General problem-solving strategy

A systematic approach to problem solving helps the learner gain confidence, and is used consistently as a "blue print" by expert problem solvers as a way to be methodical, thorough and self-monitoring. This model is used in life generally, as well as in the sciences. The steps are not linear, and multiple processes are happening in your brain simultaneously, but the basic template hinges on effective questioning as you carry out various steps

1. Engage

Invest in the problem through reading about it and listening to the explanation of what is to be resolved. Your goal is to learn as much as you can about the problem before you begin to actually solve it, and to develop your curiosity (which is very motivating). Successful problem solvers spend two to three times longer doing this than unsuccessful problem solvers. Say "I want to solve this, and I can".

2. Define the stated problem…a challenging and time consuming task

- Understand the problem as it is given you, ie. "What am I asked to do?"
- Ask "What are the givens? the situation? the context? the inputs? the knowns? etc.
- Determine the constraints on the inputs, the solution and the process you can use. For example, "you have until the end of class to hand this solution in" is a time constraint.
- Represent your thinking conceptually first, by reading the problem, drawing a pictorial or graphic representation or mind map (see example attached), and then a relational representation.
- Then represent your thinking computationally, using a mathematical statement

3. Explore and search for important links between what you have just defined as a problem, and your past experience with similar problems. You will create a personal mental image, trying to discover the "real" problem. Ultimately, you solve your "best mental representation" of the problem.

- Guestimate an answer or solution, and share your ideas of the problem with others for added perspective.
- Self-monitoring questions include: What is the simplest view? Have I included the pertinent issues? What am I trying to accomplish? Is there more I need to know for an appropriate understanding?

4. Plan in an organized and systematic way

- Map the sub-problems
- List the data to be collected

- Note the hypotheses to be tested
- Self-monitoring questions include: What is the overall plan? Is it well structured? Why have I chosen those steps? Is there anything I don't understand? How can I tell if I'm on the right track?

5. Do it

- Self-monitoring questions include: Am I following my plan, or jumping to conclusions?
- Is this making sense?

6. Look back and revise the plan as needed. Significant learning can occur in this stage, by identifying other problems that use the same concepts (remember the spiral of learning?) and by evaluating your own thinking processes. This builds confidence in your problem solving abilities.

- Self-monitoring questions include: Is the solution reasonable? Is it accurate? (you will need to check your work to know this!) Does the solution answer the problem? How might I do this differently next time? How would I explain this to someone else? What other kinds of problems can I solve now, because of my success? If I was unsuccessful, what did I learn? Where did I go off track?

Based on D.R. Woods, "Problem–based Learning", 1994