

The 8th TRIZ Symposium in Japan, 2012



Multiple Modeling to Set Up the Problems/Tasks:

Establishing and Penetrating the Methodology of Creative Problem-Solving/Task-Achieving

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Introduction: Intention of the present study

Motivation: Why the creative problem solving method, TRIZ, does not penetrate more smoothly among (especially younger) people?

What should we do?

Recognition:

- (1) TRIZ is a strong method in technological cases, where the problem and its mechanism are understood clearly; TRIZ resolves contradictions and derives powerful solutions.
- (2) TRIZ is weak, however, in finding the problem focus in complex situations in the real world, typically **in non-technological areas** where mechanism is usually not clear.
- (3) The difficulty of spreading TRIZ is not a technical problem.It is related to people, organizations, and society.It is a "common" type of problem in non-technological area.
- (4) Dealing firmly with the difficulty of spreading TRIZ is an important issue for further development of TRIZ, I believe.

Approaches of the present study:

- (a) To deal firmly with the problem of difficulty in spreading TRIZ.
- (b) To fully use the ability obtained so far in the study of TRIZ.
- (c) To use my own ability and methods without limiting to TRIZ.
- (d) **To build multiple 'Models'** viewed by multiple aspects, respectively. A model is a description of the 'System' viewed from an aspect,

and clarifies the structure of the system.

Models are made in figures/diagrams, whose formats may be flexible. Models are to be used for the basis of discussions from the aspects.

- (e) To build higher-level Models on the basis of descriptions/discussions of multiple Models.
- (f) **To write down statements and documents** on the basis of graphical representation of Models so as to clarify from what aspects the system is considered and what are understood from the Model.
- (g) As a result, to obtain the understanding of the problem situations and the directions for solving the problem.

Steps of Multiple Modeling and Analysis

[A] Modeling of Person's learning and Industry's acceptance of techniques.

Model of how a person to learn, apply, and master the TRIZ method under the influences of external information and in-company activities.

- [B] Modeling of activities of various organizations promoting TRIZ.

 Models of activities of individual organizations are accumulated and merged to see the activities as a whole.
- [C] Modeling of areas where TRIZ can/should be applied and penetrated.

This gives us the statement of our overall goal (or target requirement):

"To establish a methodology of creative problem-solving/task-achieving, to spread it widely, and

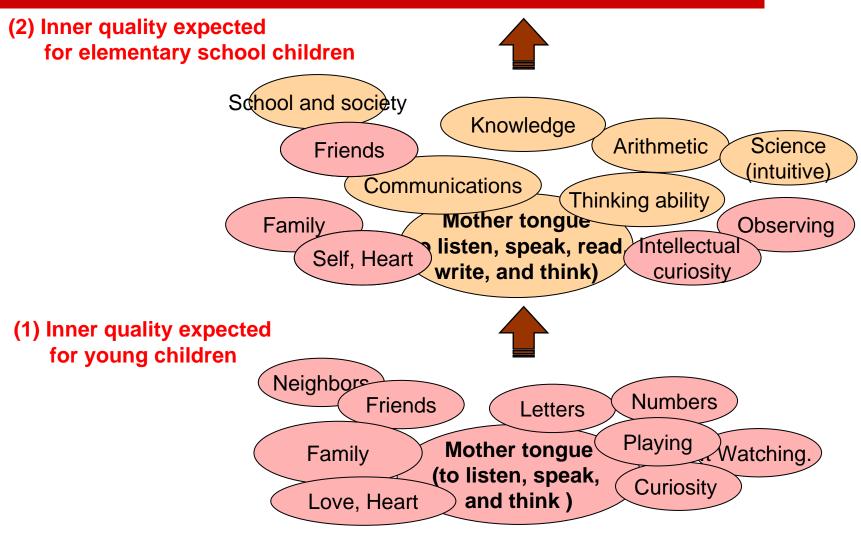
to apply it to problem-solving and task-achieving jobs in various domains in the whole country (and world)".

- [D] Modeling of tasks to achieve the goal (in TRIZ itself and in its activities).
- [E] Modeling of micro problem situations preventing TRIZ penetration.

 This serves for modeling concrete solutions to the problems.

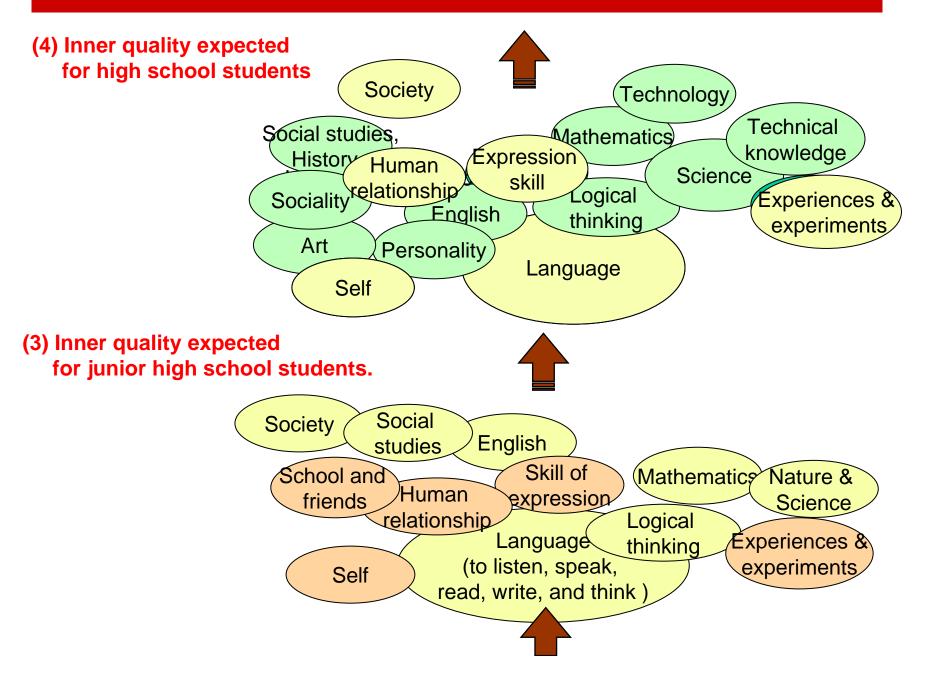
[A] Models of person's learning and industry's acceptance of techniques

[A1] Model of personal growth and expected inner quality (Part 1)

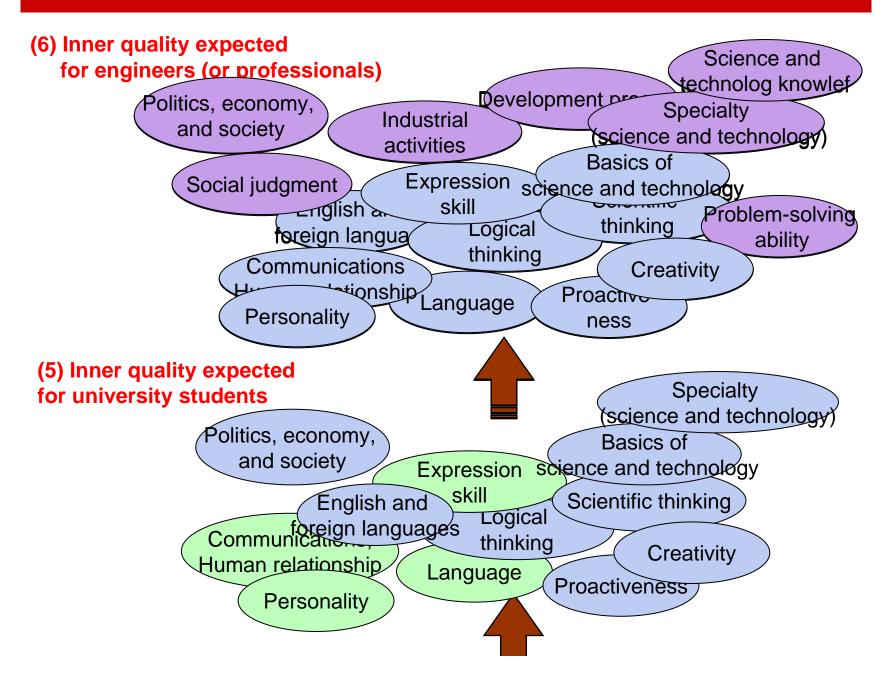




[A1] Model of personal growth and expected inner quality (Part 2)

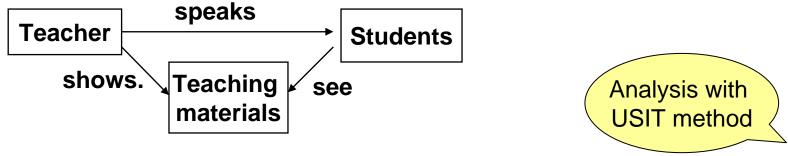


[A1] Model of personal growth and expected inner quality (Part 3)



Let's think about the mechanism of a class:

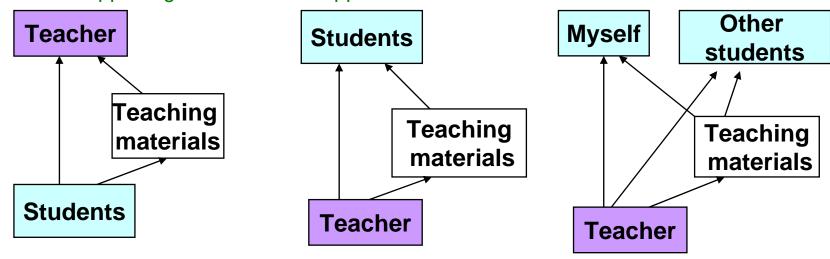
First, choose basic elements and draw the skeleton structure among them.



Put at the top the most important element for the purpose of "a Class".

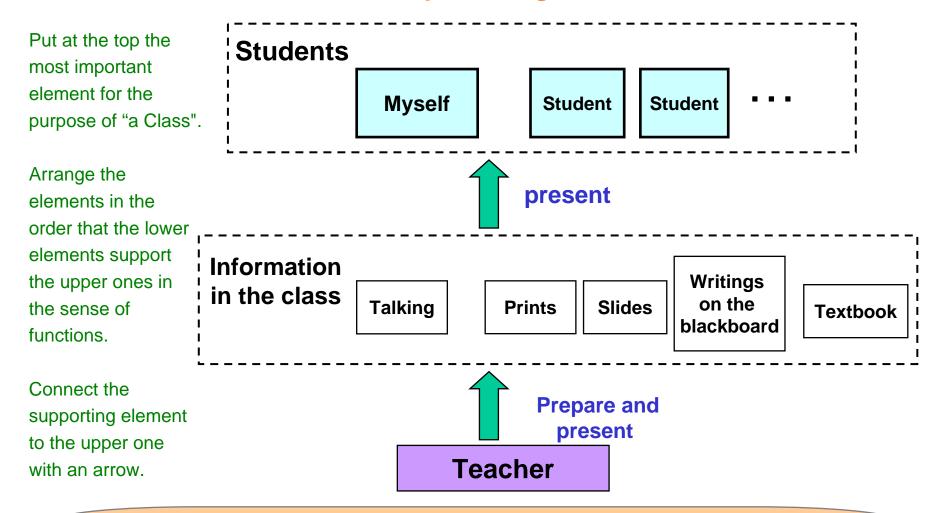
Arrange the elements in the order that the lower elements support the upper ones in the sense of functions.

Connect the supporting element to the upper one with an arrow with a note of its function.



[A2] Model of mechanism of a class (Part 2)

Show the functional relationships among the elements of the Class.



*** However, this figure is somewhat WRONG. ??? ***

[A2] Model of mechanism of a class

Students (myself) only receive the information presented in the class.

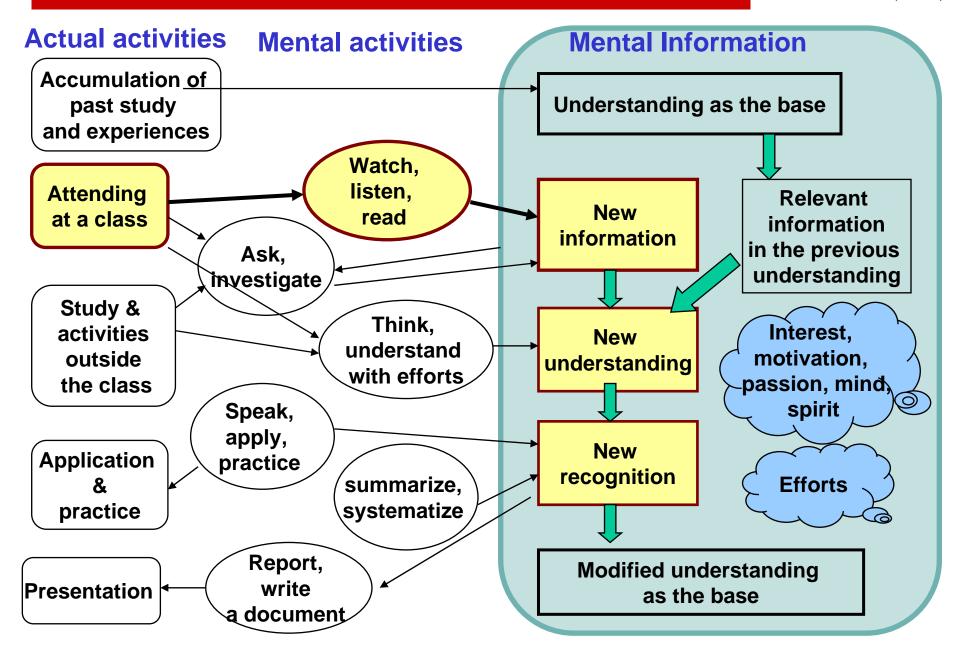
They are served but do not have their own activities, in this diagram.

The students' activities of "Learning" and "Understanding" are not expressed.

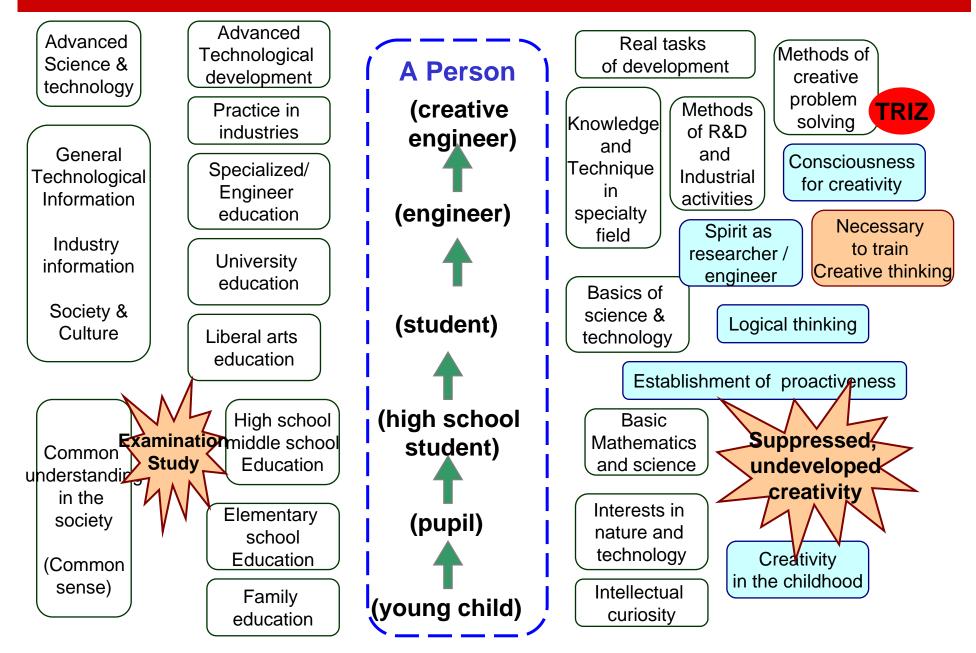
(Even if the students are sleeping, this "Class" functions well, the diagram says.)

The essential function is missing in this functional analysis. Students Myself Student Student Learn and understand **Present** for m **Information Writings Talking Prints Slides** Textbook on the in the class blackboard **Prepare and** present **Teacher**

Toru Nakagawa: OGU Lecture material (2007)



[A-4] Model of a person to learn and master a technique (i.e. TRIZ)



[A-5] Model of positioning (in life) of studying TRIZ (Part 1) Undergraduate students

Surrounding situations



My own activity



My mental situation

Drastically changing World

Advance of science & technology

Globalization of economy

Must study at higher levels Need to learn foreign languages

Advanced ICT society

Stagnation of Japanese economy

Difficult to

find jobs

Temptation to pleasure & entertainment

Aging population in Japan Hard living for family

Exam education overweighing knowledge memory

Apathy and living for the moment

Obtaining a job

Specialized subject (many)

Classes (basics of the specialty)

Many classes
(liberal arts,
seminars,
foreign languages)

part-time jobs (for long hours)

Playing (games, TVs, and PCs)

relationship with

females/males

wish and failure

Training of TRIZ thinking

TRIZ

Class

Endeavor to

find a job

Clubs, circles,

bands, etc.

Friends

bonds and friction

Family relationships (bonds and friction)

Sense of responsibility as a member of society

Study of basic

knowledge (science

technology

Study and master Creative thinking

Study and master logical thinking

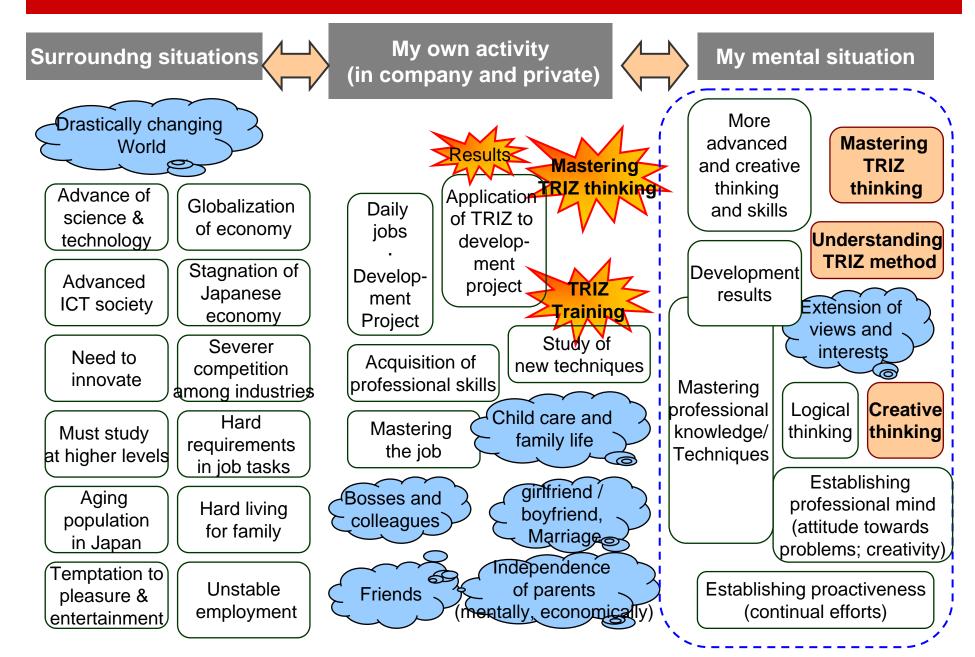
Find the direction of own life.
(Overcoming ' living for the moment')

Uncertain of the direction of own life (indecisive, postponing)

Establishing proactiveness

Lack of proactiveness (confidence and uneasiness) (pride and inferiority complex)

[A-5] Model of positioning (in life) of studying TRIZ (Part 2) Young engineers



[A-6] Model of introducing, applying, and spreading TRIZ in a company

External information

TRIZ Software tools

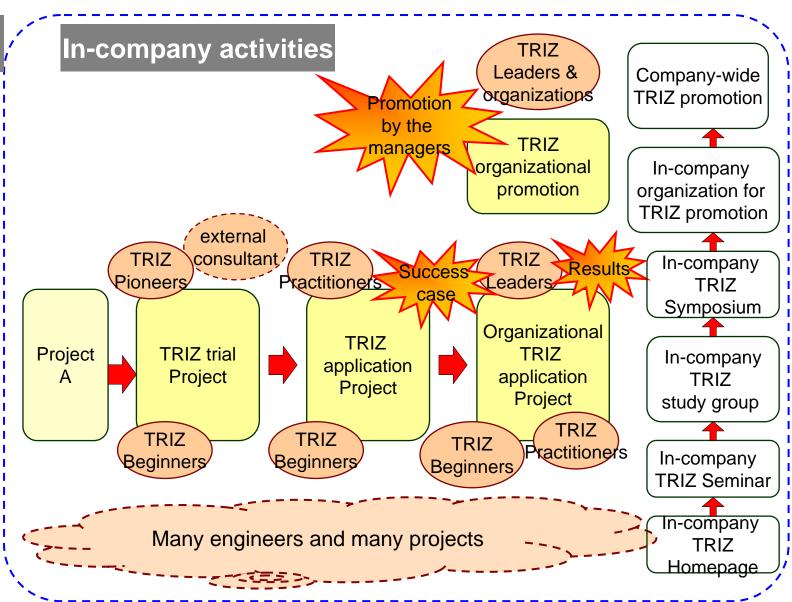
TRIZ Symposium

TRIZ Consulting

TRIZ Seminars, Training

TRIZ
Web sites,
Introductory
articles

TRIZ Textbooks



By merging the previous models, higher-level models can be derived.

[A7] Model of activities for an engineer and a company to learn and master TRIZ

(external information, growth of a person, and company activitesl)

[A3] Mental activities for learning and understanding

[A4] For a person to learn and master TRIZ

[A5] Positioning
(in life) of
studying TRIZ
(for a student,
a young engineer)

[A6] introducing, applying, and spreading TRIZ in a company

[A2] Mechanism of classes (necessity of self-study)

[A1] Personal growth and expected inner quality (young child →→ engineer)

[A-7] Model of activities for an engineer and a company to learn and master TRIZ

Personal study and growth **Activities in an industry External information** In-company **Specialized** TRIZ Organizational TRIZ Leader organization software, etc. Software tools TRIZ leaders and promoter Passion for TRIZ and mind Promotion Patent cases. promotion Systematic and Patent DB TRIZ by the Organizational practical mastering **TRIZ** managers applications activities Scientific Leaders Systematic TRIZ papers In-company journals **Application** understanding Real oplication promotion, and reports **TRIZ** In-company Domestic and Symposium, TRIZ Practice **TRIZ** International TRIZ Group experiences experiences Success study group conferences **Symposium** with success Understanding to TRIZ Dealers, TRIZ techniques **elopme** TRIZ Application oractitoners consultants. etc. Basic knowledge tasks consulting experience External TRIZ **TRIZ** Lectures, for myself consultants of TRIZ TRIZ seminars. **Trial and** seminars,. Awareness of Interest in TRIZ In-company trainings practice **Trainings** the issues TRIZ Seminars **Projects** TRIZ Knowledge and Web sites TRIZ In-company Methods of R&D. Web sites skills in Pioneers. TRIZ industrial activities specialty field Newspapers, TRIZ TRIZ Homepage TVs, magazines Basic knowledge of Introductory **Beginners** science & technology articles Many engineers Textbooks, Proactiveness, logical thinking, **TRIZ** books Spirit of a professional, creativity **Textbooks**

[B] Models of activities of TRIZ promoters

[B-1] Model of activities of various TRIZ promoters in Japan

The following organizations were described in the model.

- (case 1) (former) Mitsubishi Research Institute, Knowledge Creation Department
- (case 2) SANNO Institute of Management
- (case 3) (former) Nikkei BP, "Nikkei Mechanical' Journal
- (case 4) Japan VE Society Kansai Branch, TRIZ Usage & Spreading Study Group
- (case 5) (former) Prof. Y. Hatamura's group at The University of Tokyo
- (case 6) Osaka Gakuin University, Prof. Toru Nakagawa
- (case 7) IDEA Co.
- (case 8) Japan TRIZ Society

The Model describing (case 6) is shown in the next slide as an example. The central part of model A-7 is replaced with the activities of the organization.

Next we should think how to organize the 'external information' by some cooperative activities in the TRIZ community in Japan.

[B-1] Model of activities of TRIZ promoters (Case 6) T. Nakagawa (OGU)

External information

Activities by T. Nakagawa (OGU)

Activities in an industry

Organizational

Specialized software, etc.

TRIZ Software tools "TRIZ Home Page

In-company

Patent DB

Patent cases, TRIZ applications

Gakuin University

Nakagawa

Osaka

Education

Scientific iournals

TRIZ papers and reports

Toru

International conferences

Domestic and International conferences

TRIZ **Symposium**

USIT Trainings

Dealers. consultants. etc.

TRIZ consulting

TRIZ seminars.

trainings

Japan

TRIZ Symposium

TRIZ Society

TRIZ textbooks

MPUF USIT/TRIZ Study

Group

Papers, articles

Update

Lectures, seminars...

Trainings

Web sites

TRIZ Web sites

Newspapers, TVs, magazines

TRIZ Introductory articles

TRIZ **Textbooks** in Japan"

Research

Lectures and seminars

Program Chair

Mann ; L. Ball, etd.

(contributed & own)

announcements

organization TRIZ leaders for TRIZ Promotion promotion by the **TRIZ** managers Leaders In-company **TRIZ** In-company Symposium. **TRIZ** Success study group TRIZ practitoners External TRIZ **TRIZ**

consultants **Trial and** In-company practice TRIZ Seminar\$ **Projects**

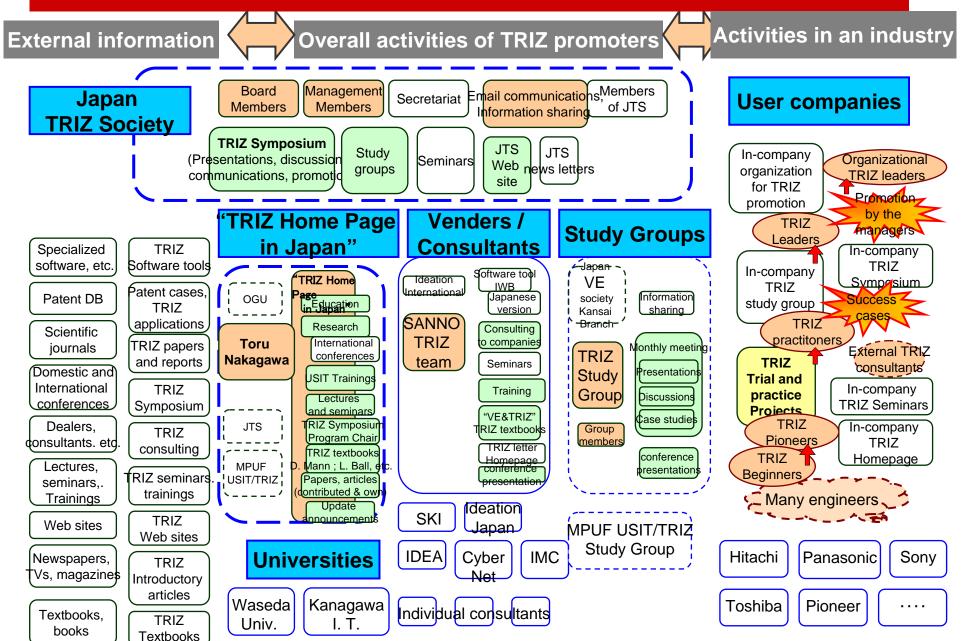
TRIZ In-company Pioneers TRIZ TRIZ Homepage

Beginners

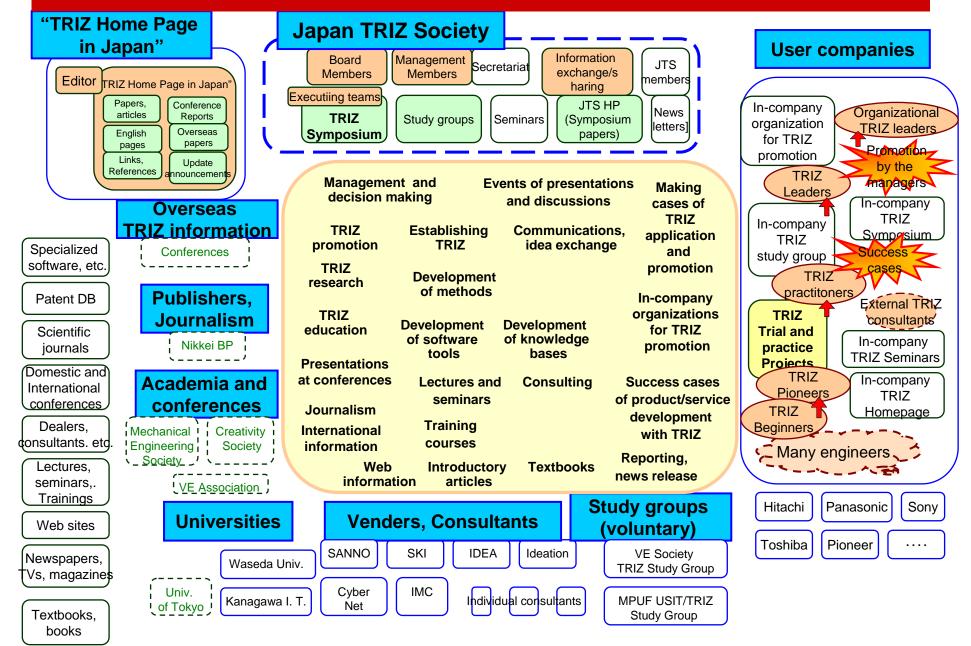
Many engineers

Textbooks, books

[B-2] Model of overall activities of TRIZ promoters in Japan (current)



[B-2] Model of overall activities of TRIZ promoters in Japan (Merged)



[C] Modeling of areas for TRIZ application and penetration

[C-1] System of TRIZ (and USIT) methodology (present)

Presented at **MPUF USIT/TRIZ** Study Group (2012)

Variety of methods for technology development

Finding problems and tasks in the real world

Focusing down the problem and stating the task to achieve

TRIZ

Thoughts of evolution of technological system

Methods of problem solving

9-screen

method

Su-Field / **Function** analysis

Technical contradictions.

Contradiction matrix

Physical contradictions

IFR

SLP

Knowledge bases in technology

Effects KB

Technology KB classified by function 40 Inventive principles and their examples

USIT

Whole process (Six-box scheme)

System of

techniques,

Textbooks

examples

Tools and

bases

Training

Knowledge

Defining the problem

Understanding the present system Application

Image of the ideal system

Generation of ideas

Construction of solutions

Constructing the solutions

Implementing the solutions

Evaluating the solution in the real world

Software tools for problem solving

General information of science and technology

Patent information

Knowledge and techniques in specialty fields

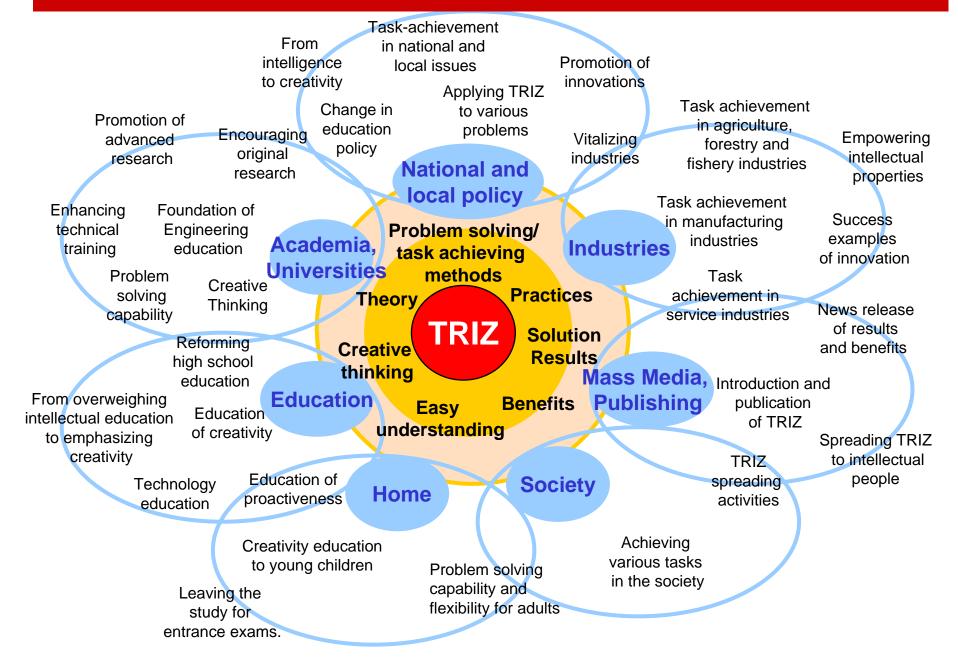
Specific concepts. theories, and methods system analysis

methods of

Design methods

Designing, manufacturing, sales, etc. Corporate base and Industrial infrastructure in the real world

[C-2] Model of areas for TRIZ application and penetration



[C-3] Model of areas for TRIZ application → Our new general target

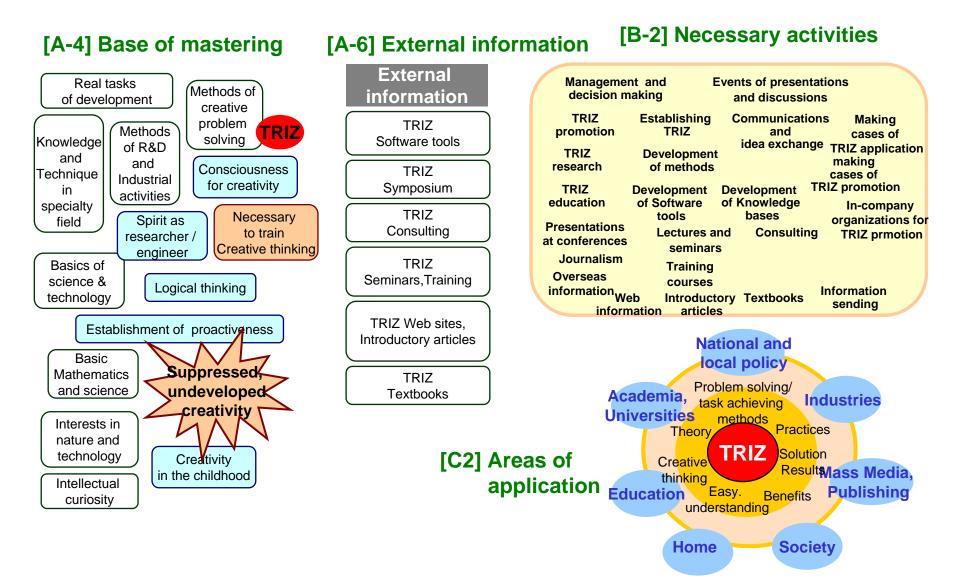
Creative Problem Foundation of **Enhancing** Encouraging Promotion of problem solving Creative Academia. solving advanced Engineering technical original **Thinking** /task achieving **Universities** capability training education research research methods (various Reforming Education From overweighing Technology **Education TRIZ** high school of creativity intellectual education education education to emphasizing creativity areas Education of Creativity education Leaving the study Problem solving/ Home proactiveness to young children for entrance exams. task achieving Things methods of problems/tasks Problem solving Achieving Theory capability and various tasks **Society** flexibility for adults in the society we need to provide Creative thinking Introduction and TRIZ spreading Spreading TRIZ News release Mass media, publication activities to intellectual of results **Publishing** of TRIZ and benefits people Easy. understanding Task achievement Success Task **Empowering** to apply Task achievement achievement in in agriculture, examples intellectual **Industries** in manufacturing **Practices** forestry and service industries of innovation properties industries fishery industries Solution TRIZ Change in Task-achievement From Applying TRIZ Promotion of Results **National &** education intelligence innovations to various in national and Vitalizing local policy policy to creativity problems local issues industries Benefits

General Target (Task Requirement):

To establish a methodology of creative problem-solving / task-achieving, to spread it widely, and to apply it to problem-solving and task-achieving jobs in various domains in the whole country (and world)".

[D] Models of tasks to achieve the goal (in TRIZ itself and in its activities).

process: From the models we built so far, the parts relevant to the tasks are collected:



[D-1] Model of establishing & promoting TRIZ and their results (working)

Task: To establish a methodology of creative problem-solving / task-achieving, and to spread it widely

Creative **Establishing TRIZ** problem solving TRIZ Method /task achieving research methods presentation at conferences Problem solving/ task achieving **Things** methods Theory We Creative need to provide thinking Easy. Web Introductory understanding articles **Practices** Solution Results

Benefits

Software tools Knowledge base development development Meetings for International Meetings for presentation communication conferences & discussion research information Real application of TRIZ Application In-company Success In-company Consulting experiences promotion Cases Promotion organization **Education and spreading of TRIZ** Lectures. **Trainings** information seminars **Journalism Public Textbooks** Reporting results of TRIZ reporting Management, Strategy **TRIZ** promotion meetings

Necessary Outputs

TRIZ Software tools

TRIZ Symposium

TRIZ Consulting

TRIZ lectures, seminars, trainings

TRIZ education

TRIZ Web sites Introductory articles

> TRIZ Textbooks

Note: The 5 main tasks described in the center are mutually related. Such relationship should be expressed in a better way. is the items relevant to TRIZ itself..

[D-2] Model of activities for achieving the tasks

Task: To establish a methodology of creative problem-solving / task-achieving, and to spread it widely

Development of method Education and spreading Promotion ["TRIZ Home Page Research of Development of Introductory Strategy, Spreading in Japan"] software tools TRI7 articles Management with Web site [JTS Home Page] methods **News letters** Development of [Japan TRIZ society] **Trainings** Research Textbooks. Lectures. knowledge bases Consulting of USIT publications seminars Software tools, **International cooperation Knowledge bases Easy** Wide International **Textbooks** Theory Inderstanding/ spreading Creative translation conferences of the problem-solving Teaching methods Creativ task-achieving / materials thinking **Holding conferences** methods Reporting the results Solution presentation, Results **Practices** Spreading Journalism discussion, communication **Benefits** information [TRIZ Symposium] **Practices of application and promotion**

Information exchange

Email Information Communication sharing

Application In-company
experiences promotion
Success in-company
cases organization for TRIZ

Note: [] shows the current effective activities

[D-3] Model of "Creative problem-solving/task-achieving methods" (for technology)

Requirements at the preceding stage

Able to solve problems creatively in the fields of Science & Technology

Requirements at the succeeding stage

Applicable widely to science & technology

Mechanical, electrical/electronic, chemical, etc.

biological, medical, etc.

Using effectively the whole information in science & technology

Implementing the S & T information in the method.

Effectively using patent information

Possible to use concepts, theories, and methods in the subject-matter fields.

Use the method of system analysis in the subject-matter field.

Clear relationships with methods for technology development

Able to find and understand the problem in the real world

Able to focus down the problem and clarify the task.

Able to refer to S & T information whenever necessary

Able to apply to preparing for patents

Able to apply for circumventing existing patents.

Able to transfer knowledge and techniques in other areas.

Whole procedure

Consistent whole procedure

Simple/ specialized processes

Finding the problem

Understanding the problem systematically

Consider the goals and tasks

Consider from broad perspectives

Focusing the problem

Understanding the present system

understanding difficulties and root causes Understanding the mechanism of the present system

Functions & space & time charattributes acteristics

time characteristics

Clarifying contradictions

Examine various Learn similar tasks present solutions in different fields

of the ideals properties

Imaging the ideals

Desirable

Collection

hints

of possible

behaviors &

Generating ideas

Techniques of idea generation

Thinking

the images

Generate ideas as widely as possible

Identifying excellent ideas

Consider

Resolve

contra-

dictions

the direction

of evolution

Constructing solutions

Extending the ideas

Designing new solutions

Solving secondary problems

Application

examples

Improving solutions with the ideas

Introducing good ideas used in different fields

Identifying and evaluating excellent solutions

Software tools &

knowledge bases

Able to construct solutions

Able to use designing techniques in the subject-matter field

Able to implement the solutions

Coordinated with methods for implementing solutions (CAD/CAE/CAM, Taguchi method, etc...

Able to evaluate the solutions in the real world

Coordinated with industrial and company infrastructure, e.g., designing, manufacturing, and sales

Introductory articles & materials

Easy-to-understand methods.

Textbooks of the methods

Practical application methods

Chances to learn

Chances of training

[D-4] Model of "Creative problem-solving/task-achieving methods" (for non-technology areas)

Requirements at the preceding stage

Applicable widely to non-technological areas

> Areas related to humans, society, business, etc.

From wide perspectives on world situations, society, etc. and also with delicate sense of humans

Using various preceding methods

> TRIZ is extended from technical to non-technical areas.

Effectively using the knowledge of different areas

Possible to use concepts, theories, and methods in the subject-matter fields.

Use the method of system analysis in the subject-matter field.

Considering from wide perspectives on world situation. history, etc.

Able to find and understand the problem in the real world

Able to focus down the problem and clarify the task.

Able to refer to many previous cases and knowledge whenever necessary

Able to apply for policy making and solution planning

Able to apply for finding solutions in the cases of serious conflicts of interests/ opinions

Able to merge the knowledge and abilities of all the persons involved

Able to solve problems creatively in non-technology
Requirements fields (e.g., humans, society, business) at the

Whole procedure

Consistent whole procedure

Simple/ specialized processes

Finding the problem

Understanding the problem systematically

Consider the goals, tasks. and visions

From multiple perspectives

Focus the problem

generation Consider in steps

Understanding

Clarifying

contra-

dictions

the present system understanding Understanding difficulties and the mechanism of the present system

Functions & properties of organizations & persons

Examine

preceding

Introductory

articles &

materials

Easy-to-

methods.

understand

cases

root causes

space & time characteristics

Learn similar tasks in different countries. companies, and fields

Textbooks of

the methods

Practical

methods

application

Thinking

of ideals

the images

Techniques

of idea

List up the ideas as widely as possible

Constructing solutions

Stating

vision

Collection

of possible

hints

the

Generating ideas

Consider the

directions &

Resolve

excellent ideas

Identifying

conflicts &

contradictions

steps of evolution

Extending the ideas

Designing new solutions

Solving secondary problems

Identifying and evaluating excellent solutions

Improving solutions

with the ideas

Introducing good

ideas in different

countries and fields

Application examples (with the results)

Chances

to learn

Chances of training

Methods to transfer to different fields

Software tools &

knowledge bases

succeeding stage Imaging ideals & visions

Able to

construct solutions

Able to use methods and institutions in the subject-matter field

Able to implement the solutions

Coordinated with various methods & institutions for implementing solutions

Solutions are effective and beneficial in the real world

Coordinated with real-world infrastructures. e.g., society, culture, and environment

[D-5] Model of areas for applying our 'Creative PS/TA Methods'

Stage 3 in our general target: To apply widely **Development area Emphasis** area **Problem** Promotion of Foundation of Enhancing **Encouraging** Academia, Creative Creative solving advanced original **Engineering** technical **Universities Thinking** (various capability research education training research PS/TA Reforming From overweighing **Education** methods Technology **Education** high school intellectual education of creativity education education to emphasizing creativity Problem solving Creativity education Education of Leaving the study for Home task achieving to young children entrance exams. proactiveness methods **Things** 으 **Achieving Problem solving** Theory problems/tasks various tasks **Society** capability and in the society flexibility for adults Creative we need to thinking **TRIZ** Introduction News release Spreading TRIZ Mass media. spreading & publication to intellectual of results **Publishing** activities of TRIZ and benefits understanding people provide **Empowering** Success in agriculture. Task achievement **Practices** in service to apply) intellectual examples **Industries** forestry and in manufacturing industries of innovation properties fishery industries industries Solution Results Task Change in From **Applying TRIZ** Vitalizing Promotion of **National &** achievement intelligence education to various innovations industries local policy in national and Benefits to creativity policy problems local issues

Note: Actually, we should find and get specific opportunities to try and apply the Creative PS/TA methods. Development of the method and extension of application area should be carried out in parallel. .

Conclusion

- 1. For finding and understanding the non-technology problem in complex situations, **a method of building models viewed from multiple perspectives** is demonstrated.
 - -- Each model illustrates the problem system from a different perspective.
- 2. Multiple models are found useful for understanding the problem from different perspectives, considering the present system and ideal system, and thinking of solution directions
- 3. Throughout the presentation, a problem is illustrated as an example: "What should we do to penetrate TRIZ into younger people?"
- 4. The key to the penetration is reconfirmed to be "the method should be easy to understand and effective to apply depending on the user and the application field".
- 5. We obtained the statement of **General Target**: "To establish a methodology of creative problem-solving / task-achieving, to spread it widely, and to apply it to problem-solving and task-achieving jobs in various domains in the whole country (and world)".
- 6. We also obtained the directions of activities toward this target.