

# Teaching Creative Thinking and Problem Solving Skills by TRIZ

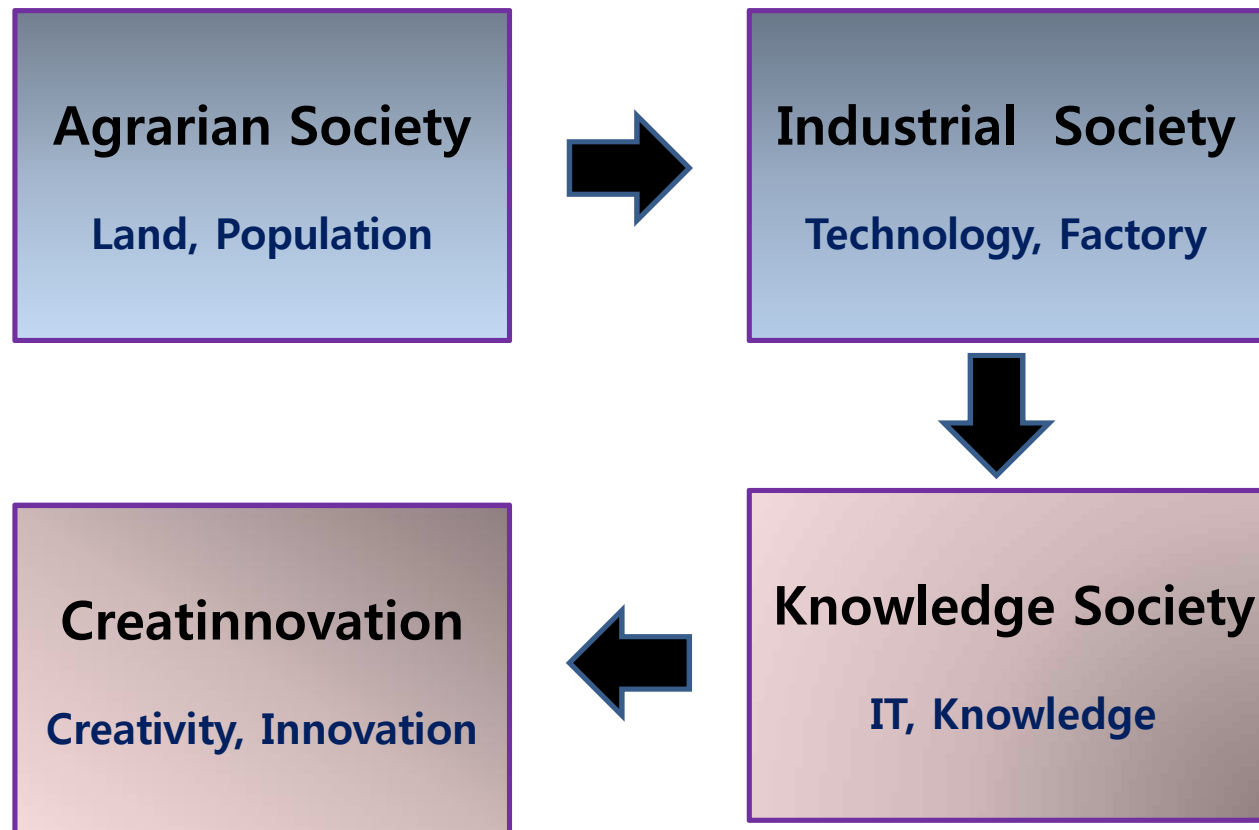
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# The flow of ages

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## What is creativity?

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The opposite concepts:

**Banality, Stereotypical Thinking : “다 그래”**

**Typical Answer**

**Common Sense**

## What is creativity?

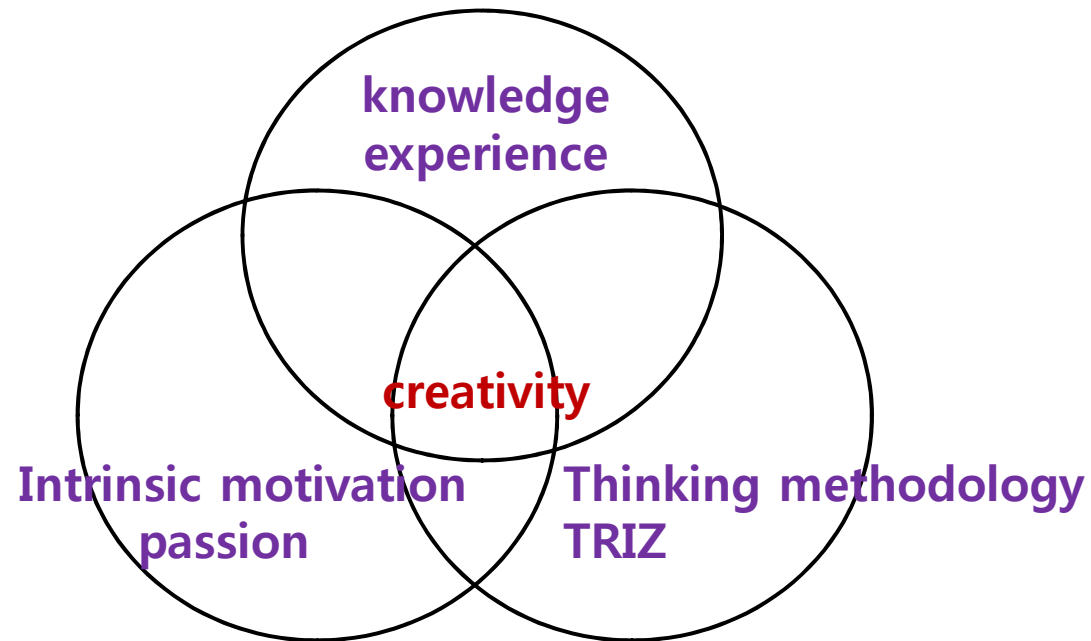
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- Creativity – from Latin word “creatio”
- The ability to use your imagination to produce or use new ideas – Longman Dictionary
  
- Creativity contains the following factors ;
  1. New/unique - Originality
  2. Usefulness
  3. Effectiveness (economical)

# What is creativity?

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- What do we need to be creative ?



Torrance(1979)

# 트리즈(TRIZ) : 통합적 문제 해결 방법론

Integrated thinking methodology for problem solving



## What is TRIZ ?

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- TRIZ – Theory of Inventive Problem Solving  
창의적 문제해결 이론이란 뜻의 러시아어 약자  
(Teoriya Resheniya Izobretatelskih Zadach)
- G. Altshuller began to make the theory of TRIZ from 1946
- Having analyzed more than 200 thousands patents, he extracted common creative principles of problem solving and made TRIZ theory
- Powerful methodology of creative thinking and innovation
- Recently spread to many worldwide big companies like BMW, Intel, Samsung and proved to be very effective and practical
- It helps to improve creative thinking

# What is TRIZ ?

- TRIZ works in many companies



Samsung. Intel, Boeing  
BP Amoco , Chrysler Corporation  
Dana Corporation, DTM Corporation  
Emerson Electric Company  
Ford Motor Company  
General Motors Corporation  
Goodyear, Hewlett Packard Company  
Honeywell, Inc. Johnson & Johnson  
Lockheed Martin Corporation  
Lucent Technologies  
Massachusetts Institute of Techn.

Motorola  
NASA  
National Semiconductor Corporation  
Navistar International Corporation  
Nordak Innovatikk AS  
Nortel (Northern Telecom)  
Nupro (Swagelok Company)  
Pratt & Whitney  
Ridge Tool Company  
Rockwell International  
Solarex Corporation  
United States Air Force  
Xerox Corporation

...



# What is TRIZ ?

## 러시아식 경영혁신 '트리즈' 효과만점

# 삼성전기 1년만에 불량률 절반으로

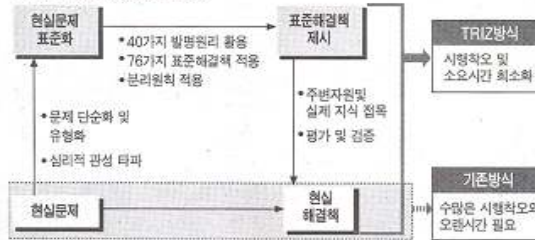
삼성전기 반도체용 기관 개발팀은 올초 '2007년에 출시될 차세대 제품을 개발하라'는 주문을 받고 고민에 빠졌다.

머리카락 굵기의 4분의 1에 불과한 각종 회로들이 얽혀 있는 기존 기관보다 회로선폭이 2배 이상 좁은 제품을 만들어내는게 이들에게 떨어진 일이었다.

다른 건 별 문제 없이 해결됐지만 회로에 금속도금을 입히는 문제는 도저히 풀리지 않았다. 도금 표면을 균일하게 하기 위해선 도금 두께를 최대한 얇게 해야 하지만, 이럴 경우 상당수 회로에 도금액이 침투하지 못하기 때문. 도금을 두껍게 하면 침투 문제는 해결되는 반면 표면을 균일하게 처리할 수가 없었다. 도금액의 성분을 바꿔보는 등 다양한 시도를 해봤지만 허사였다. 불량률은 너무 높았기 때문이다. 트리즈(TRIZ) 기법을 적용한 것은 이 때부터였다.

트리즈란 '창의적인 문제해결'이란 러시아어의 앞글자만 딴 것으로, 러시아 발명가 겐리히 알츠홀

TRIZ 활용한 문제해결 과정



## 연구 과제에 의무적용 ... 해외사업장으로 확산

러가 1946년 개발한 '발명 방법론'. 그는 "천재가 아니어도 발명할 수 있다"는 생각에 50여년간 전 세계에서 출원된 특허 2백만건을 분석한 뒤 새로운 발명이나 아이디어를 생각해내는 공통된 유형과 방법론을 찾아내 프로세스화했다. 다른 산업이나 공장에서 유사한 모순을 해결한 경험을 원용해 해결책을 모색하는 기법이 바로 트리

즈다.

남창현 선임연구원은 "도금을 얇게 해야 하지만 얇게 해서 안 되는" 모순을 극복하기 위해 트리즈 기법상 '시간에 의한 분리'와 '공간에 의한 분리' 원칙을 적용했다. 이러자 해결책이 나왔다. 도금 두께가 얇아야 할 부분과 얇지 않아도 될 부분을 구분한 뒤 도금을 나눠서 실시한 것. '도금은

한번에 해야 한다'는게 워낙 오래된 관행이었기 때문에 분리해서 도금한다는 것은 어느 누구도 생각하지 못했다.

효과는 대만점. 불량률은 절반 이하로 떨어졌다. 설비를 바꾸지 않고 공정 프로세스 개선만으로 이 만큼의 성과를 올린 것이다. 이를 확대 적용할 경우 효과금액이 연간 수백억원에 달할 것이란 게 회사측 설명이다.

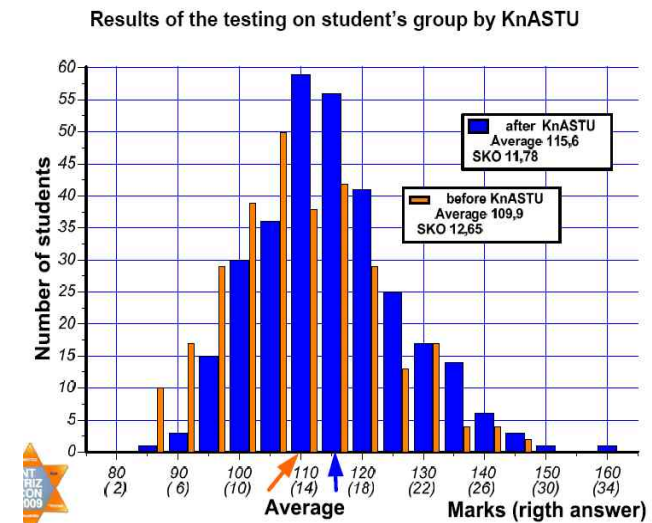
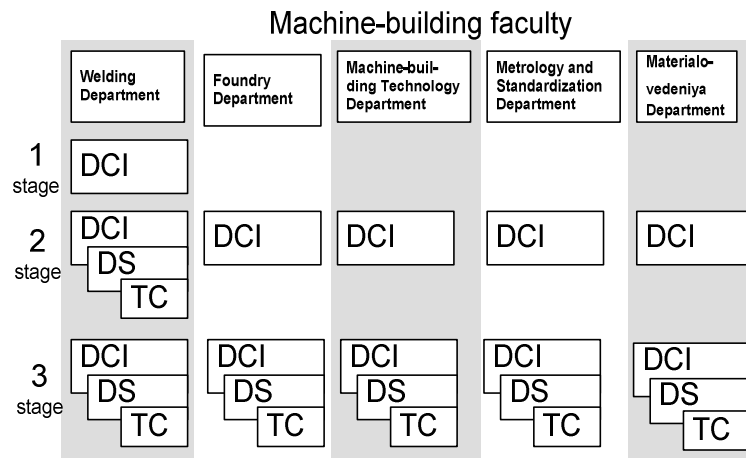
삼성전기는 최근 수원사업장에서 '트리즈 경진대회'를 열고 이 사례를 비롯한 12건을 우수 사례로 선정했다. 회사측은 올 한해 트리즈 기법을 활용해 28건의 특허를 따냈으며, 1백억원이 넘는 성과를 냈다고 설명했다. 삼성전기는 2001년 시범도입한 트리즈가 큰 효과를 내는 것으로 검증되자 올해 들어 모든 연구개발 과제에 대해 이를 의무적용토록 한 데 이어 내년에는 해외 사업장으로 확대하는 등 '트리즈 경영'에 박차를 가하기로 했다.

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# TRIZ application in education

## Komsomolsk-na-Amure State Technological University(Russia)

- They teach TRIZ for 3-4 semesters
- After TRIZ studying the average level of IQ increased from 15 % to 30% according to the number of correct answer -- by Victor Berdonosov, 2007 the III TRIZ symposium in Japan



창의성은 과학이다

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# Goal of Education

Improving the ability of **Problem Solving**

# Problem is :

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Difference



Education

Problem

# TRIZ – creative thinking and problem solving methodology

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## TRIZ

- **Systematic Analysis Method (multi screen thinking, substance-field analysis, function analysis, function-cost analysis, cause-effect analysis...)**
- **Resource**
- **Ideal Final Result (IFR)**
- **Contradiction (administration contradiction, technical contradiction, physical contradiction)**
- **Solution Methods (40 inventive principles, separation principles, effects, standards)**
- **The Trend(Law) of Technical System Evolution**

# MATRIZ Certification Standard

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## Level 1

TRIZ. Sources and components of TRIZ.

The notion of Engineering system (ES) and its functions. Supersystems and subsystems.

Inventive situation and inventive problem, mini problem. Non-desirable effect (NE). Cause-effect chains as a means for identifying key NE.

A tree of goals and use of this tree in the analysis of inventive situation.

Ideality, ideal final result (IFR) as an operator for selecting a direction for problem solving.

Resources, types of resources. System analysis as a tool for search for resources.

Contradiction (EC, PC), problem solving as optimization and as contradiction resolution. Techniques for eliminating EC.

Trends of engineering systems evolution.

### **Requirements to level of competence:**

1. Understand the essence of TRIZ and be able to render it in own words.
2. Know the fundamental notions of TRIZ (within the scope of proposed minimum) and be able to illustrate it with own examples.
3. Find subsystems and supersystems of specified object.
4. Find a key NE via construction of cause/effect chains.
5. Formulate EC.
6. Work with the Table of EC resolution.

### **Grounds for certification:**

Oral or written examination.

**Volume of recommended training load: 12-24 hours**

# MATRIZ Certification Standard

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## Level 2

Trends of engineering systems evolution.

Analysis of initial situation (in-depth exploration and analysis).

DTC operator (Dimension - Time - Cost).

IFR, a step backward from IFR. Practice of using IFR for solving inventive problems.

The notion of Su-Field. Su-Field analysis. Synthesis of engineering solutions using Su-Field analysis.

Standards. Application of standards for inventive problem solving.

Effects (physical, chemical, geometrical). Application of these effects for problem solving.

ARIZ-85 (acquaintance). Structure. Logics. Tools. Macro- and micro-levels of PC. Method of smart little men.

Comparative analysis of existing methods and TRIZ: Brainstorming, Synectics, Morphological analysis and synthesis. Main principles and area of application. Versions of methods.

### **Requirements to level of competence:**

1. Illustrate the main notions of TRIZ with own examples.
2. Use the notion of IFR in problem solving
3. Be able to solve problems using Su-Field analysis.
4. Be able to solve problems using standards
5. Be able to use effects in problem solving.
6. Know the structure of ARIZ, have skills of formulating macro- and micro- PC.
7. Be able to use the method of smart little men in problem solving.
8. Application of studied TRIZ tools for solving training problems.
9. Knowledge of main principles and fields of application of other methods.

### **Grounds for certification:**

- Course paper
- Written examination

**Volume of recommended training load:** 40-80 hours

# MATRIZ Certification Standard

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## Level 3

Application of ARIZ-85B for problem solving.

Lines of engineering systems evolution, forecasting of development.

VEA (Value Engineering Analysis). Main principles and possible fields of application. Stages of VEA.

Employment of VEA for improving devices and technologies.

Research problem, method for problem inversion.

Failure anticipation analysis.

Place of TRIZ in the system of innovative methods.

Examples of using TRIZ in non-engineering spheres.

Review of modern TRIZ tools (Function analysis of Inventive situation - FAIS, integration of alternative systems developed by Gerasimov, Algorithm of inventive problem selection - AVIZ, Trees of evolution)

## Requirements to level of competence:

1. Illustrate the main notions of TRIZ with own examples.
2. Analysis of inventive situation (using one of the methodologies accepted in TRIZ).
3. Problem solving using ARIZ-85B.
4. Ability to "convert" a research problem into an inventive one.
5. Forecasting the evolution of an engineering object.
6. Failure anticipation analysis.

## Grounds for certification:

- Diploma paper

**Volume of recommended training load:** 40-80 hours



# TRIZ – creative thinking and problem solving methodology

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## TRIZ Education

1) For Students of Korea Polytechnic University;

third, fourth year students

Fall semester, 2010

Program : MATRIZ Level 1, part of 2

Faculty name	Mechanical	Mechatronics	Electronic	Game Engineering	New Materials	Design	E-business	Nano-optics	Total
# of attendees	2	5	3	1	7	2	2	10	32

# TRIZ – creative thinking and problem solving methodology

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## TRIZ Education

2) For outside volunteers (not from KPU);

Attendees : professors, researchers, CEOs, managers, etc

Education hour : 88 hours

Program : MATRIZ certification program, Level 1, 2, 3

Type of Organization	University	Institute	Company	Other	Total
# of attendees	10	2	8	3	23

# TRIZ – creative thinking and problem solving methodology

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## TRIZ Education Result

### 1) Result of students' education – by survey on the questions;

question	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Has TRIZ developed problem solving skill ?	72%	20%	8%	0	0

question	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Do you think you can solve any problem you meet ?	44%	48%	8%	0	0

question	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Did TRIZ help you to develop thinking skill/creativity ?	68%	32%	0	0	0

# TRIZ – creative thinking and problem solving methodology

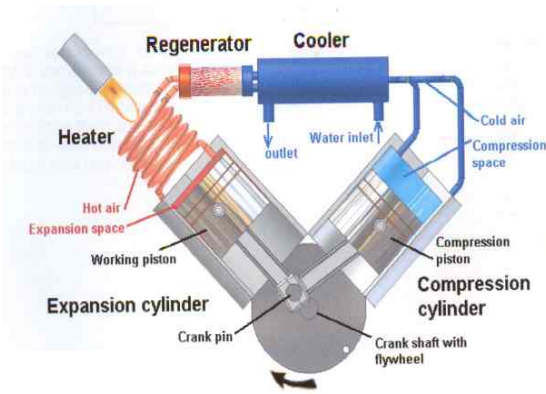
## TRIZ Education Result

2) Result of TRIZ education of MATRIZ Level 3 course

All attendees could have solved their own technical or non technical problems;



Condensation of interior wall



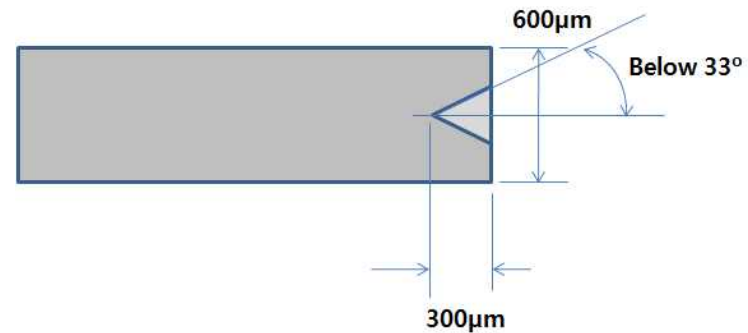
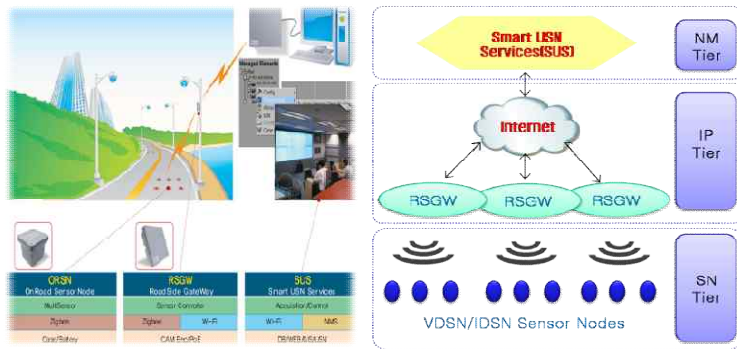
Increase the efficiency of stirring engine



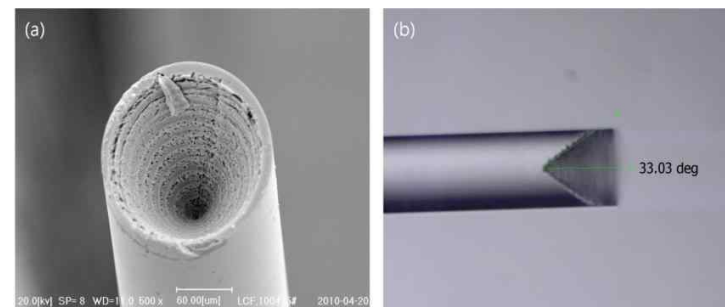
Surge detecting and monitoring system

# TRIZ – creative thinking and problem solving methodology

## TRIZ Education Result



ITS System



Endoscope optical fiber tip

# TRIZ – creative thinking and problem solving methodology

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## Conclusion

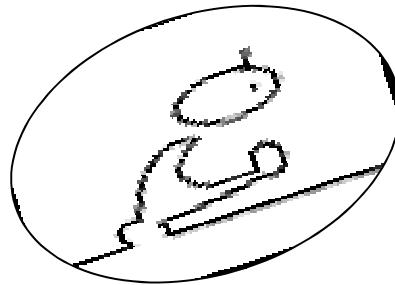
1. Students perceived that their problem solving skills had been enhanced by the TRIZ course.
2. TRIZ contributes very much to systematic and creative thinking and solving problems.
3. TRIZ gives people confidence and helps them to believe that they can solve unfamiliar problems they meet;

*“This course contributes to my confidence in tackling unfamiliar problems”*

- response of TRIZ course attendees -

**누구나 창의성에 도달할 수 있다!**

**창의성은 과학이다!**



**감 사 합 니 다**