

Some evidence-based components of expert problem-solving¹

Observe yourself as you solve problems. Rate how often you DO any of the following. Progress toward internalizing these targets, aiming for doing these activities 80-100% of the time.

Targets for expert problem-solving	20%	40%	60%	80%	100%
1. I describe my thoughts aloud as I solve the problem.					
2. I occasionally pause and reflect about the process and what I have done.					
3. I don't expect my methods for solving problems to work equally well for others.					
4. I write things down to help overcome the storage limitations of short-term memory (where problem-solving takes place).					
5. I focus on accuracy and not on speed.					
6. I interact with others. ²					
7. I spend time reading the problem. ³					
8. I spend up to half the available time defining the problem. ⁴					
9. When defining problems, I patiently build up a clear picture in my mind of the different parts of the problem and the significance of each part. ⁵					
10. I use different tactics when solving exercises and problems. ⁶					
11. I use an evidence-based systematic strategy (such as read, define the stated problem, explore to identify the real problem, plan, do it, look back). I am flexible in my application of the strategy.					
12. I monitor my thought processes about once per minute while solving problems.					

Source: Woods, D.R., Felder, R.M., Rugarcia, A., Stice, J.E. (2000). The Future of Engineering Education III: Developing Critical Skills. *Chemical Engineering Education*, 34 (2), 108-117.

¹ Problem-solving contrasts with exercise-solving. In exercise-solving, the solution methods are quickly apparent because similar problems have been solved in the past.

² An important target for team problem-solving

³ Successful problem-solvers may spend **up to three times longer** than unsuccessful ones in reading problem statements.

⁴ **Most mistakes are made in the definition stage!**

⁵ The problem that is solved is not the textbook problem. Instead, it is your mental interpretation of that problem.

⁶ Some tactics that are ineffective in solving problems include:

- trying to find an equation that includes precisely all the variables given in the problem statement, instead of trying to understand the fundamentals needed to solve the problem
- trying to use solutions from past problems even when they don't apply
- trial and error