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What Good Problem Solvers Do

Take time to carefully define a problem…
Ineffective problem solvers are are sometimes led astray because they make incorrect assumptions about what a problem requires. An effective problem solver will take the time to ensure that she understands the problem and what it is requiring her to do. She will be able to clearly state the problem in terms of what is known and what is unknown. She will be able to articulate the relationship of resources involved in a problem.

Know what they know...
Good problem solvers perform an inventory of what they already know and incorporate that knowledge into their understanding of the current problem. This is done both in terms of understanding the shortcomings of an existing system as well as designing a solution or improvement to that system. Effective problem solvers engage existing knowledge across disciplines and in novel situations.

Can figure out what they need to know...
Good problem solvers can identify gaps in their own understanding, and articulate those gaps in the form of questions. Such questions include both over-arching questions that get to the solution of a particular problem (how can I design an alarm system that uses a laser beam as a trigger?) as well as more tactical, informational questions (what does a pull-down resistor do, and why are they important in a circuit that uses digital logic?) good problem solvers are constantly asking themselves "what don't I understand about this system, and what do I need to learn in order to understand it better?) Good problem solvers recognize when their existing schema and mental models must be updated, revised or abandoned.

Can effectively and efficiently find the information they need...
Good problem solvers are expert researchers. They are well versed and comfortable using all manner of information resources (including classmates). Not only are they able to distinguish between reliable and unreliable sources, but they can also identify high quality sources that are understandable at their reading level.

Collaborate...
Good problem solvers view teammates as sources of information and talent. They help teammates to divide tasks equitably and according to one another's strengths. Good problem solvers help their team to work through conflict and to value the contributions of all team members.

Are undaunted by complexity...
Good problem solvers don't look at a problem as a monolith, and are not overwhelmed by large, complex systems. Rather, they are capable of breaking a problem down into small, discrete, inter-related components, which can be understood and attacked independently.

Model solutions and test them...
Good problem solvers can visualize a solution in their mind. They sketch out diagrams to clarify their thinking. They build digital simulations and physical models. They use these models to test the functionality of their solutions following a methodical process to troubleshoot their solutions.

Produce multiple, divergent, and creative designs...
Effective problem solvers are good divergent thinkers. They can imagine multiple and varied possible solutions. They can recognize and overcome functional fixedness in their own thinking. In other words, they can see past the traditional uses of an object to imagine applications that are completely new. A soda cap could be a wheel, a dial, a shield for a toy soldier for example.

Persist through ambiguity, challenges, and setbacks...
Good problem solvers stay with problems for a long, long time. Challenges and setbacks are met with a positive attitude and as an opportunity to explore new paths with a clean slate.

Evaluate the quality of their solutions with brutal honesty and make revisions…
Good problem solvers have an idea of what the solution to a problem should look like. They measure the quality of their work against that mental model and these standards, doing so throughout the process and not waiting until the end. They are courageous in their willingness to scrap significant amounts of work and to start over when they realize that they are pursuing a dead-end. They recognize that there are gradations in the quality of solutions available to any given problem. They strive for excellence always, but simultaneously balance that striving with the realities of material and time constraints.

**********Kid Friendly Version**********

Take Inventory…
- What is the problem I am trying to solve? Frame it as a question.
- What do I already know about this problem?
- What do I need to figure out?

Gather Your Resources…
- What books, websites, publications might be helpful?
- How can I construct an effective Web Search?
- How can I identify the most helpful websites?
- Do I have teammates or classmates that know more about this?
- Your teacher might not always be the best source of information.

Generate & Test Solutions…
- Quantity is better than quality at this point. Brainstorm.
- Tinker, test, talk to determine the best solution.
- Identify dead-ends quickly and move on.

Build, Evaluate, Revise…

- Have I set the bar high enough?
- Are my standards realistic?
- Have I been brutally honest with myself about the quality of my work?
- Can I make it better?

Keep a Maker Mindset…

- Make solutions, not excuses.
- Be brave.
- Be tenacious.
- Be curious.
- Be playful.