…





'Little-C' Creativity: Everyday Experience

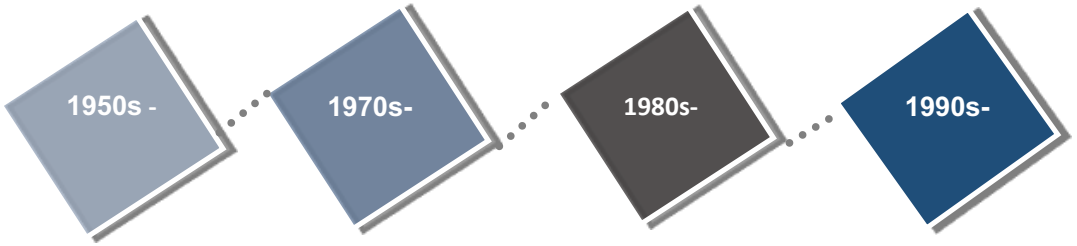
What is Creativity?

Creativity is the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning tasks constraints).

- Novelty
- Appropriateness / Usefulness

- ***Generation of new and meaningful perspectives, ideas, questions, and***
- ***Problem-Solving and Learning contexts***

- **Writings in ancient Greece and Rome**
- **Creativity Research Started Since 1950s**



Psychological Approach

Personal aspects: traits, characteristics, attributes…

Cognitive Approach

Creative process and stages of creative thinking

Sociological Approach

Influences of social and environmental factors

More Comprehensive and Integrated Models

Combining personality-related, cognitive, social and cultural factors

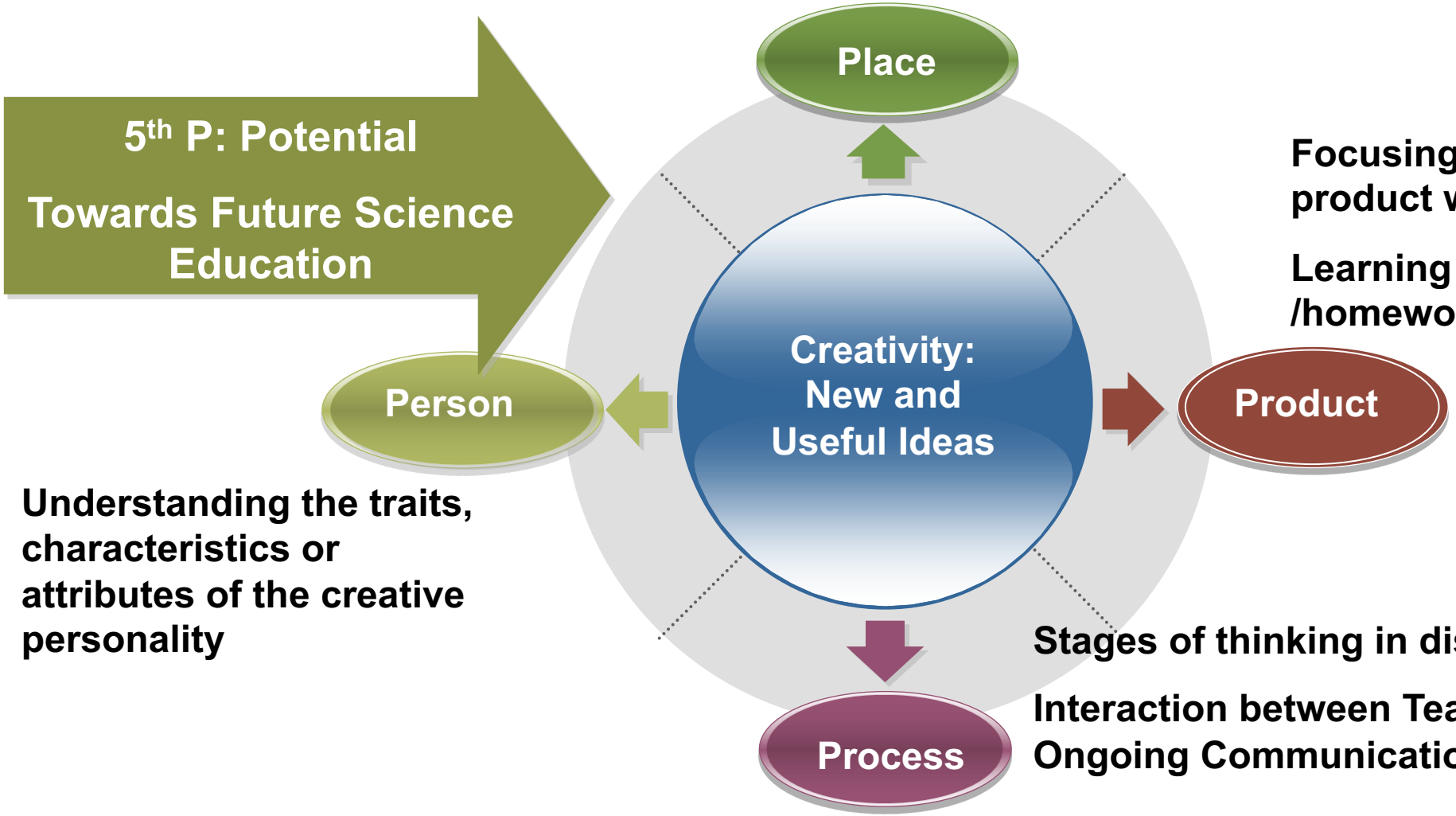
Creativity as a Scientific Literacy: Being able to Think & Reflect

- *Everyday creativity*
- *Being able to think something new in daily study/working practice*
- *Scientifically and Seriously coming up with solutions to ill-defined problems*
- *'Care' : Needs, Empathy, Responsibility*

A Systems Perspective

Where the students works which may be conductive to or inhibitive of creativity

Classroom/School/University/Community



Focusing on the qualities of a product which make it creative

Learning Outcomes /homework/Report

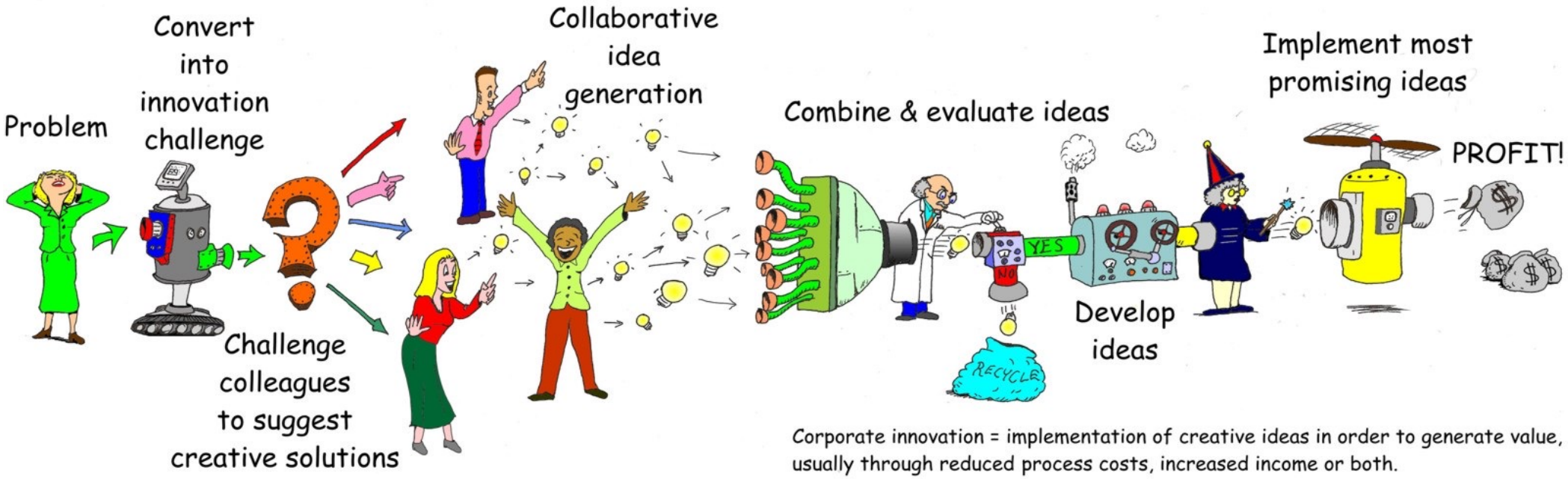
Understanding the traits, characteristics or attributes of the creative personality

Stages of thinking in discovery/ invention

Interaction between Teaching & Learning
Ongoing Communication/Facilitation

4Ps of Creativity

Creativity is about Collaboration



(Problem Solving Practice)Its nature is a cooperative enterprise, done by teams of people with different backgrounds, abilities, and responsibilities.

(Zhou, C., 2012)

The skills associated with successful teamwork – listening, understanding others' viewpoints, leading without dominating, delegating and accepting responsibility, and dealing with the interpersonal conflicts that inevitably arise - may be more vital to the success of a project than technical expertise.

(Zhou, C., 2012)

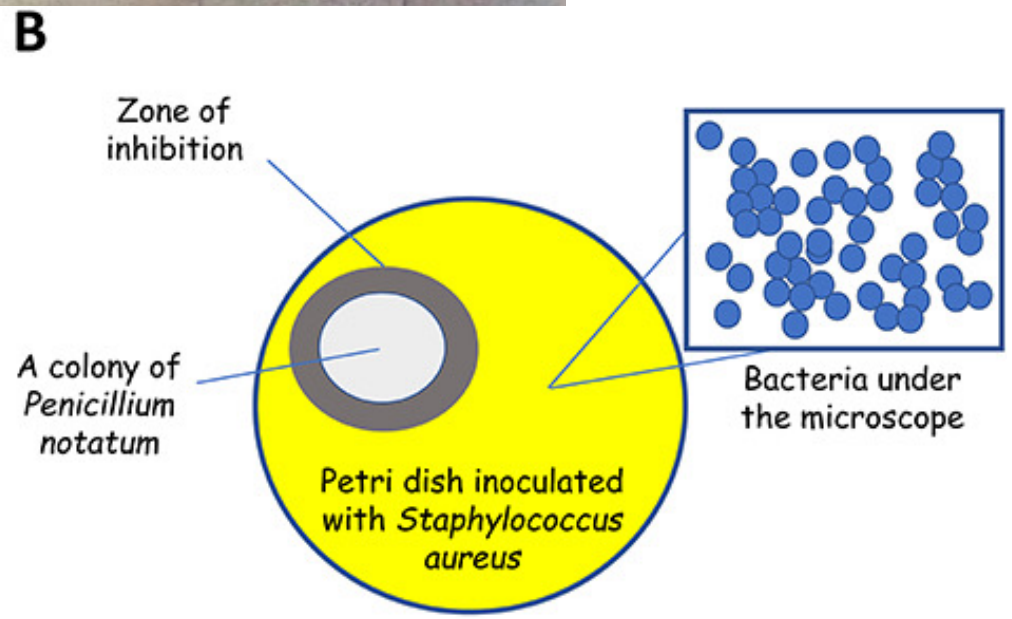
Creativity is about Method

In between Routine and Non-Routine

- Intuition
- Insight
- Experience
- Prior Knowledge
- Situated Context
- Emergency

A

Alexander Fleming in his laboratory



Education Objectives

Abilities to Apply Knowledge across Situations

Disciplinary Knowledge & Skills in Depth

To design, formulate, build, invent, compose, generate, derive, modify or develop. To take two or more scientific processess or ideas and putting them together or taking a process and placing it in a new context.
Example: Address a way over a lake that is to freeze the water to make ice and then car can drive across, rather than drive around.

To support, defend, judge, compare,contrast, argue, justify, or convince.To make a judgment about a process.procedure or some research points.
Example: give peer review comments to others research reports.

To break down something into parts, classifying, categorizing, simplifying or find patterns that link to the scientific process or principle.
Example: what can we learn from the graph of a liguid becoming a gas?

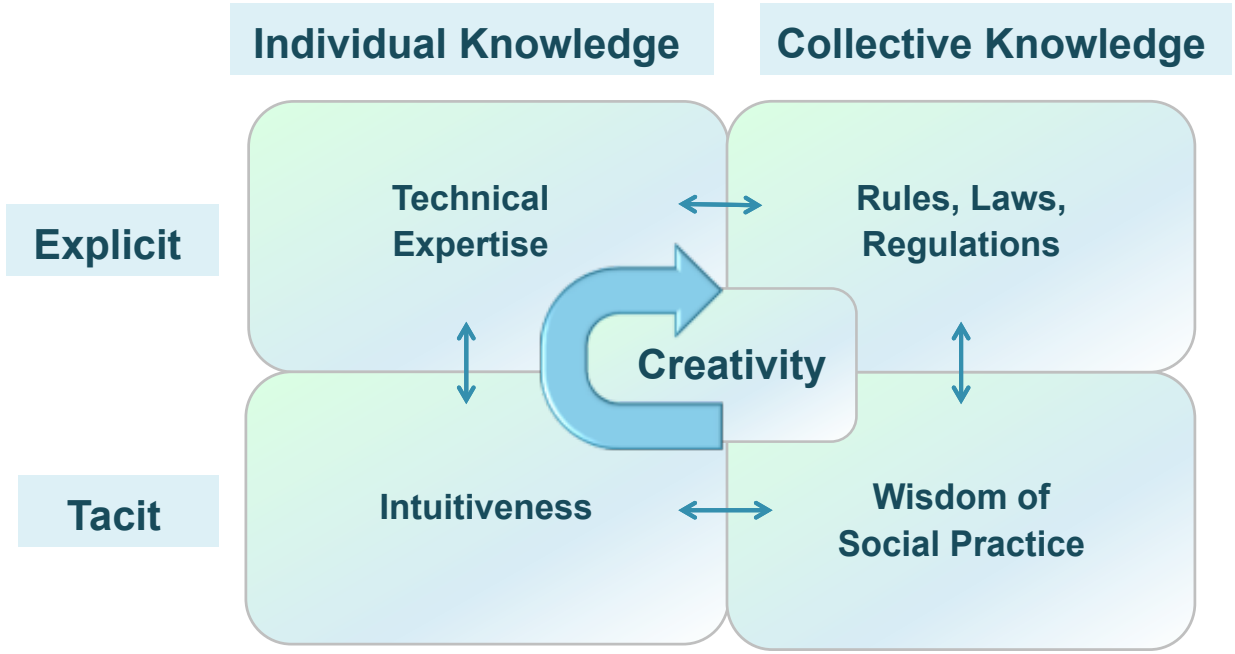
To apply a scientific principle into practice. To caculate, predict, solve or determine what might be affected or see how science is in real life.
Example: how to heat a gas and get different sizes of balloons.

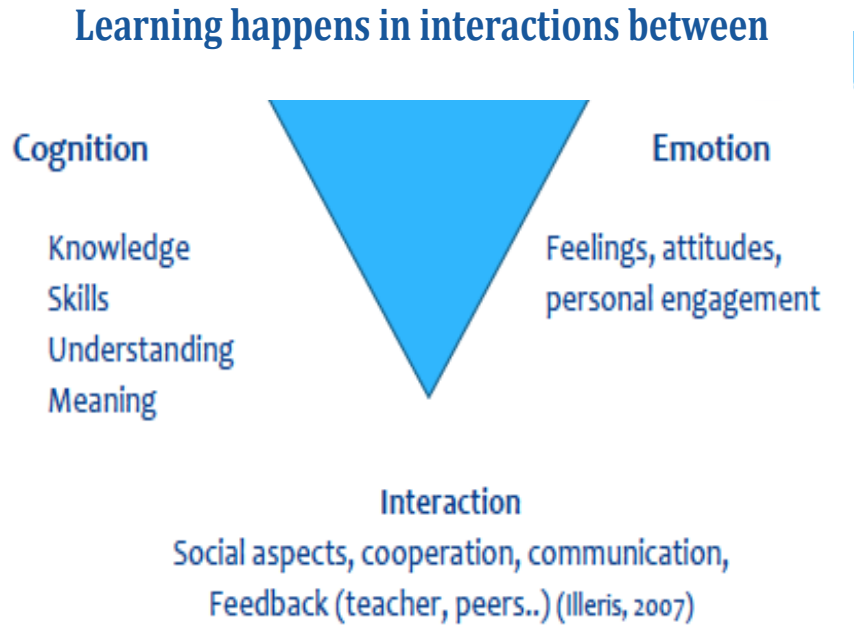
To describe or explain one's own understanding of the science behind the question.
Example: to understand when to heat a solid, why does it turn into a liguid and fills the container?

To Write some facts or answer questions that have been learned about science.
Example: the three types of matter are solid, liquid and gas, examples canbe ice, water and steam.

Bloom (1994), Zhou(2019)

Creativity as Shaping New Knowledge in Learning





Emotion as Coordinating Social Life

- **Emotions are mental states arising from personal evaluations of the world with prompt a readiness to act in support of well-being** (Newton, 2013).

- Following many psychological theories, emotions are views as **constructions organized by biological, social, and psychological factors** (Averill, Chon, and Hahn, 2001).

- Some emotions, such as fear, are organized primarily by **biological factors** and may have developed through evolution to assure a rapid and often adaptive physiological response (e.g., escape from a fearful situation). Other emotions are organized by **a combination of biological and social factors**. Emotions such as anger, happiness, and love are sharable, public, and bounded by specific organizing principles for emotional categories. **The biosocial emotions influence behaviour and are used for interpersonal communication such as expressing how one feels about an object, person, or event** (Lubart and Getz, 2010).

- Ahmed (2004) highlighted "**emotions shape the very surfaces of bodies, which take shape through the repetition of actions over time, as well as through orientations towards and way from others**" (p.4).

Playfulness as an Emotional Element of Creative Climate

- "Climate" has been used to describe the **recurring patterns of behaviour, attitudes, and feelings** that characterize life in certain working or learning environment (Al-Beraldi, & Rickards, 2003).

- Lieberman (1965) is the first to name and construct playfulness according to the research on divergent thinking of kindergarten children. He holds that **playfulness is the quality of play**, and it is the necessary spontaneous personality during children's playing and leisure activities. In his later study, it shows that, **both adolescents and adults will convert the playfulness in their minds into a personality** (Chang, Hsu, and Chen, 2013).

- However, a more concrete definition of playfulness derives from Webster's definition of "free inclination" (Chang, 2013). Thus **"freedom" is embedded in the nature of playfulness** (Taylor and Rogers, 2001).

- Furthermore, Aguilar (1985) further explained playfulness by the point of social context, accounting that **playfulness is an innate disposition, while social environment stimulates playfulness to show up.**

Creativity & Playfulness in Learning Science

Having FUN

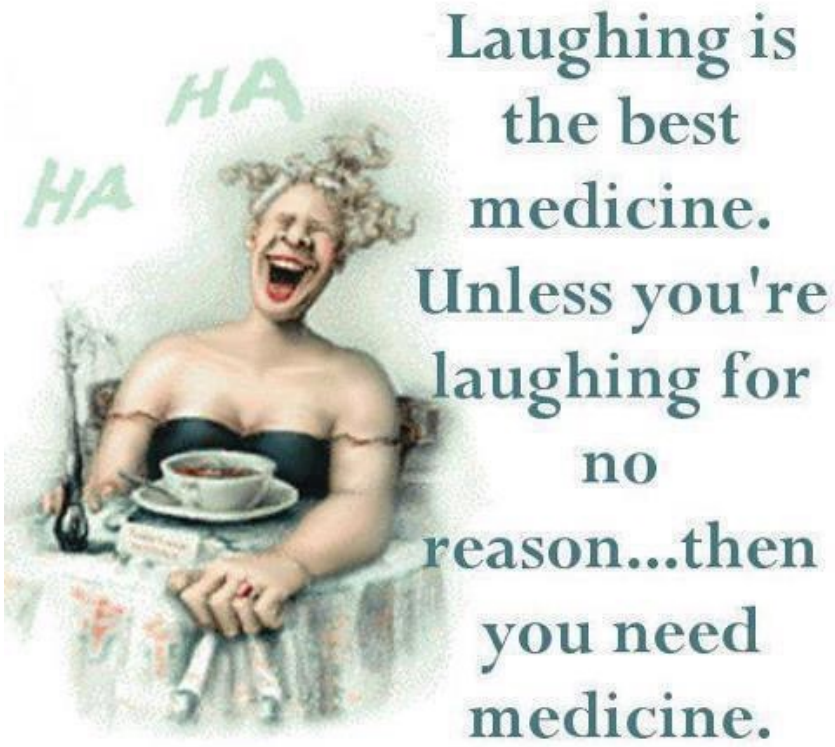
Ha-Ha: The Moment of Laughter

Aha!: The Moment of Discovery

#eduDK

A Learners' Perspective Investigation – Questions

- How do science students think of creativity and playfulness in their everyday learning experience?
- Based on the perceptions on creativity and playfulness among science students, to explore:
- How to improve creative learning environments and playful pedagogical designs in university science education?



A Learners' Perspective Investigation – Empirical Work

The empirical work involves interviews with science students (n=22) in bachelor education at Aalborg University (January, 2020)

- Computer Science (n=5)
- Mathematics (n=6)
- Chemistry (n=4)
- Physics (n=4)
- Biology (n=3)

Each Interview around 40 minutes

Boys n=19; Girls n=3

A Learners' Perspective Investigation – Findings

Understanding on Creativity - Two Polars

- **Science should be far away from creativity**; creativity mainly belongs to some fields related to arts and design; Science study should follow scientific principles and take serious attitude

'I cannot image, if I do all my experiments with plastic made tubes. Creativity means to take the risk, we are not allowed'

- **Creativity is very important to develop innovation**, creativity is their project reports and present their research results to others.

'Creativity is a skill in making PowerPoint, we should use multimedia technologies, to make our presentations more attractive'

A Learners' Perspective Investigation – Findings

Everyday Playfulness Means a Lot

'Like playing or not', this is about personality & attitude'

'Playfulness is everywhere, it is about how you look at the things you are doing'

'Playfulness brings surprising or some feelings out of expectations, maybe even sometimes you feel sad after playing'

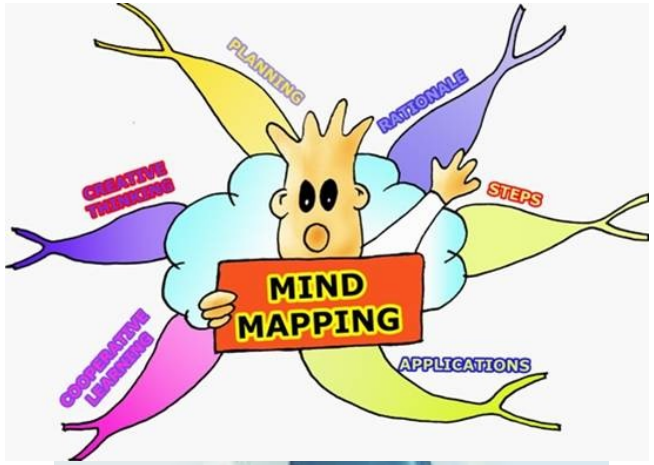
- Creativity & play in spare time means opportunities **to try different experiences**
- Playfulness is more related to experience of individual relaxing like watching funny video, and getting along with with others in the daily jokes, and usually embedded in their experience of playing computer games and physical activities such as playing footballs or basketballs and even baking cakes using new recipes

Maybe Creativity is Difficult

But Play is Easy

Setting Playful Learning Environment

- Individual thinking
- Group learning
- Meaningful Learning Experience
- Learning by doing



What is the current information on the issue or problem?	How does everyone feel about the current situation, issue or problem?	What are the positive aspects of the current situation, issue or problem?	What are the negative aspects of the current situation, issue or problem?	What are new creative ideas or alternatives in solving the issue or problem?	How does everyone feel now that we have worked on the issue or problem?	What conclusions or summaries can we make in moving forward on the issue or problem?

Pedagogical Design – Staff Development

Student-Centered

Problem & Project-Based
Inquiry-Based
Design-Based
Practice-Based
Hands-on Experience

How to Educate Creative Scientists & How to Foster Creative Learning Environment?

Teacher-Led

Lecture-Based
Theory-Focused

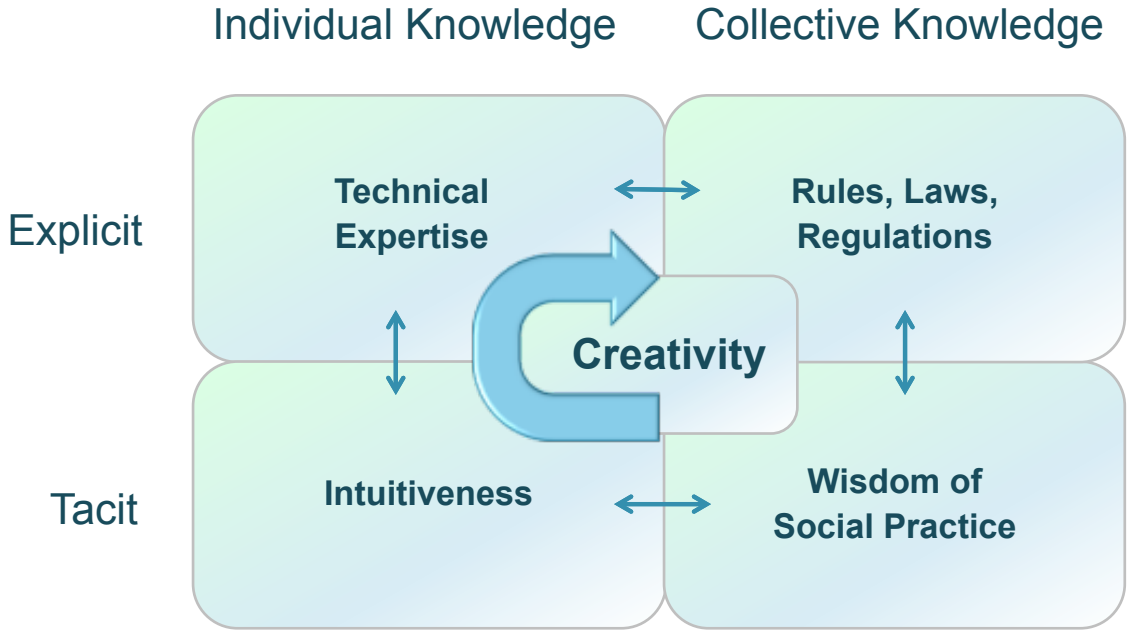
Supporting Playful/Creative Learning

Formal & Informal Learning

Everyday Life

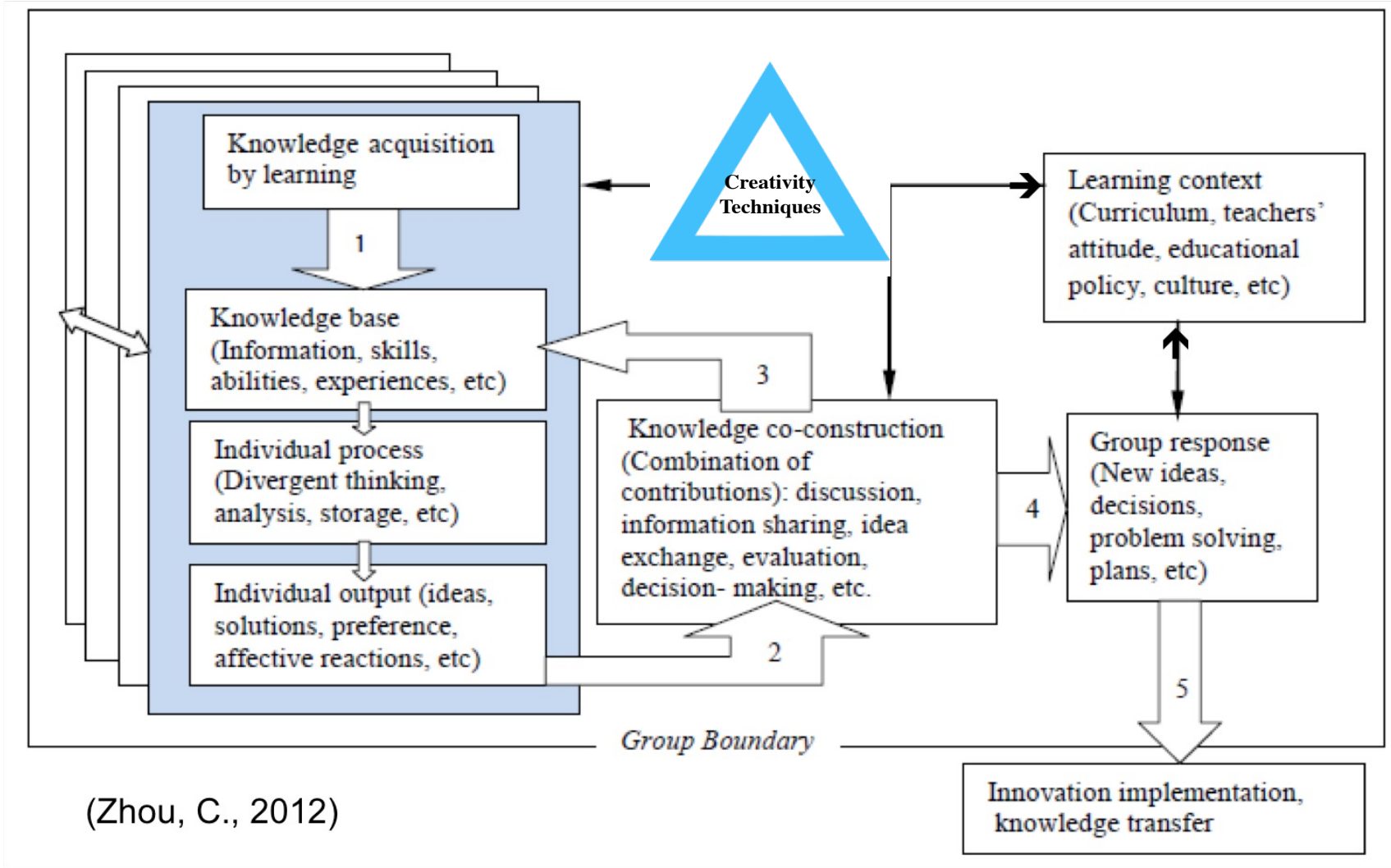
Creativity Techniques

- Methods/Techniques to be creative
- Positive attitude & confidence
- Good conceptualization
- Professional identity



- Pedagogical development & educational tools for supporting creativity in a long-terms run
- **For example, game can be a pedagogical Strategy, playfulness should be an embedded element**
- Greater sense of awareness of the complex relationships between student, teacher, and task, and any possible student responses

Interplay between Individual & Group Work

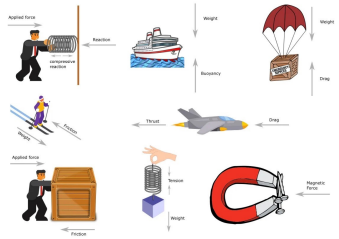


(Zhou, C., 2012)

Group Discussion: Archimedes & Daily Life

How Archimedes Created Interesting, Meaningful & Effective Life

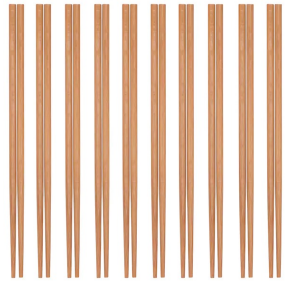
How Does a Lever Work?
https://owlcation.com/stem/Simple-Machines-How-Does-a-Lever-Work



10 Lever Simple Machines Examples in Everyday Life
https://studiousguy.com/lever-simple-machines-examples/

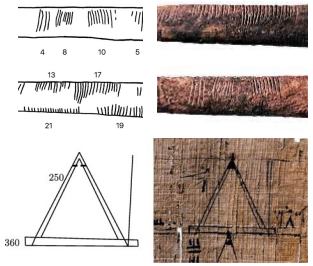
Let us Continue… Authentic Experience
Let us try chopsticks!

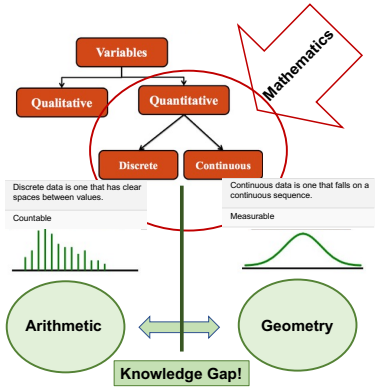
History of Chopstick Research
https://marcosticks.org/history-of-chopstick-research/



Starting Point: Discrete or Continuous?

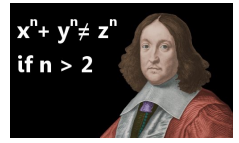
In Between
Counting & Measurement



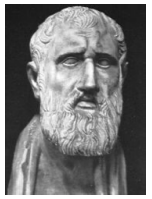


Role-Playing: A Math Dialogue on Dice

1. René Descartes

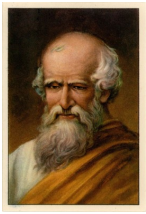


2. Pierre de Fermat



3. Zeno

4. Pythagoras



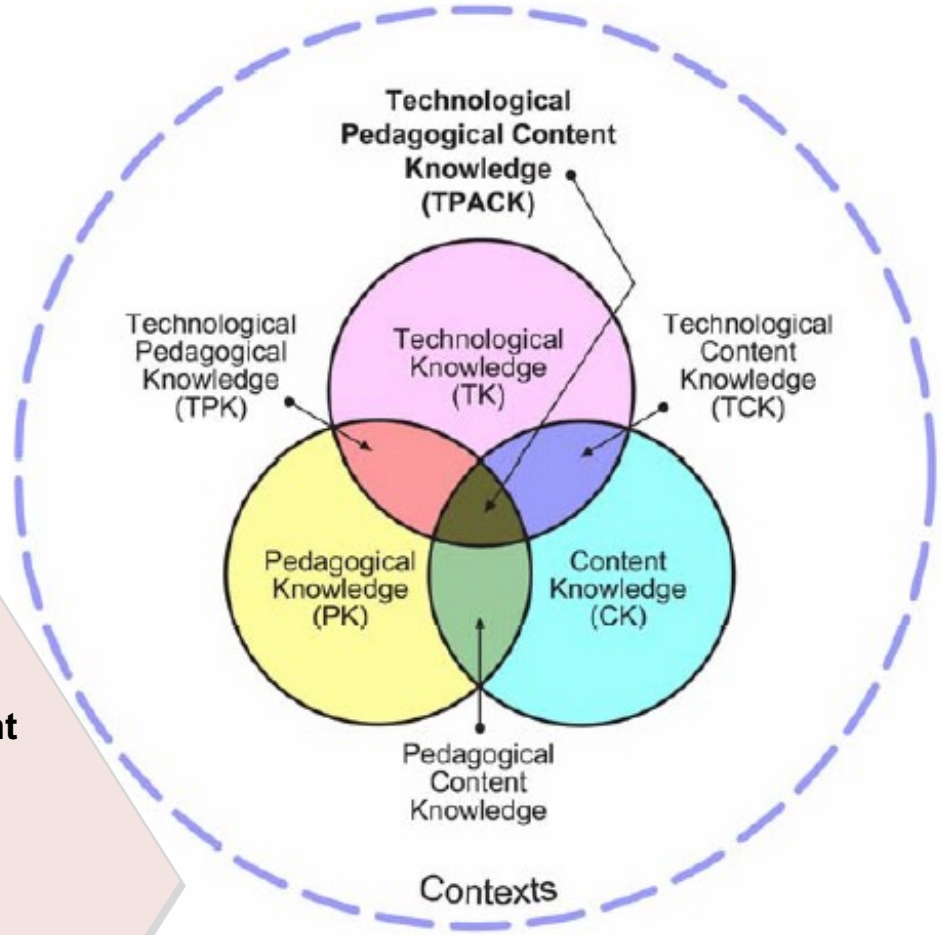
5. Archimedes

1) Sitting in Groups
2) Let the dice to tell you 'who' you are (see the number of mathematician)
3) Introduce 'yourself' to the group
4) Put the dice on the table
5) Then, think about 'your contributions' to history of mathematics, and interpret certain questions/analysis in relation to the dice.

Staff Development for Creativity

Staff Development on Creativity:

- A Series of Pedagogy Training Activities providing methods of creative teaching
- Technology knowledge element in training
- The potential activities are workshops, lectures, writing portfolios, peer learning, and sharing experiences, etc.;



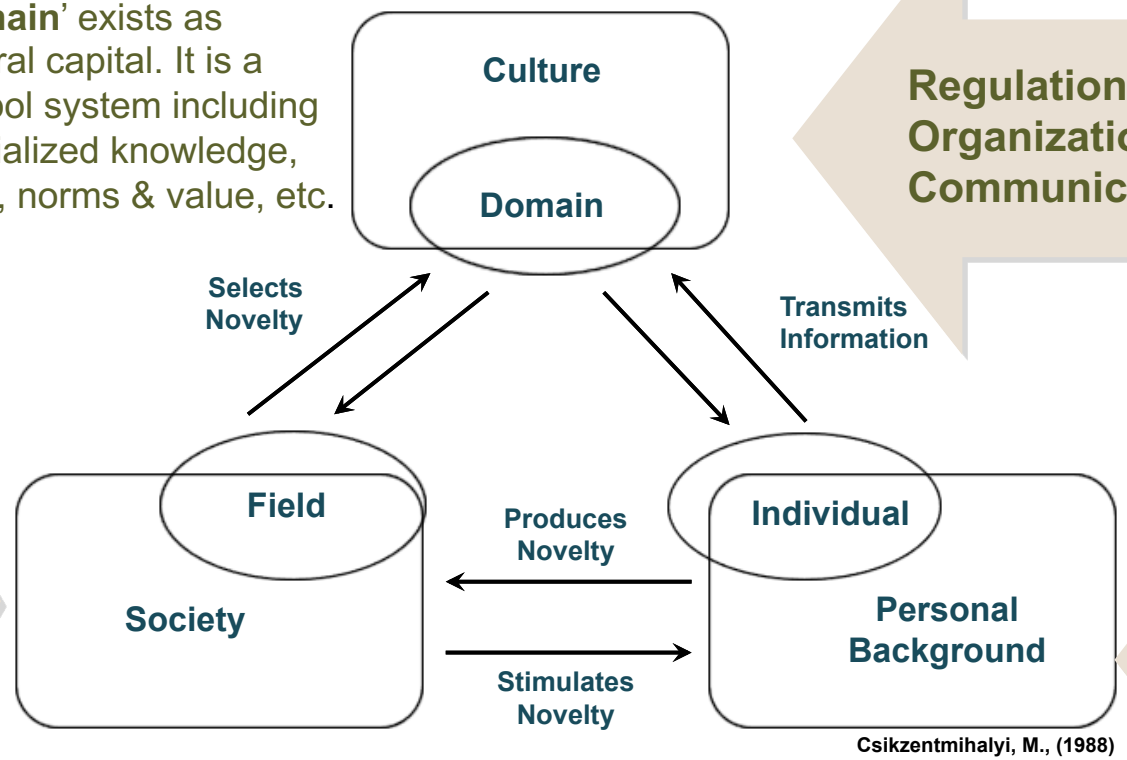
A Framework of Technological Pedagogical Content Knowledge (TPACK)

- Content Knowledge (CK): what we teach
- Pedagogical Knowledge (PK): how we teach
- Technological Knowledge (TK): use of new technology

(Koehler, et al., 2011)

A Socio-Cultural Perspective…

'**Domain**' exists as cultural capital. It is a symbol system including specialized knowledge, skills, norms & value, etc.



Csikzentmihalyi, M., (1988)

Field refers to social organizations of the domain – to 'Gatekeepers' who decide what belongs to a domain and what does not.

Management

Regulations/Policies/
Organization Structure/
Communication/Facilities

Teachers

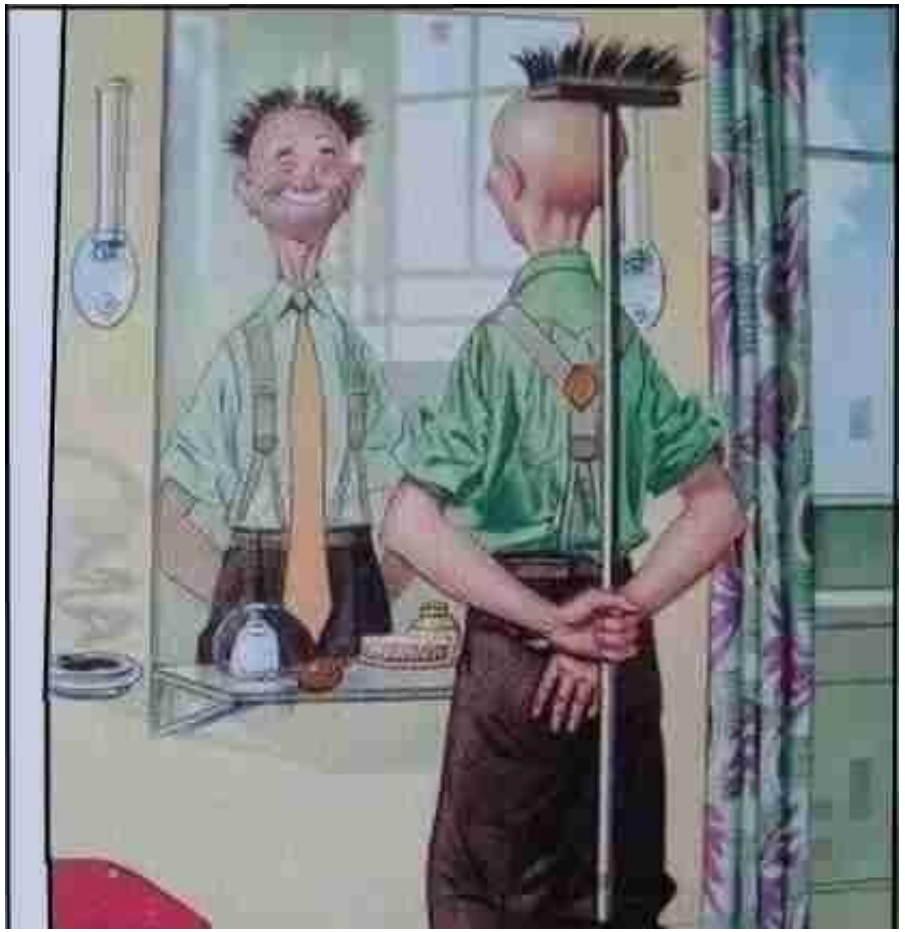
Awareness /
Recognition of
Creativity

Teaching
Practice

Active Learning
Ownership
Interests
Motivation

Learning
Experience

Final Reflection: Self-Evaluation



- Teaching Staff's Perspective
- Other Universities / Cultures?
- Any institution /culture cannot compensate the needs of fostering strongest creative environment required by science education
- Only through a self-evaluation of the own culture, the elements that are blocking the populace, and the construction of more fertile creative soil can we lead new findings of creativity development.

Thank You Very Much!