Case Study: How to fix a string shorter than the needle at the end of sewing

References:
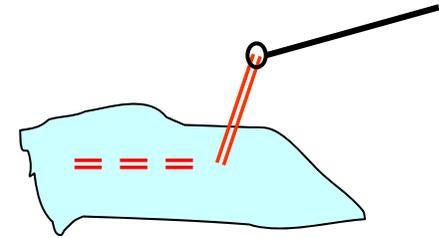
[1] Source: "Creative Problem Solving Methods: How to fix a string shorter than the needle" , Tsubasa Shimoda, Thesis, Osaka Gakuin Univ. (Guided by Toru Nakagawa), Feb. 2006

[2] Introductory article: "Everyday-life Case Studies (1) How to Fix the String Found Shorter Than the Needle" in " TRIZ: Creative Problem Solving Methodology for Innovation (5)", Toru Nakagawa, "InterLab" Journal, May 2006;
"TRIZ Home Page in Japan", May 9, 2006 (in Japanese)

[3] Presentation: "A New Paradigm of Creative Problem Solving (3) Usage and Significance of the Six-Box Scheme in USIT", Presented at 2nd Japan TRIZ Symposium, Aug. 31-Sept. 2, 2006;
"TRIZ Home Page in Japan", Nov. 1, 2006 (in Japanese and in English)

[4] Description of this case study: "USIT Case Study (1)",
    by Toru Nakagawa (OGU), Apr. 21, 2015 (in Japanese), Jun. 2, 2015 (in English)

USIT Case Study 1. How to fix a string shorter than the needle

Introduction: Outline and Significance of this Case Study

The present Case Study is based on the thesis work carried out by **Tsubasa Shimoda** under the guidance by Toru Nakagawa at Faculty of Informatics, Osaka Gakuin University.

The thesis work aimed at learning the methods of creative problem solving and especially at working out a case study of applying TRIZ/USIT to some problem.

In the seminar class, 5 students worked on different individual problems but made collaborative discussions together on all the topics.

This particular problem was proposed by Nakagawa.

> "At the end of sewing, when I wanted to make a knot of the string, I found that the string left was too short to make a knot in the standard way. Find some suitable method to fix the string."

Shimoda had similar experiences before, e.g. in the homemaking class at junior high school.

Even though the problem is simple, the present Case Study is useful because of its clear and detailed descriptions of the thinking process.

The crucial key to the present case is the understanding of the function of the needle in the standard method of making a knot.

This case is a good example of TRIZ/USIT, having some unexpected ideas and some points to think over. Even children can understand the problem and the thinking process.

This is my favorite case study, placed at the first in the Collection of USIT Case Studies.

USIT Case Study 1. How to fix a string shorter than the needle

Table of Contents

In the Real World, raise an issue and prepare for the Project (Thesis Work)

(1) Preparation: Thesis Work for learning the Creative Problem Solving Methods

Situation: The capability of solving problems creatively is a basic and yet advanced and widely-applicable quality for students to master. In the thesis work, the students are expected to learn the methods and have the experiences of solving problems for themselves.

Target: To work to apply the TRIZ/USIT method to some familiar problem for solving the problem creatively and for mastering the methods and the thinking ways.

Project: Thesis work at Nakagawa's Seminar Class, Faculty of Informatics, Osaka Gakuin University. Students study in the Seminar Class during their 3rd and 4th years. The theme for the thesis is decided in June of the 4th year, and the thesis is submitted next February. After the thesis work, Nakagawa brushed up the work and finished as a USIT Case Study.

Activities: The Seminar has a regular class of 90minutes every week. 5 Students in the Class. Nakagawa guided them both individually and collaboratively in the group work .

Team: 5 students in the Class. The students have their own individual themes and make practices and discussions together on all the themes.

Theme: This theme was proposed by Nakagawa, as a familiar problem. Mr. Shimoda and all the students well understood the problem situations.

Define the Problem (using the standard template in the USIT Manual)

1	**User's specific problem**

Step 1
Define the problem

2	Well-defined specific **problem**

3	Understanding of the present system + Understanding of the ideal system

4	Ideas for a new system

5	Conceptual solutions

6	User's specific solution

Please refer the instructions in the USIT Manual
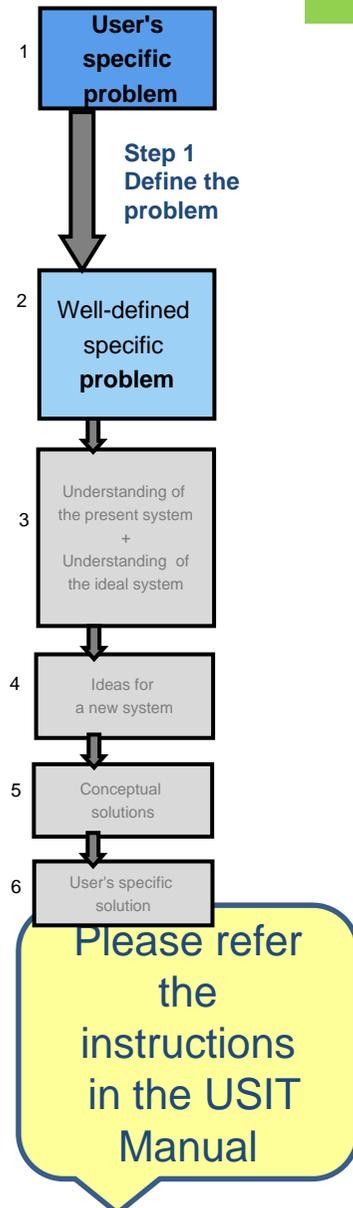
Step 1. Define the Problem

(a) An unwanted effect:

The string is shorter than the needle and prohibit applying the standard way of making a knot.

(b) Task statement:

Devise methods for fixing the string left shorter than the needle.

(c) Simple sketch of the problem situation:
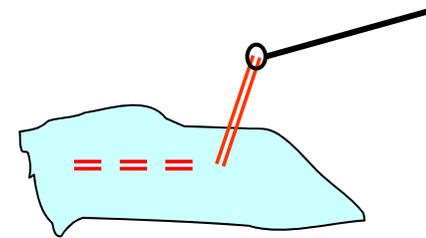
(d) Plausible root causes:

The standard way of making a knot is applicable only when the string left is longer than the needle

(e) A minimum set of relevant objects:

Cloths, string (already sewn), string (left), the needle

(A1) Understand the Space Characteristics

1 User's specific problem

2 **Well-defined specific problem**
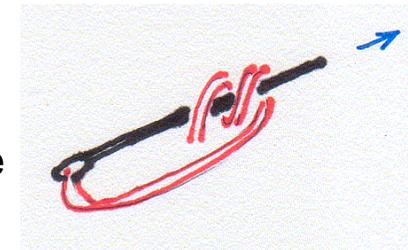
Step 2 Analyze the Problem

(A) Understand the present system

3 Understanding of the present system + Understanding of the ideal system

4 Ideas for a new system

5 Conceptual solutions

6 User's specific solution

The purpose of making a knot is to make the string end 'suddenly thick' so that the string would be resistant to be pulled away.

Watch out the topological relations in 'a knot of string' and in the needle hole and the string, etc.

(There is a commercial needle with 'a slit at the hole', i.e. no genuine hole at all.)

(A2) Understand the Time Characteristics

Think about the process of sewing (in several steps)

The problem can be solved by going back to the preceding steps:
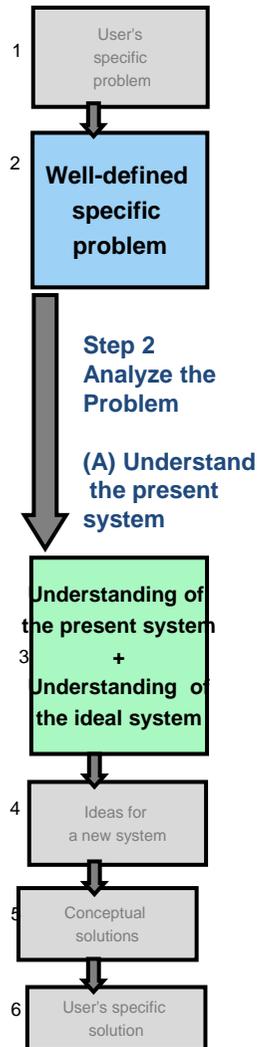 **"No problem if we would have done .... in the previous step."**
  "We can go back the process now, and restart ... "

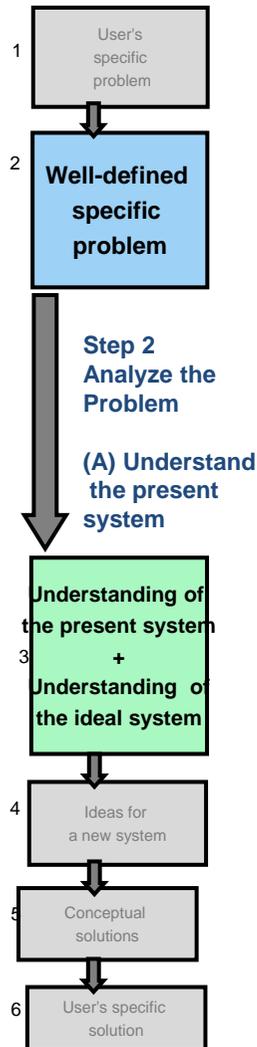**To solve the problem at the present final step**
  of sewing
  <== This is the approach we want to work
      in the present case study.

This is the problem setting in the present case study. We assume that the string can not be pulled to make it longer.

(A3) Understand the Attributes (properties)

1 — User's specific problem
2 — **Well-defined specific problem**
Step 2 Analyze the Problem
(A) Understand the present system
3 — **Understanding of the present system + Understanding of the ideal system**
4 — Ideas for a new system
5 — Conceptual solutions
6 — User's specific solution

What kind of properties do the string and the needle have?
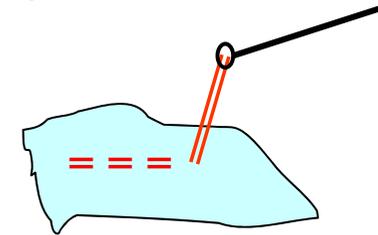
The string does not get longer.
   = The length of the string (left) does not change.
The needle is hard.
   = The shape and the length of the needle do not change.
The needle is thin.   = The needle hole is small.
   = It is difficult to release and pass the string through the hole again.

These properties are taken for granted.
   ==> These form the constraints, in our natural/common sense.

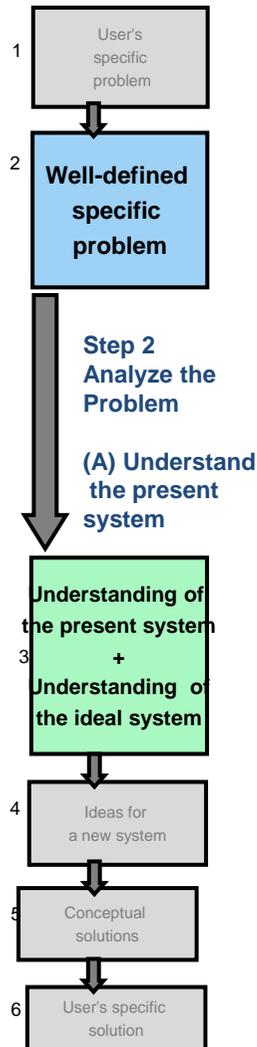**Do we need to follow these constraints?**

Once we lift/break a constraint properly, we can have new solutions.

   Constraints often come from our psychological inertia.

   In the Thinking World, we can think freely without the constraints.

(A4) Understand the Functional Relationships

|	
1	User's specific problem
2	**Well-defined specific problem**
	Step 2 Analyze the Problem
	(A) Understand the present system
3	Understanding of the present system + Understanding of the ideal system
4	Ideas for a new system
5	Conceptual solutions
6	User's specific solution

**What is the function of the needle
in the standard way of making a knot?**

How the needle is working ?

How are you using the needle?

How do you want to arrange the string by use of the needle?

==> Express your answers in words
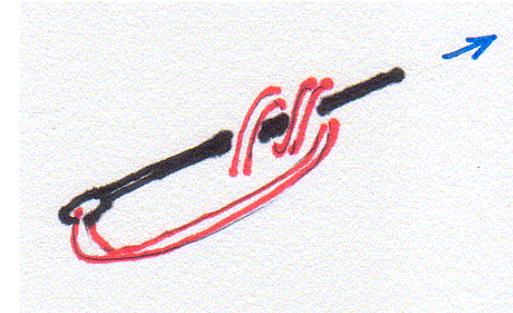
A student answered "Kuru-Kuru Suu" in Japanese.
    It represents the motion of our hand.

==> The hand handles/moves the string.
        "Kuru-Kuru" makes two loops of the string around the needle,
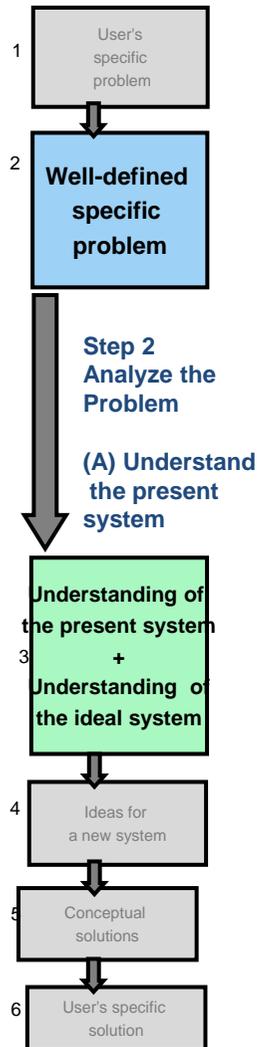   "Suu" passes the needle forwards, to pass the string through the loops.

==> Then, how the needle is working?   What is the function of the needle?
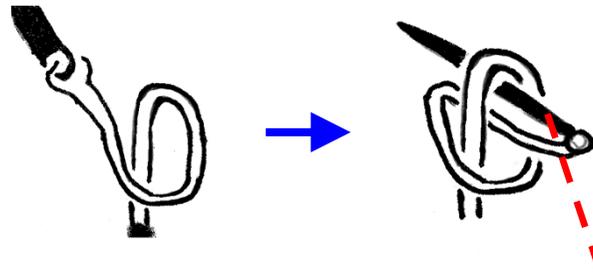
**The needle works as: the base of making loops of the string and
                              the guide of the string to pass through the loops.**

(A5) Survey for known methods and techniques

1 User's specific problem

2 **Well-defined specific problem**

Step 2 Analyze the Problem

(A) Understand the present system

3 Understanding of the present system + Understanding of the ideal system

4 Ideas for a new system

5 Conceptual solutions

6 User's specific solution

Grandma's usually operate like this:

Hold the pointed end of the needle, and operate the string in the air so as to make a loop of the string, and pass the hole part of the needle into the loop. Then, cut the string near the needle hole, and pull the string to make a knot.

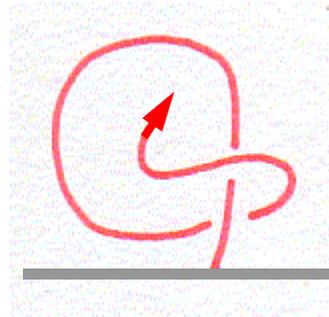To make the string loop in the air is difficult and needs much practice.

A commercial needle;

The hole of the needle has a slit, thus the string can be passed and removed without cutting the loop of the string. (a commercial product)
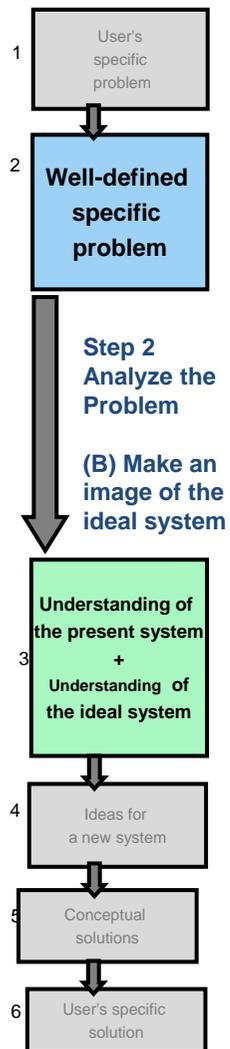
(B) Make an image of the ideal system

1	User's specific problem
2	**Well-defined specific problem**

**Step 2
Analyze the
Problem**

**(B) Make an
image of the
ideal system**

3	**Understanding of the present system + Understanding of the ideal system**
4	Ideas for a new system
5	Conceptual solutions
6	User's specific solution

The image of the ideal arrangement
of the string for making a knot:

It is nice if we can hold the string in this
arrangement in the air,
and if we can guide the string in this
arrangement.

1	User's specific problem
2	Well-defined specific problem
3	**Understanding of the present system + Understanding of the ideal system**
	Step 3 Generate ideas:
4	**Ideas for a new system**
5	Conceptual solutions
6	User's specific solution

Step 3: Generate ideas

(1) By use of the similarity between the known method and the ideal way.
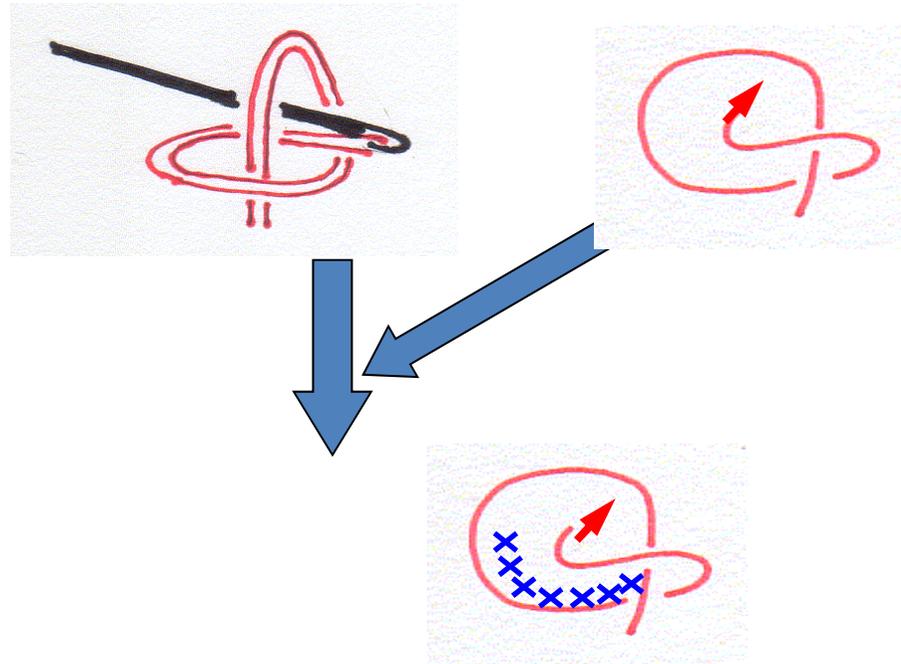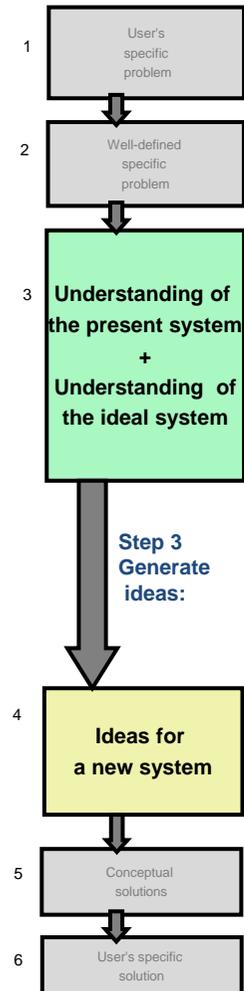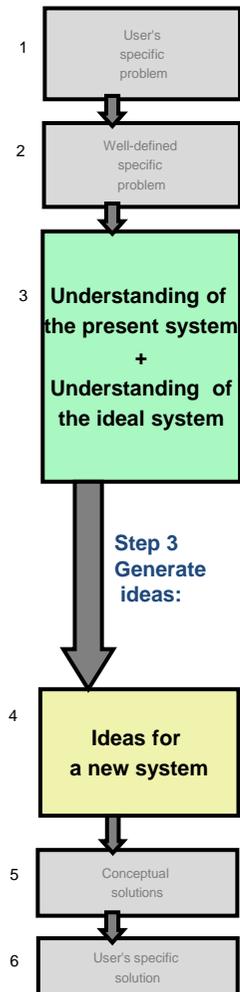

We should just hold the string in the air at the positions similar to the ideal ones.

A small experiment for trying this idea revealed a solution very quickly.

The solution is written in the slide of Step 4 of USIT.

1	User's specific problem
2	Well-defined specific problem
3	**Understanding of the present system + Understanding of the ideal system**
	Step 3 Generate ideas:
4	**Ideas for a new system**
5	Conceptual solutions
6	User's specific solution

Step 3: Generate Ideas

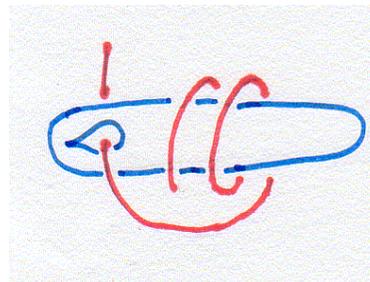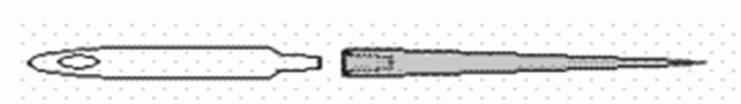## (2) Ideas with breaking the constraints (of properties)

Let's break the needle into two !

Since it is difficult to break,

Screw type

What does this mean?

Sewing is already done. So the needle point is not necessary .
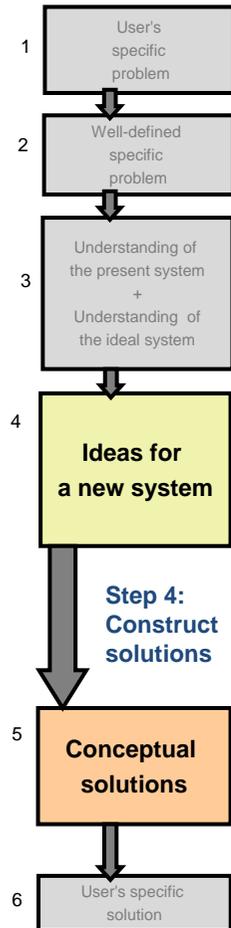
Ridiculous !
I thought first.

When I think over the implication,
I found its significance..

A needle without the point and specialized for making a knot.

Step 4: Construct solutions:

|	
1	User's specific problem
2	Well-defined specific problem
3	Understanding of the present system + Understanding of the ideal system
4	**Ideas for a new system**
	Step 4: Construct solutions
5	**Conceptual solutions**
6	User's specific solution

Idea of holding the string in the air

    First I tried with a straw
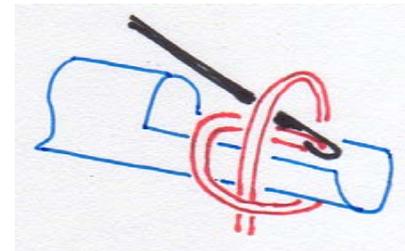
      ==> failure

For passing the string through the string loop, not a circular pipe but a half pipe is suitable.
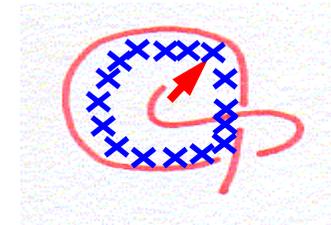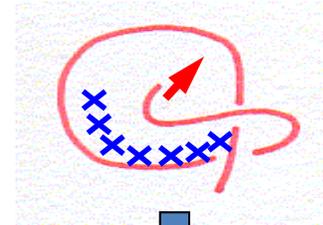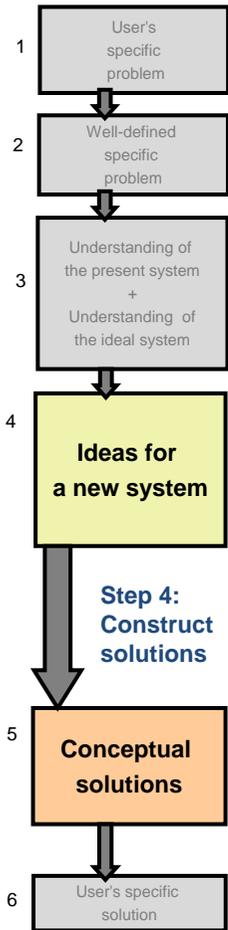
No good.

A tool made of a straw

At home, you may cut the edge of a straw into a half pipe.

A tentative idea for a product:
    Made of a metal or a plastic, in the shape of a half pipe.
    diameter: 3 mm, length: 50 mm,
    Illustration of usage on the handle part.

[Case 1. Sewing] Step 4: Construct solutions:

1	User's specific problem
2	Well-defined specific problem
3	Understanding of the present system + Understanding of the ideal system
4	**Ideas for a new system**
	Step 4: Construct solutions
5	**Conceptual solutions**
6	User's specific solution

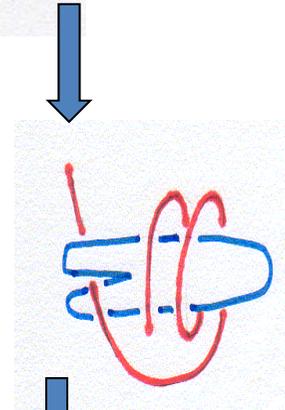**Idea of a pointless needle specialized for making a knot:**

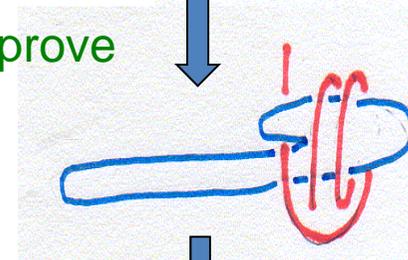Improve the idea step by step for making it more useful:
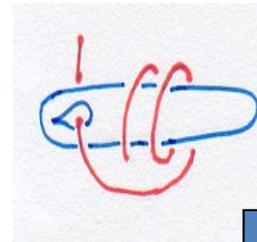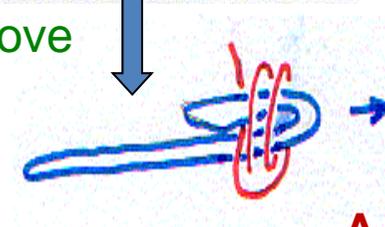
Not a hole but a slit:

Make an end longer for easy holding by hand.

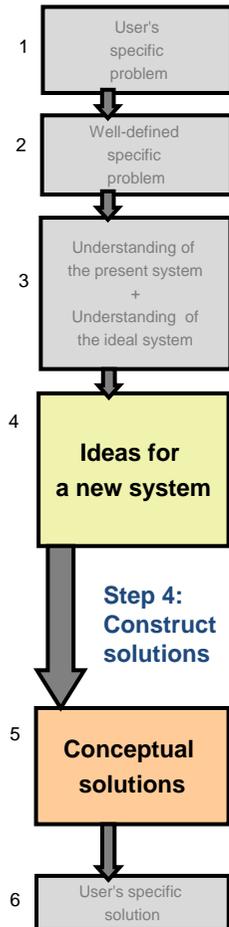A hairpin type for better holding of the string

Improve

Improve

Improve

Improve the idea step by step.

We can have better solutions.

A hairpin like tool for making a knot

Report as a Case Study.   Conclusion of the Case Study.

1	User's specific problem
2	Well-defined specific problem
3	Understanding of the present system + Understanding of the ideal system
4	**Ideas for a new system**
	Step 4: Construct solutions
5	**Conceptual solutions**
6	User's specific solution

A new and fine Case Study of USIT Application was completed, for a simple and familiar problem '"How to fix a string shorter than the needle."

The standard way of applying USIT was found effective.

The concepts of functions and attributes are used effectively and are illustrated well.

The Case Study was described fully and presented at conferences and seminars; thus it became much refined than the original thesis work.

This Case Study is good for illustrating the USIT method and its usage.

The conceptual solutions of this Case Study have not been tried to make as real products. We may try it at some occasions in future.

Whole USIT Process is well illustrated for a familiar problem

Toru Nakagawa and Tsubasa Shimoda (2006)

Thinking World

Understanding of the ideal system

Understanding of the present system

Function: Needle: ...
Attributes (properties)
Space & time characteristic
Known techniques:

Box 3

Analyze the Problem .

Generate Ideas

(USIT Operators, etc.)

Ideas for a new system

Holding the string in the air:

Pointless needle for making a knot

Box 4

Construct Solutions

Well-defined Problem

.
Task statement:

Root causes:

Box 2

Define the problem

Conceptual Solutions

Box 5

Implement the solution

Real World

Initial problem situations (User's specific problem)

Box 1

Implemented Solution

(User's specific solution)

Products, etc.

Box 6

USIT Case Study 1. Toru Nakagawa, Apr. 21, 2015 >> Jun. 14, 2015