

- often essential than its solution, which may be merely a matter of mathematical or experimental skill.
- To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science



Problem Definition

The First Four Steps

- 1. Collect and analyze information and data
- 2. Talk with people familiar with the problem
- 3. If at all possible, view the problem first hand
- 4. Confirm all findings













Ask insightful questions

















When Boxright analyzed this information in detail, it was stated that the data would not be expected to apply to industrial-size equipment or processes









- Can that person explain the reasoning as to how they arrived at that particular problem statement?
- Are the reasoning and assumptions valid?
- Has that person considered the situation from a number of different viewpoints?
- Have you used the first four steps to gather information about the problem?



 Has sufficient data been collected? (our engineer initiates his own investigation)













Hitting 'Em Where They

The Situation: "During WWII, a number of aircraft were shot down over Germany. Many of the planes that made it back safely to base were riddled with bullet and projectile holes."

Instructions: "Reinforce these damaged areas with thicker armor plating"





















Statement-Restatement

Problem Statement Triggers

- 1. Vary the stress pattern-try placing emphasis on different words and phrases.
- Choose a term that has an explicit definition and substitute the explicit definition in each place that the term appears.
- 3. Make an opposite statement, change positives to negatives, and vice versa.
- Change "every" to "some," "always" to "sometimes," "sometimes" to "never," and vice versa.
- Replace "persuasive words" in the problem statement such as "obviously," "clearly," and "certainly" with the argument it is supposed to be replacing.
- 6. Express words in the form of an equation or picture, and vice versa.





Trigger 2 - Choose a term that has an explicit definition and substitute the explicit definition in each place that the term appears.

Breakfast food that comes in a box is not getting to <u>the place where it is sold</u> fast enough to keep it from <u>getting stale</u>.

(Makes us think about the box and staleness... what changes $% \left(\frac{1}{2}\right) =0$ might we make to the box to prevent staleness?)











Problem Solving

End of Chapter 3