

Learner-focused Teaching

Applied to the Use of Resources in TRIZ Problem Solving

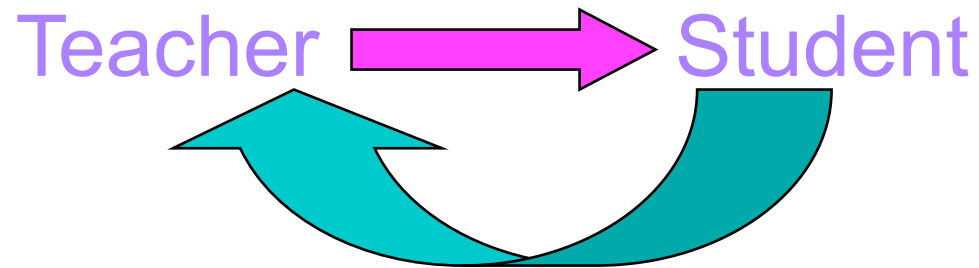
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Learning TRIZ \neq Teaching TRIZ

Teaching:



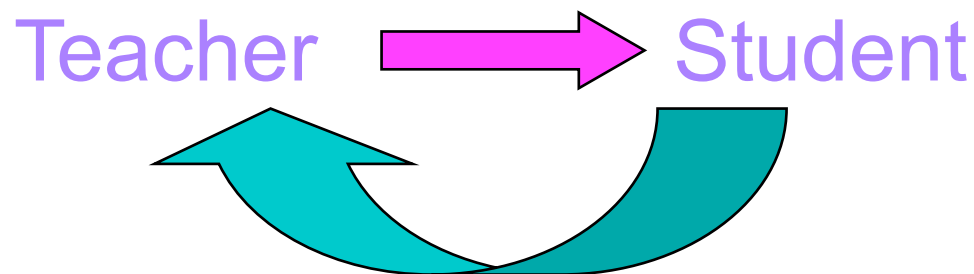
Teacher-oriented Classical Method

1. Tell them
2. Show them
3. Let them try
4. Give feedback

Teacher  Student

The Complete Technical System Model Improves Teacher-Centered Training

- 4 Elements of the tool system
 - Energy source
 - Energy transmission
 - Tool
 - Guidance & Control
- The object



TRIZ Fundamentals Applied to Teaching/Learning

**Somebody, Someplace,
Has Solved this Problem**

Find that solution and apply it to your situation.

Bloom's New Taxonomy Is Learning-Centered

Level	Name	Description of student's success
1	Remembering	Retrieving, recognizing, recalling knowledge
2	Understanding	Constructing meaning, interpretation, inference, comparison, explanation
3	Applying	Using a procedure, demonstrating execution of a process, implementation
4	Analyzing	Determining how the parts of a system relate to each other and to the overall system
5	Evaluating	Making judgments based on criteria and standards
6	Creating	Putting elements together into a new pattern or structure

Typical TRIZ Training and Bloom's Taxonomy

- Initial “practioner-level” TRIZ training → Bloom 3 for basic TRIZ problem-solving concepts (use it in new situations)
- Mid-level → Bloom 3 for TRIZ problem-solving and technology forecasting concepts (use more, integrate)
- Advanced → Bloom 5, 6 (new applications, new contributions)

Clark's Method: Each Item Requires a Specific Process

- **Fact: Unique information, specific data**
- **Concept: Representation of ideas or objects with common characteristics**
- **Process: How “it” works. A process is composed of many procedures**
- **Procedure: Routine tasks, clearly defined steps**
- **Principle: Strategic tasks, value-based, knowledge-based.**

“Resources” is a Concept but Learners Want a Process

- Applies to both uses of resources
 - Use of resources as stand-alone tool for problem solving
 - Use of resources as key to achieving ideality and mini-problem solutions
- Resolution: Provide 2 processes
 - Process for identifying the available resources,
 - Process for applying the resources and their attributes to solving the problem

Students Are Self-Motivating

- *Speed of implementation:*
 - The materials, energy, information, and properties of the resources are already understood in the organization
 - Use of familiar elements also results in no need to re-educate employees or customers or suppliers.

Students Are Self-Motivating

- *Speed of approval in regulated situations.*
 - Use of resources from the current system can help avoid years of certification and approval actions for pharmaceutical companies, military contractors, food providers, medical device developers
 - This is also true for second and third tier suppliers in automotive, aerospace, and other industries where changes (to parts, to software, to test methods, to materials, etc.) require multiple levels of acceptance testing.

Students Create Their Own Examples

- Teacher mentions the speed of implementation and speed of approval that can result from use of resources.
- Students recall one situation in their organization where they solved a problem using a resource, and what the benefits were.
- Start building the organization's library of cases.

Use Examples to Teach Concepts

- *Examples must be relevant to learner.*
 - Physical contradiction: Familiar but unfamiliar
- *Examples must be fresh*
- *Learners need to work with various examples*
 - Simple-complex
 - Technical-social-management
 - Observation: examples don't have to be presented in order of increasing complexity, or of increasing abstraction, if discussed and explained

Leave the Classroom to Find Examples: Grocery



Chenopodium album,
Lambs-Quarters



Amaranthus retroflexus,
Redroot Pigweed

Leave the Classroom to Find Examples: Airport or Farm



Leave the Classroom: Hide in Plain Sight



Leave the Classroom: Hide in Plain Sight



Geocache containers



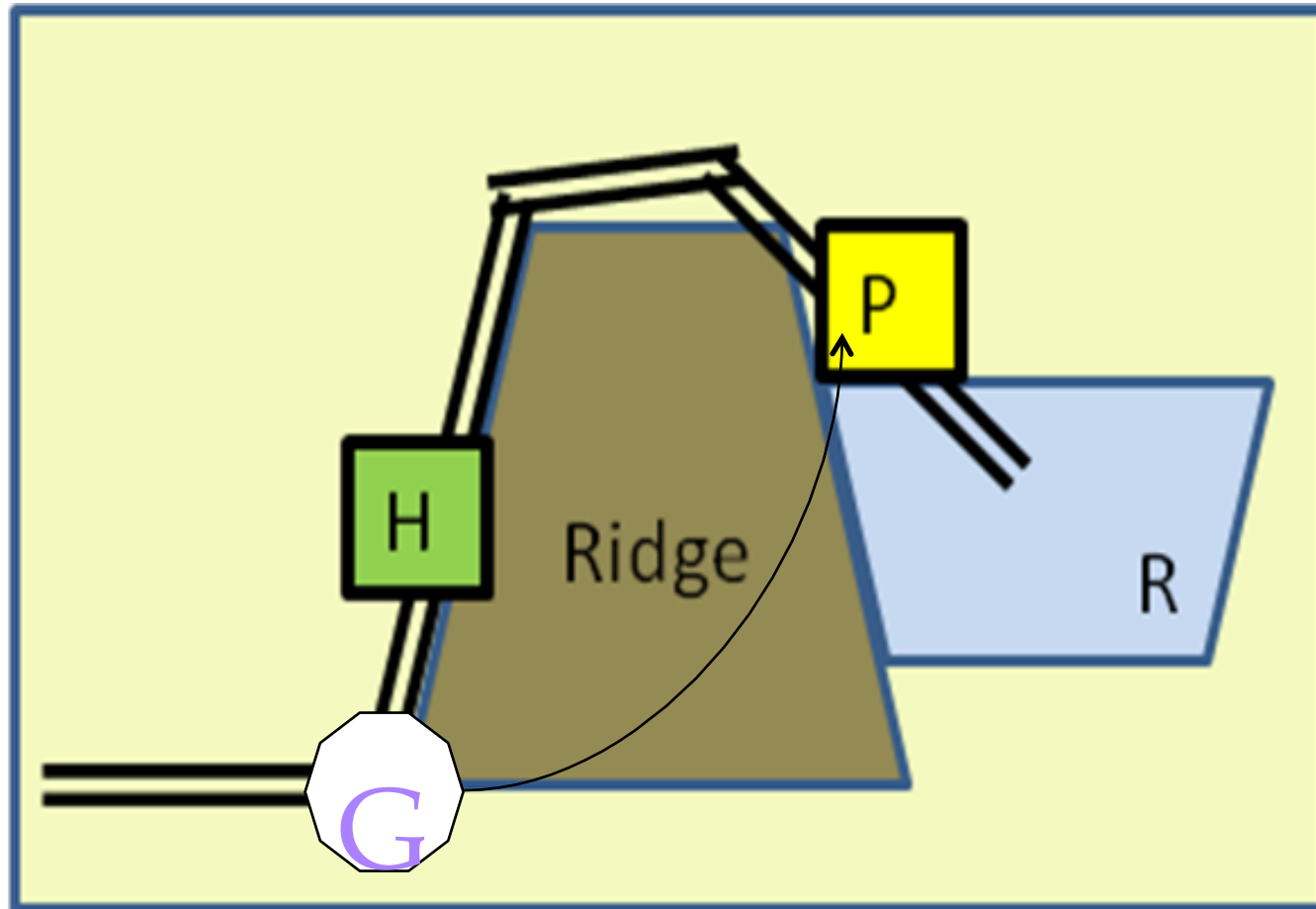
Leave the Classroom to Find Examples: Payson AZ USA

- Payson AZ – A Complex Needs / Solutions Situation
- Demonstrates resource identification and use at many system, sub-system and super-system levels.
- Demonstrates complex situations may require diverse resource utilization and management in time and space.

Payson AZ – A Complex Needs / Resources Situation

- Needs
 - Remove Growth Restraints
 - Answer Demand for Higher Education
- Resources
 - Physical resources (water, solar energy, land, forest, ..)
 - Governmental resources (federal, state and local government agencies, including state university, ...)
 - Knowledge & Information resources (particularly methods of changing governmental policies, ...)
 - Financial resources (private investment companies, ...)
 - Technological Resources (Satellite Communications, Data Processing,

Payson's Geology Helps Solve the Water Problem



Payson's Environment Partially Solves the Education Problem

- Availability of Water
- Availability of Forested Land in Un-Utilized Tonto National Forest Holdings slated to be sold
- Location very suitable for a University Campus
- Availability of Solar Power

Payson's Creative Financing Solves Education and Development Problems

- Create a “Separate Legal Entity (SLE)”
 - Effectively a municipal organization within a town
 - Shelters local residents from tax risk
- Build “Campus” with private funding and help of Multinational Technology Companies
- SLE “buys” services from town, “sells” Space, services, and facilities use to University
- University manages curriculum and learning processes.

Informal Training Lacks Adequate Structure

- List all resources in the problem and environment
 - TIE = Things, Information, Energy
- List attributes of the resources
- List what the problem needs to be solved
- Look for matches between lists

Formal (ARIZ) Training Needs Different Structure

1.1 Formulating the Mini-Problem

1.2 Defining the Conflicting Elements,

2.3 Defining the Substance and Field Resources.

Part 4, Mobilizing and Utilizing Substance-Field Resources

Two relationships between the ARIZ view of resources and basic TRIZ concepts are not often seen by beginning learners:

- If there's a contradiction, it's because we are mis-using a resource.
- Breaking "Psychological Inertia" is challenging the assumptions about how resources are used.

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Clark's 4 Considerations for Training Design

1. Content
2. Learning outcomes (Bloom's Taxonomy levels)
3. Instructional methods (This depends in part on the medium. It includes simple text or lecture, structured games or simulations in classroom settings, rote practice sessions, online simulation, on-the-job supervision, etc.)
4. Media (classroom, e-learning, self-paced workbooks and textbooks)

Sequence of Tables Facilitates Teaching Use of Resources

- Learner has guidance for after-class application
- Teacher can be live or asynchronous
- Tables can be used in classroom, simulation, or on-the-job learning
- Documentation of cases helps build organizational library

3 & 4

Example of Resource Attribute and Function Table

Environment Describe, use drawings, photos	Resources Things, information, energy	Attributes of Resources	Functions due to Attributes What new functions could be performed by this resource because of this attribute?
Environment A	Resource A.1.	Attribute 1 of A.1. Attribute 2 of A.1. Attribute 3 of A.1. ...	Functions 1,2,... enabled by Attribute 1 Functions ...enabled by Attribute 2 ...
	Resource A.2.	Attributes of A.2. ...	
Environment B

Conclusion

- We are all TRIZ Learners
- Some of us are TRIZ Teachers
- Somebody, someplace understands teaching and learning—take advantage of what they know for better, faster, learning that is transferred from the classroom to LIFE.

Research on How to Teach TRIZ

- Teachers and students are invited to contribute their observations and their learning
- This is part of a series of conference presentations based on community contributions.

