

Inventive Problem Solving Course in a Graduate School

**Rebuilding Japan by Education
as a Nation of Leading Technology**

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Kanagawa Institute of Technology**

How we started this course.

- Ikeda and Ishihama met at the 2nd TRIZ Symposium in 2006.
- Exchanged information on TRIZ education at the 5th TRIZ Symposium in 2009.

Expectation from university teaching staff:

- Let our graduate student have skill of creative use of technological knowledge and their brain.

Evaluation at this moment:

- Surpassed our expectations. Proper teaching staff need to have teaching skill and experience.

Speaker's Background



- Working Experience
Joined SONY. '1983
Product Design Engineer. 20 years.
In-house consultant and trainer. 7 years.
- Academic Experience
Lecturer/ Graduate School of Kanagawa Inst. Tech.
Member/ Education with TRIZ Study Group, Japan TRIZ Society
- License
CompTIA(U.S.A.), CTT+lecturer, Personal Profile DiSC authorized consultant.



Policy as a lecturer: Support growth and happiness of people

Request to Today's Participants

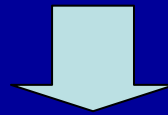
- Let's try finding answers to the two questions below while listening to this presentation!
 - 1. How can we improve people's skill of inventive problem solving?*
 - 2. How can we contribute to this challenge?*

Syllabus –continued-

Week	What to learn
1	Overview of this course
2	How to break down objectives. S-curve analysis.
3	Tracing back cause and result chains. Week 1
4	Tracing back cause and result chains. Week 2
5	Function analysis Week1
6	Function analysis Week2
7	40 Inventive Principles Week1
8	40 Inventive Principles Week2
9	Identifying technical contradictions Week1
10	Identifying technical contradictions Week2
11	Identifying physical contradictions Week1
12	Identifying physical contradictions Week2
13	Trend of evolution Week1
14	Trend of evolution Week2
15	Methods of promoting inspiration. Brain storming.

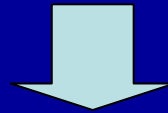
A Message from the Teachers to the students.

- Our lives are full of **“Problem Solving”**



We ask our students a question:

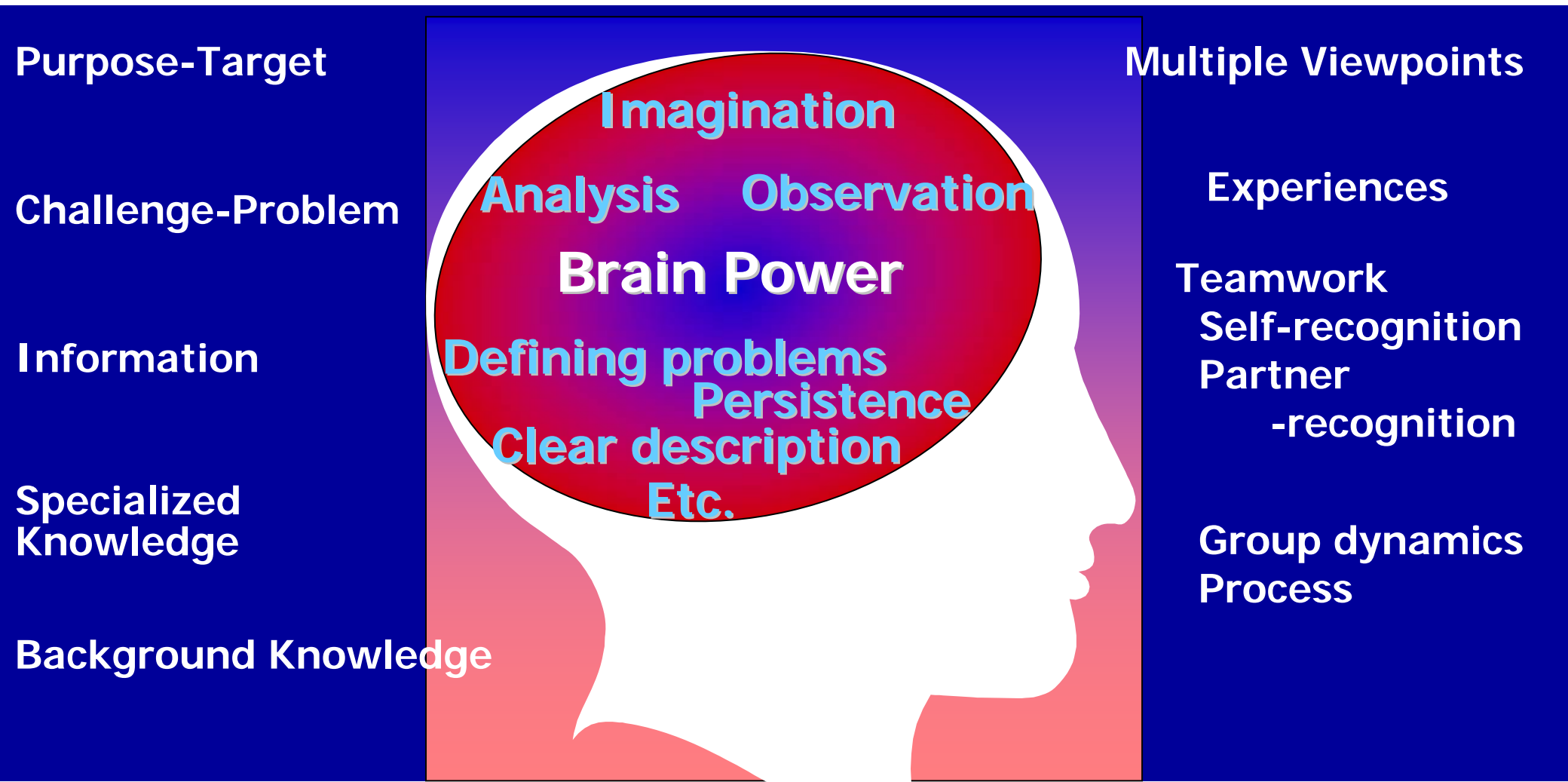
“What is the decisive factor in making our lives happy or unhappy?”



Teacher's message:

- **“Inventive Problem Solving Ability”**
of each person is.

Brain Power = Inventive Problem Solving Ability



"Brain Power": The focus of this course



TRIZ

Formal knowledge
of creativity



Embed
creativity into
"human"



Brain Power

**Brain Power Enhancement is more important
than giving knowledge.**

Points in Enhancing “Brain Power”

A. Bringing out students' latent “**perception**” with three steps.

1. Individual  2. Small group  3. Whole class

B. Learn by **repeating**: Let the students step up **three levels of knowledge**.

1. To know  2. To understand  3. To use

C. Focusing on a point:

In a simple and systematic way.

1. Three steps of bringing out students' perception.

1. Individual thinking

Let a student have his/her own idea.



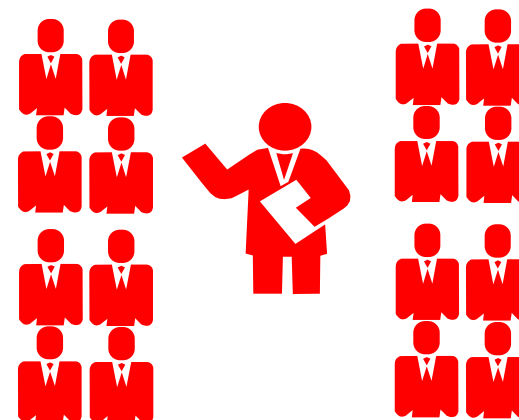
2. Presentation & discussion in a small group

Let a student have others' viewpoint.



3. Presentation & discussion in a whole class

Let a student have multiple viewpoints.



A Snap Shot in the Course

1. Individual thinking



A Snap Shot in the Course

2. Presentation & discussion in a small group

Each student presents his/her idea and receives feedback from the group members.

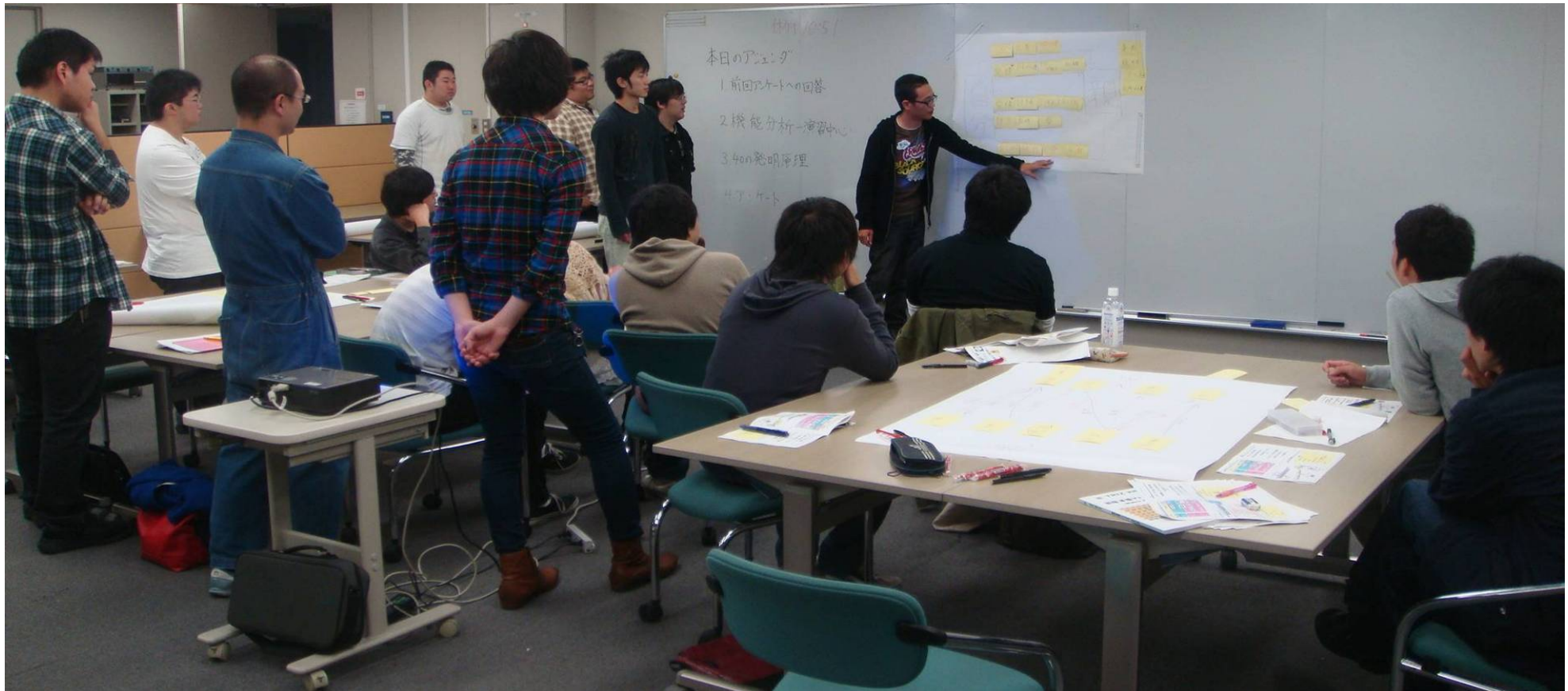
The teacher continuously walks around the students and gives advices to them.



A Snap Shot in the Course

3. Presentation & discussion in a whole class

Let a student have multiple viewpoints.



Points in enhancing “Brain Power”

A. Bringing out students' latent “perception” with three steps.

1. Individual → 2. Small group → 3. Whole class

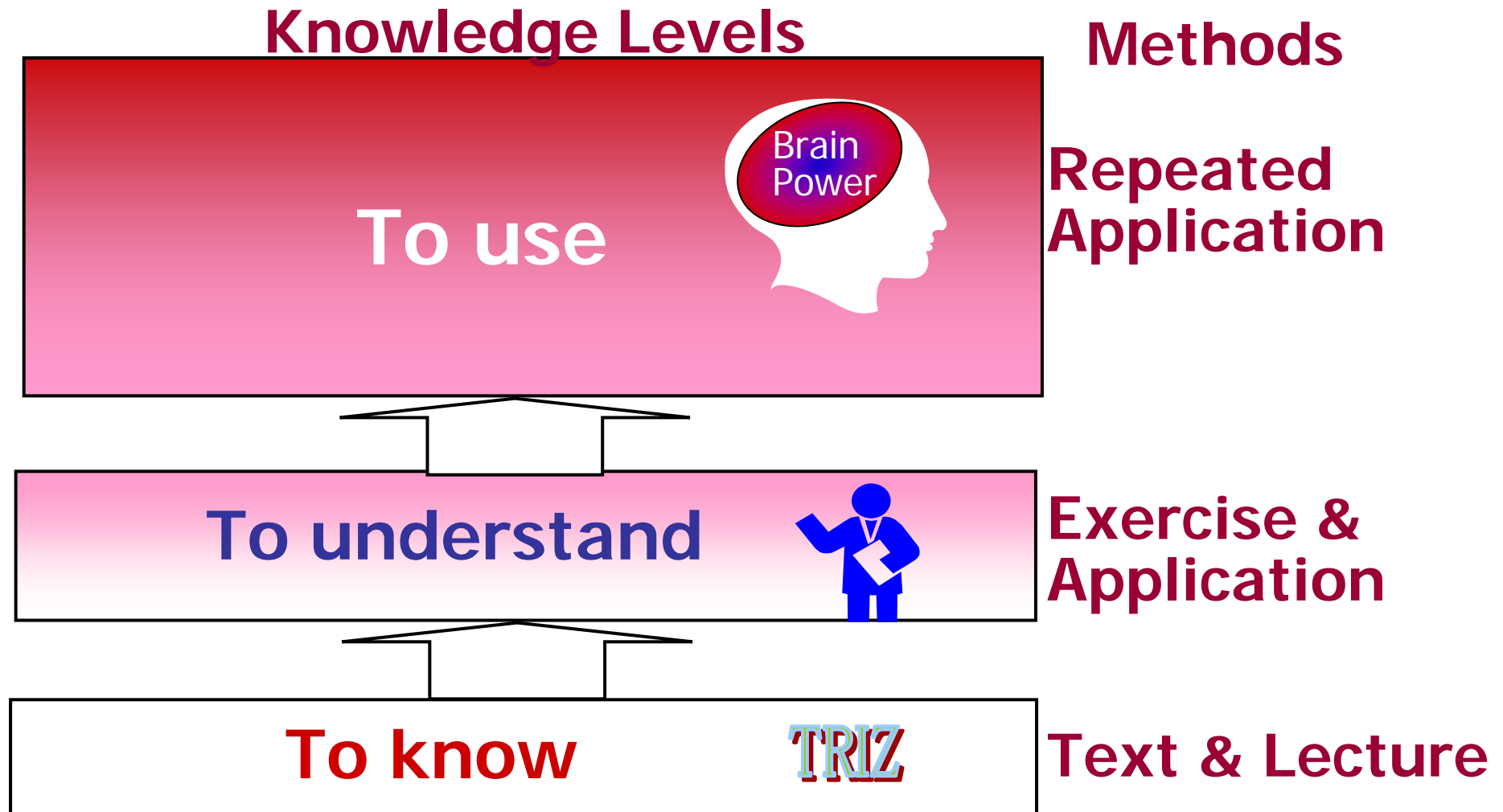
B. Learn by **repeating**: Let the students step up **three levels of knowledge**.

1. To know → 2. To understand → 3. To use

C. Focusing on a point:

In a simple and systematic way.

Method of Stepping-up the Three Levels of Knowledge



Repeating Process in Class

Next week: Review & Additional Exercise



Dig deep.

Answer to Questionnaire

Extract points not fully understood

Supplementary Lecture

Organize points

Presentation in whole class

Group Exercise

Individual Exercise



Exposed to various viewpoints and get perception

Lecture

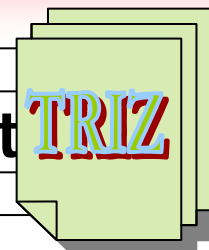
Learn by Listening

Home Assignment

Learn by Thinking

Pre-hand out text

Learn by Reading



To Use
(Entrance Level)



To Understand



To Know

Contents of the Questionnaire Asked at the End of Every Class

Objectives of this questionnaire:

For students; Draw a clear line between what are understood and what are not.

For teachers; Prepare for the next class by knowing the effect of today's class and weak points of the students.

Questionnaire Card on Today's Lecture & Exercise

Date: December 8, Student Name: _____

Content: "Definition of Physical Contradiction"

1. *What are the most impressive points to you?*
2. *What subjects are hard to understand? Do you have any specific questions?*
"It is hard to use the inventive principle "Separation in Space."
3. *Please write your impression and comments for our future classes.*

An Example of Review & Additional Exercise

A number of students in this class answers to the questionnaire in the last week as - - -

*“It is hard to use the inventive principle
“Separation in Space.”*

“Let’s exercise it once more!”

An Example of Additional Exercise

Contradiction among the functions of a cup:

Parameter: Temperature (of the container)



Desire to increase the parameter (+):

“hot” (to keep the content warm)

Desire not to increase the parameter (-):

“not hot” (for easy handling)

“Separation in space”:

Where on a cup do we need the parameter increased?

Where do we need the parameter decreased?

An Example of Additional Exercise

Contradiction among the functions of a car body:

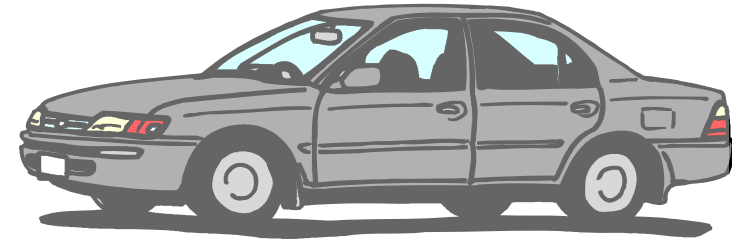
Parameter: Stiffness (of the body)

Desire to increase the stiffness (+):

to withstand against weather, dent and roll over accident.

Desire not to increase the stiffness (-):

to protect pedestrians in collision.



“Separation in space”:

Where on a body do we need the stiffness increased?

Where do we need the stiffness decreased?

An Example of Additional Exercise

Contradiction in drinking habit (of alcohol lovers):

Parameter: **Desire to drink**

Desire to increase the parameter (+):

"To become happy"

Desire not to increase the parameter (-):

"To be healthy"



"Separation in space":

Where on our body do we need the parameter increased?

Where do we need the parameter decreased?

Points in enhancing “Brain Power”

A. Bringing out students' latent “perception” with three steps.

1. Individual → 2. Small group → 3. Whole class

B. Learn by repeating: Let the students step up three levels of knowledge.

1. To know → 2. To understand → 3. To use

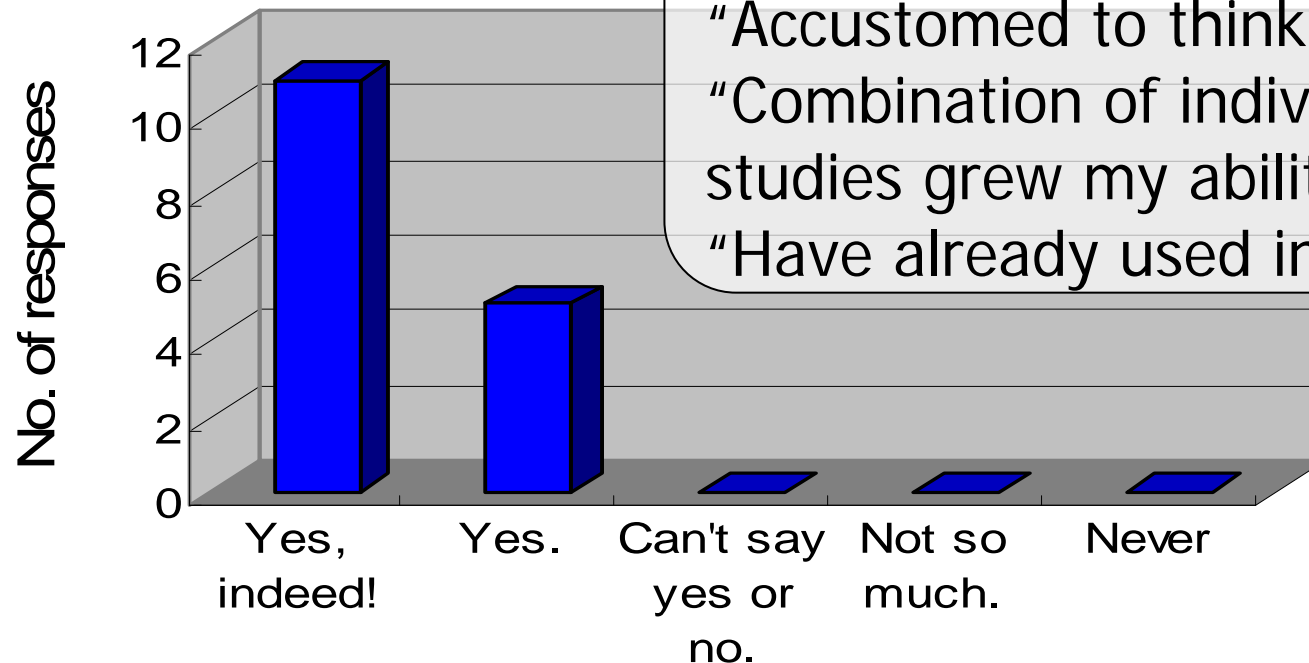
**C. Focusing on a point:
In a simple and systematic way.**

Focusing on a point: In a simple and systematic way

Identifying the subject	<p>Analyzing objectives: Identify the purpose and set a goal.</p> <p>S–Curve analysis: Identify current status.</p>
Analyzing the subject	<p>Root cause analysis by cascade queries: Logical digging & development.</p> <p>Function analysis: Inter–element analysis. (Both positive and negative effects.)</p>
Generating ideas	<p>40 Principles of Invention</p> <p>Evolution trend</p> <p>Technical contradiction</p> <p>Physical contradiction</p>
+α	<p>Approach to inspiration: Control of thinking.</p> <p>Brain–storming: Team work skill</p> <p>Human skill: Know–how on individual and group activities.</p>

Voice of the Students: Answer to the questionnaire

Q1. Did the class stimulate you in problem analysis and enhancing creativity?



Comments:

"Got a reliable tool at my hand."

"My horizon became wide."

"Accustomed to thinking."

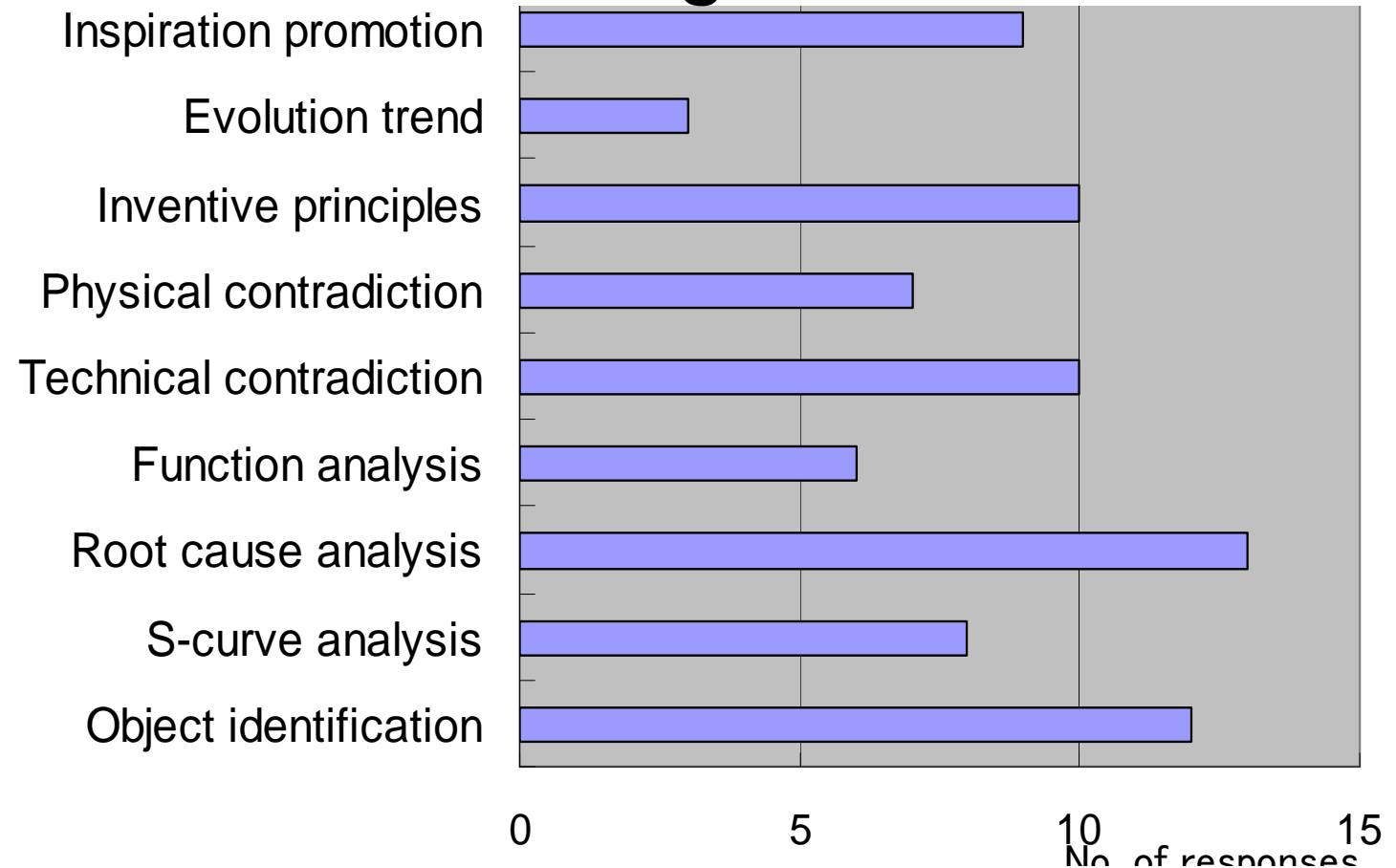
"Combination of individual and group studies grew my ability."

"Have already used in my research."

Voice of the Students: Answer to the questionnaire

Q1. What tool did you feel useful?

All the TRIZ tools were recognized as useful.



Voice of the Students: Answer to the questionnaire

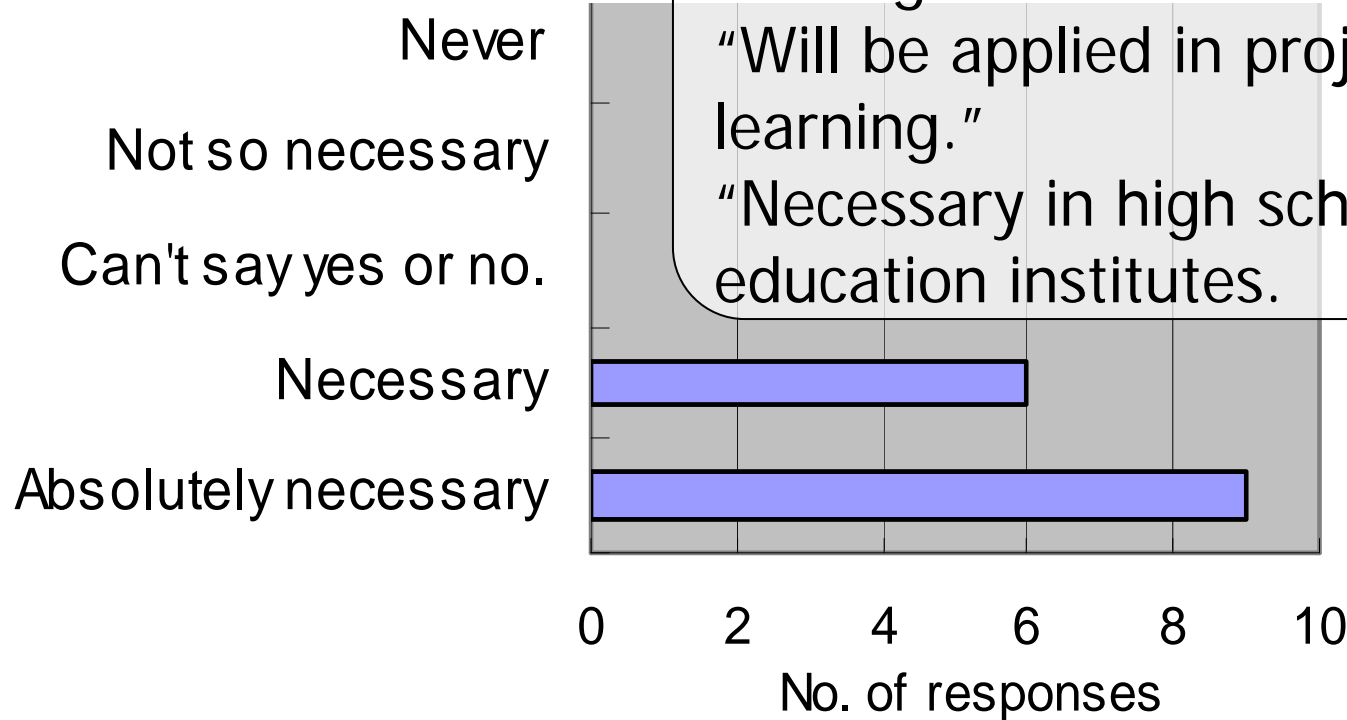
Q3. Is this course necessary in university education?

Comments:

"Without creativity, we can make nothing."

"Will be applied in project based team learning."

"Necessary in high schools or in lower education institutes."



Voice of the Students: Answer to the questionnaire

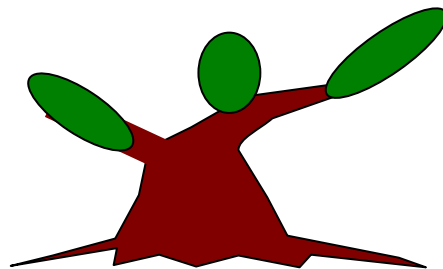
Other notable comments from the students.

- By understanding the goal of the course at the beginning, I didn't lost my way till the end.
- Reviewing the last lecture each time removed my hazy understandings and led me to the next step.
- By proceeding from individual thinking to group activities, I was able to organize my idea.
- Because the lecturer was an active manager in industry, his own experiences gave me fresh impression.
- Learned what I cannot learn in regular other courses.
- Hope the lecturer advise me in thesis research.
- I was happy to attend this course.
- The best course I've ever had since my childhood.

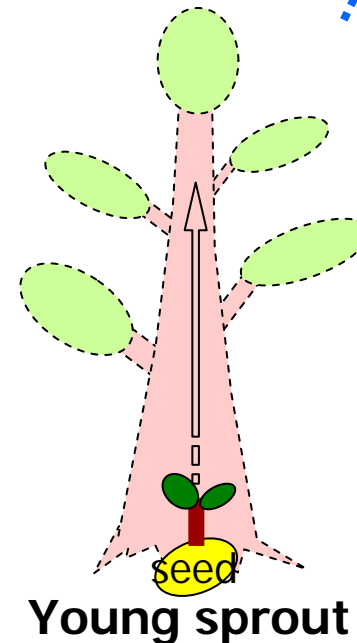
Lessons the Lecturer Obtained

• Every person has a seed of creativity. We can let such a seed germinated and grow. Important point is how to **water** it.

• The younger the bigger it grows. (At least before its full growth.)

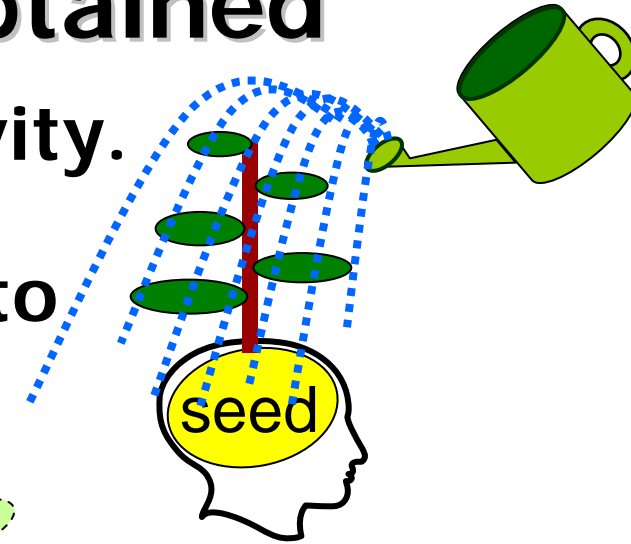
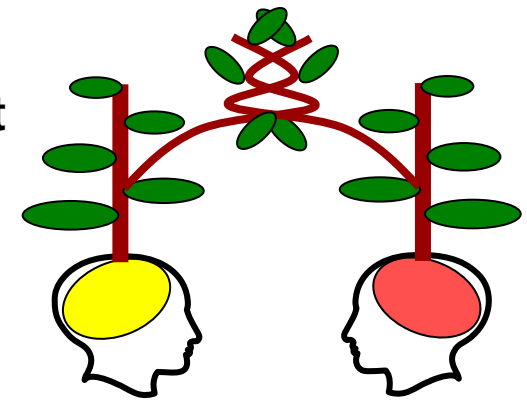


Engineer in industry, already grown.



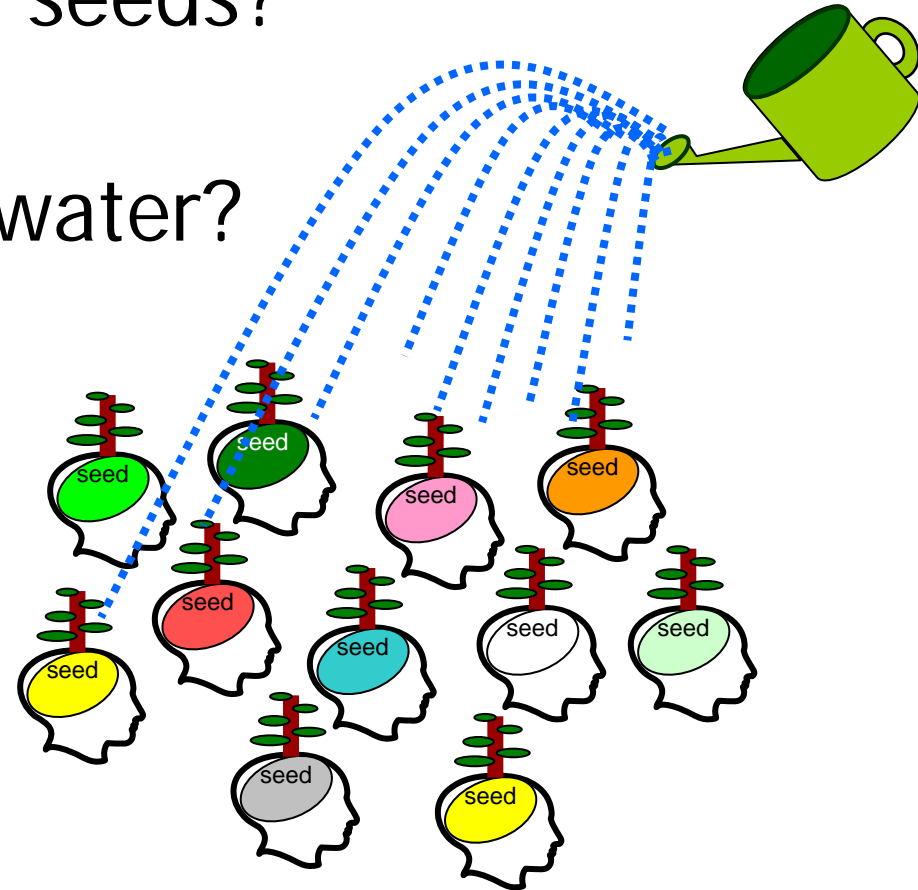
Young sprout

• Sprouts grow better when they are tangled each others.



Challenges Remaining

- How can we water “many” seeds?
- When and how should we water?
- What kind of water?
- Know how of operating a class of many student.

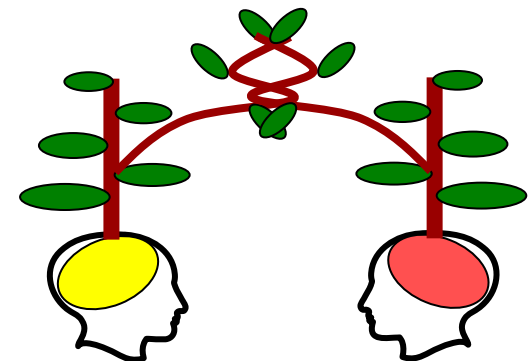


Proposals

- Implementing creativity education that inspires students' perception systematically.
- Building a creativity education structure from kinder garden to university, and further to industry.



- Let's tangle our sprouts to push creativity education forward.



Thank you for listening.