

Consider a skier

You have just gotten off the ski lift and are standing at the top of a slope that is looking pretty darn steep. You begin to wonder what you are doing here and if you are going to make it down in one piece. You know that if you are tentative, you'll crash.



This is the point at which you take some deep breaths, and say to yourself, "Calm down, I can do this. What do I remember about skiing? What did the instructor say this morning? O.K., I can get to the bottom in one piece if I just need to keep my hands forward to get my weight right, shift weight to turn, and turn a lot to keep my speed down. If I start to lose it, fall uphill. If I just do what I learned, I can do this. It might even be fun, as well as terrifying."

1) Engage: I want to and I can

Without confidence and desire at the beginning, the skier is likely to get hurt (see picture). Similarly, a good problem solver starts by reducing stress and developing a positive attitude.

In this first stage of problem solving, we:

- Manage our stress (deep breathing, positive self talk)
- Maintain our confidence and motivation
- Be willing to risk
- Monitor our thoughts

2) Define the Stated Problem

For the skier, getting to the bottom of the hill in one piece is the problem. For most engineering problems encountered in school, you will have to read some text and extract the important information – the problem, the knowns, and the constraints before you can begin. For other problems, you may need to parse your boss's words or diagnose the problem on your own.

In this stage we:

- Systematically classify information
- Recognize that some information may be inferred rather than explicit
- Organize the information in a way that will be useful
- Be thorough in reviewing the problem statement
- Extract the words relevant to the problem
- Begin to translate the words into symbols and pictures

3) Explore: Create an Internal Idea of the problem

In this stage you poke through all those boxes of knowledge that you have stashed in the attic of your brain. You thought you wouldn't need that stuff once the course was over, but here it comes again.

Here the skier racks their brain to recall everything they know that will help them survive the trip. You are considering everything you know about problems like this one and problems in general. You are trying to stay focused on principles and fundamentals rather than equations. You may ask “what if?” questions.

In this stage we:

- Resist the urge to jump to a solution
- Continue to translate information into pictures and symbols
- Generalize, Simplify, and Modify to broaden your perspective
- Review resources – brain, book, Web, people
- Learn new stuff
- Apply rules of thumb
- Be creative/brainstorm
- Be willing to try and willing to be wrong

4) Plan a Solution

Now you need to decide. Select an approach that is most likely to get you to the goal. This is the point where the skier listed the important techniques.

Here we:

- Commit to a decision
- Outline a plan
- Resist using a calculator

5) Do It: Carry out the Plan

Now is the time to be the stereotypical engineer with that single-minded focus and attention to detail. Keep track of your units, your conversions, and your notation because those things will save your engineering soul. Keep monitoring the process - Is this reasonable, consistent, and logical? The skier is now in motion, internally monitoring and correcting position and balance.

Now it is time to:

- Be organized and systematic
- Be detail oriented (AR)
- Check as you go

6) Evaluate: Check and Look Back

At the bottom of the hill, you may be patting yourself on the back or kicking yourself in the butt. If you try to do both, let me know; I want to watch. At the end of a problem solution, you should also look back. Certainly you are checking your work, but you are also mentally listing any lessons learned. Reviewing what you did helps you anchor that knowledge so you will gain experience over time and not just get old.

In this stage:

- Overview your work. – Is it understandable, reasonable, consistent?
- Consider the big picture – Did you solve the problem?; How does this fit into other things you've done?; What other problems would be amenable to this solution.

