What do we mean by Problem Solving Skills?

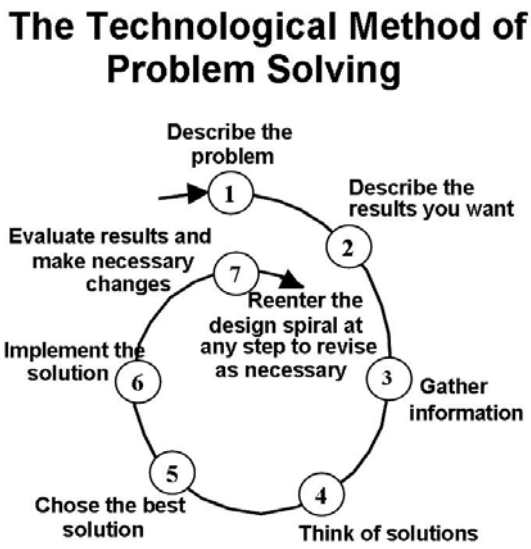
One of the main objectives of academic programmes is to prepare students for real life **problem solving**. We, the teachers keep talking about developing **problem solving skills** amongst our students without giving much emphasise to it. As this is an important skill that our students should develop, hence I thought, I should deliberate on this topic in brief.

In our professions we come across challenging problems that we need to solve them under the constraints of cost, time, quality, technology and talent available. Let me illustrate some of the examples that I come across in my day to day operations. In South India, Coconut harvesting is a major challenge, farmers want to have a low cost, portable, durable, automated coconut harvester. A coffee planter wants a robotic arm for harvesting coffee; a cotton grower wants a multifunctional robot which can meet all his requirements like drilling, sowing, weeding, spraying and harvesting. A company wants to develop renewable energy based cooking stove; another company wants us to develop a low temperature Rankine cycle based power plant for rural electrifications; a car company wants us to develop efficient transmission system; an health care provider wants us to develop a bionic arm and the forest department wants us to develop a drone for forest fire detection and thus every day, we come across very interesting enquiries from various sources requesting for solutions. We should be capable of providing solutions to such problems, the question is how do we prepare our graduates to provide solutions to such varied requirements? It is necessary that students be trained on problem solving skills during their studies. This description is clearly in the context of engineering.

The term problem-solving is used in many disciplines, sometimes with different perspectives, and often with different terminologies. For instance, it is a mental process in psychology and a computerized process in computer science. Problems can also be classified into two different types (ill-defined and well-defined) from which appropriate solutions are to be made. Ill-defined problems are those that do not have clear goals, solution paths, or expected solution. Well-defined problems have specific goals, clearly defined solution paths, and clear expected solutions. These problems also allow for more initial planning than ill-defined problems. Being able to solve problems sometimes involves dealing with pragmatics (logic) and semantics (interpretation of the problem). The ability to understand what the goal of the problem is and what rules could be applied represent the key to solving the problem. Sometimes the problem requires some abstract thinking and coming up with a creative solution [http://en.wikipedia.org/wiki/Problem_solving]. It is clear from this paragraph that the scope of problem solving is quite involved and may take philosophical turns, but my aim is to make the students know the steps involved in problem solving exercise.

Scientists, engineers, and ordinary people use problem solving each day to work out solutions to various problems. Using a systematic and iterative procedure to solve a problem is efficient and provides a logical flow of knowledge and progress.

Let me illustrate The **Seven Steps of Technological Problem Solving** in the following paragraphs:



(http://www.teachengineering.org/view_lesson.php?url=collection/cla_/lessons/cla_lesson2_problem_solving/cla_lesson2_problem_solving.xml)

1. Identify the problem

- Clearly state the problem. (Short, sweet and to the point. This is the "big picture" problem, not the specific project you have been assigned.)

2. Establish what you want to achieve

- Completion of a specific project that will help to solve the overall problem.
- In one sentence answer the following question: How will I know I've completed this project?
- List criteria and constraints: Criteria are things you want the solution to have. Constraints are limitations, sometimes called specifications, or restrictions that should be part of the solution. They could be the type of materials, the size or weight the solution must meet, the specific tools or machines you have available, time you have to complete the task and cost of construction or materials.

3. Gather information

Research

- Research is sometimes needed both to better understand the problem itself as well as possible solutions.
- Don't reinvent the wheel – looking at other solutions can lead to better solutions.
- Use past experiences.

4. Brainstorm possible solutions

- List and/or sketch (as appropriate) as many solutions as you can think of.

5. Choose the best solution

- Evaluate solution by: 1) Comparing possible solution against constraints and criteria 2) Making trade-offs to identify "best."

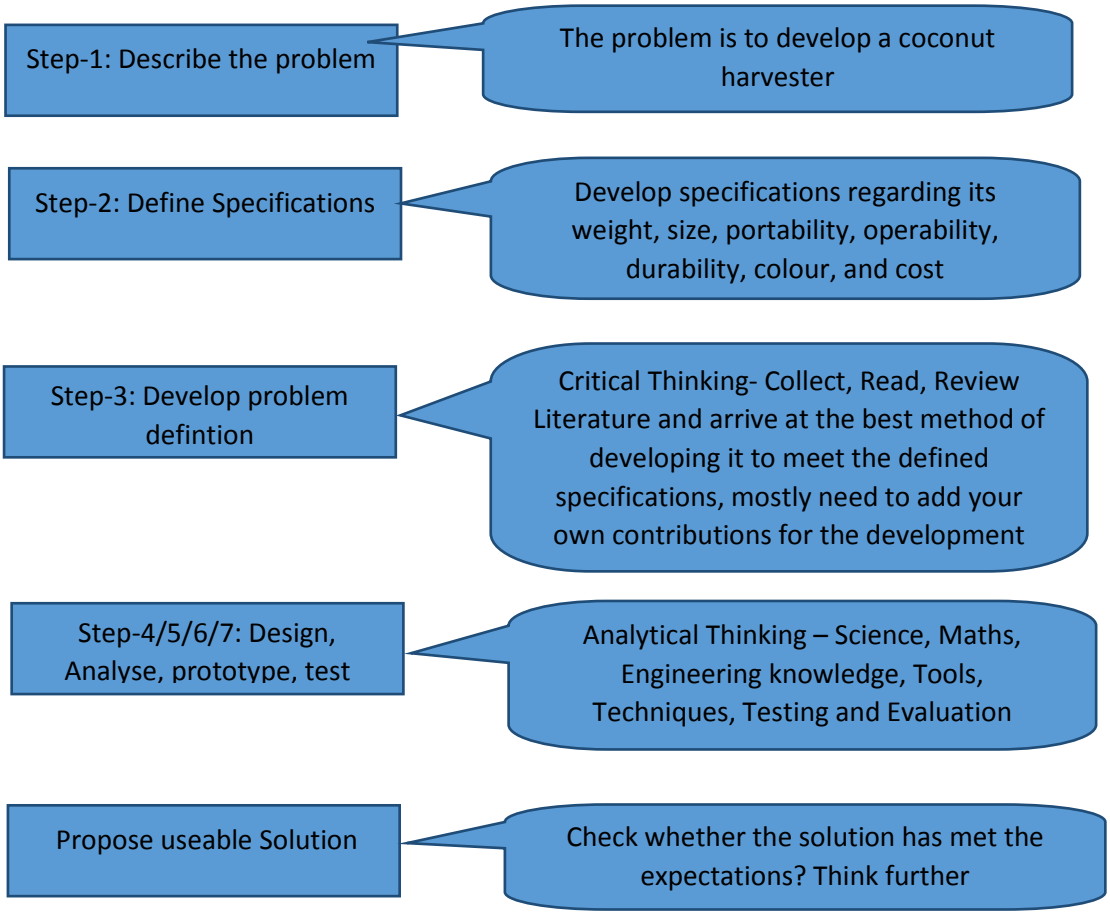
6. Implement the solution

- Develop plans that include (as required): drawings with measurements, details of construction, construction procedure.
- Define tasks and resources necessary for implementation.
- Implement actual plan as appropriate for your particular project.

7. Test and evaluate the solution

- Compare the solution against the criteria and constraints.
- Define how you might modify the solution for different or better results.

The following flow chart explains the steps involved with an example



I would like to draw the attention of the importance of Critical and Analytical Thinking during Problem Solving. Please note that the same procedure can be applied to most of the well-defined problems irrespective of the domain we work.

The scheme of Modular Teaching at postgraduate level at M.S. Ramaiah University of Applied Sciences has created ample opportunities for students to train on this important aspect. Students are expected to solve a real life context based problem during every module assignment. This practice has lifted the confidence level of the students and to emphasise the importance of problem solving, let me quote Albert Einstein here, "**If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solution**s."

Here is a real example of –**self-confidence gained during studies in the University can do for a student**.

Chintan Majithia <info.supernitroo@gmail.com> 3:27 PM (22 hours ago)

to president

Dear Sir,

How are you doing? Hope everything is fine.

With immense pleasure I am writing this email to share the details on my new venture of importing superbikes and custom bike designs, development and manufacturing.

For your perusal, the link to our website is www.supernitroo.in

Before joining Ramaiah what I knew about automobile design is the data books, some formula's and theory calculations. But Ramaiah opened doors to actual design and development process from sketches to complete manufacturing processes.

The group projects and thesis project boosted the confidence to do achieve something beyond numbers (exam scores).

All the teachings and exposure at Ramaiah has helped me to achieve this and am sure it will help me in long run for sure.

Thank you to you and the entire Ramaiah management and staff for bringing world class facilities in India and helping us grow.

Looking forward to hear from you.

Best Regards,
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Prof. S.R. Shankapal