

Over Fifty Problem Solving Strategies Explained

by **John Malouff** Ph.D., J.D.

The comprehensive nature of the list of problem solving strategies allows individuals to use a checklist approach to problem solving. It also could facilitate training others in problem solving. The classification of the strategies into types may facilitate the development of new strategies that fit into a specific category. The explanations and examples given could serve as a valuable supplement to other explanations and examples available in books and on the web.

The strategies on this list are in themselves not original. The original aspects of this list are (a) putting all these specific strategies together, (b) organizing them into the types described below, and (c) giving each type of strategy a fresh explanation with new examples.

Problem solving strategies explained, with examples

Strategies to help you understand the problem

Clarify the problem

Clarify the problem. It is easier to solve a specific problem than a vague one. So clarify the problem before you start looking for a solution. If your problem is that your spouse tells you that you are not supportive enough, find out what he or she means by supportive. If your problem is that your mother can't get the new VCR to work, determine what doesn't happen that she wants to happen. If your problem is a math homework question, read carefully the question (usually at the end): Is the answer supposed to be in metres or centimetres, rounded or not, square or not, etc.

Identify key elements of the problem

Identify key elements of the problem. Problems come to us with varying amounts of important and useless information. Focusing on useless information distracts us and wastes time. So identify the key elements of the problem before you start looking for a solution. If the problem is that of a couple who come to you for counselling because they argue continually, ask them what they argue about, when, and where. If the problem is that your bike squeaks when you ride it, determine what part squeaks.

Visualize the problem or a relevant process or situation

Visualize the problem or relevant process or situation. Sometimes we can see the problem and all its important details right in front of us. This helps us understand the problem. Other times we can't see important elements because they have already occurred or are not visible. In these cases, it is valuable to visualize important elements of the problem. So, if you want to predict the future of the universe, visualize the big bang and the ensuing events. If you want to open a lock without a key, visualize the lock mechanism. If you want to determine how a murder was committed, visualize events that would explain the physical evidence.

Draw a picture or diagram of the problem or a relevant process or situation

Draw a picture or diagram of the problem or a relevant process or situation.

Visualizing a problem can aid understanding. However, we can keep only some much visual information in our minds at once. Hence, it is often useful to draw a picture or diagram. So, if you want to calculate when two airplanes will collide, draw their paths and speeds. If you plan to assault a house where a terrorist holds hostages, draw a picture of the room, doors, windows, hostages, etc. If you want to speed up delivery of goods to retailers, draw a diagram showing the steps in the process.

Create a model of the problem or a relevant process

Create a model of the problem or a relevant process. Creating a model of a problem or relevant process helps us focus on essential elements and gives us the potential to alter the model and see what happens. For instance, if you want to minimize harm to individuals in auto accidents, create a computer model of the structures and forces involved. If you want to build a Mars rover, build a model. If you want to reduce international strife, create a model of causes.

Imagine being the problem, a key process, or the solution

Imagine being the problem, a key process, or the solution. Imagination can help us understand a problem by visualizing it. More understanding can occur in some cases if we go farther and imagine being the problem, a key process, or the solution. So, if you want to understand space and time, you can imagine, as Einstein did, riding a light beam. If you want to help a person who is very paranoid, you can imagine being that person and seeing the world as he does. If you want to get a hit in a big baseball game, you can imagine going up to bat, seeing the ball clearly, and swinging crisply while you step into the pitch, etc.

Simulate or act out a key element of the problem

Simulate or act out a key element of the problem. Understanding complex or vague problems can be difficult. Simulating or acting out some key element of the problem can be productive. For instance, if you are calculating probabilities of some event happening, you can simulate the situation and observe outcomes yourself. If you want to help someone become more socially successful, you can act as that person does and observe the consequences. If you want to determine why a spacecraft exploded, simulate its flight, and try ways of recreating the explosion.

Consider a specific example

Consider a specific example. Problems often come to us in the abstract. Creating a concrete example helps us explore the problem just as we might explore a specific example of dinosaur bones to understand dinosaurs. So, if you want to determine what makes a person psychotic, consider real people who have become psychotic. If you want to learn how to calculate the volume of a sphere, use a specific radius, such as one metre, and apply the formula. If you want to determine why frogs are dying right and left in your community, examine dead frogs.

Consider extreme cases

Consider extreme cases. Considering extreme cases is a type of considering a specific example. Here the example is chosen to test the limits of a relevant parameter.

Sometimes this gives insight into important processes. So, if you want to determine whether level of intelligence affects retention on a police force, consider officers with the highest and lowest intelligence on the force. If you want to determine what happens to black holes in the long run, consider black holes that continue for infinitely long or black holes that suck up everything in the universe. If you want to determine how temperature affects the flow of electricity, consider a temperature of absolute 0.

Acquire knowledge of relevant domains

Acquire knowledge about relevant domains. If you want to understand and solve an electrical problem, it may be necessary to learn about electrical systems. If you want to solve the problem of how to keep humans free from solar-wind harm on the way to and from Mars, you may need knowledge of various domains of science, engineering, and medicine. Great knowledge of relevant domains sometimes helps experts solve problems that others cannot.

Change perspective

Change perspective. If you want to reduce crime in a community, look at crime from the perspective of criminals and victims. If you want to convince a hostage taker to surrender, take that person's perspective. If you want to avoid being bitten by a vicious dog, take the dog's perspective.

Consider levels and systems

Consider levels and systems. If you want to prevent skin cancer, consider events that trigger the cancer at the level of the external environment, the intercellular level, and the intracellular level. If you want to reduce school violence, consider systems such as communities, families, and individuals. If you want to predict the weather, consider local conditions and approaching fronts.

Strategies to help you simplify the task

Solve one part at a time

Solve one part at a time. It is sometimes possible to make a problem easier to solve by attacking one part at a time. For instance, if you want to reduce international conflict in the Middle East, choose two countries with continuing conflict and focus on those. If you want to send a human to Mars, send and retrieve information-gathering robots first. If you want to improve your personality, choose one characteristic to improve at a time, starting, for instance, with your outgoingness.

Redefine the problem

Redefine the problem. If a problem seems presently unsolvable, consider what value underlies the desire to solve that problem, and redefine the problem into something solvable. For example, if a farmer cannot solve the problem of how to grow a specific crop on his land, he might analyse why he finds growing this crop is desirable. If he decides that the reason is that the crop generally has a high profit margin, he might review what other crops have a high profit margin or even consider profitable uses of his land that do not involve farming. He thereby has redefined the problem from raising a certain crop on his land to making a high profit with his land.

Strategies to help you determine the cause of the problem

Collect information about what happens before, during, and after the problem

Collect information about what happens before, during, and after the problem.

Problems are often triggered by something observable and reinforced by something that happens afterward. So if Carrie often has temper tantrums, observe her and the situation carefully to collect information about what happens before, during, and after the tantrum. You may find that pressing her to do difficult schoolwork usually happens before and allowing her to avoid the schoolwork happens after. If Jake often has digestive problems, you might find that nothing special happens before, during, or after. No specific foods seem to trigger the problem, so diet restriction is unlikely to help. If you want to help heart surgery patients avoid depression after their surgery, observe them before, during, and after surgery.

Organise information into a table, chart, or list and look for a pattern

Organize information into a table, chart, or list and look for patterns. Information collected about a problem often becomes easier to search for patterns when put into a table, chart, or list. The patterns may reveal causes of the problem. So, if you want to predict the next time a man will beat his wife, organize information about his prior instances of wife beating and look for a pattern, such as beating being delivered after he suffered an affront and drank heavily. If you want to determine how to prevent auto accidents, put information about causes of past accidents into a table and look for patterns in the aggregated data, such as a high proportion of the accidents being caused by young males who have been drinking and were driving faster than the speed limit. If you want to predict when a stock will rise, chart its price fluctuations over time and events in the past.

Try to make the problem worse

Try to make the problem worse. One way to determine whether you know what causes a problem is to try to make the problem worse. This may be worth doing when the supposed solution is so difficult, inconvenient, expensive, or dangerous as to justify caution in trying it. So, if you suspect that eating strawberries is causing your nose to turn red, wait until your nose is its usual colour and eat a few strawberries. If you think that a mentally retarded child has tantrums because of changes in his routine, change the routine substantially on a few occasions and observe his behaviour.

Compare situations with and without the problem

Compare situations with and without the problem. Comparing situations with and without the problem can sometimes shine light on a difference that causes the problem. So, if you want to eliminate bacterial infections that kill women giving birth, compare the care given women who become infected with those don't. You might see, as a 19th Century researcher did, that the women who are "helped" by physicians who don't wash their hands between patients women become ill and the women who are helped by midwives who do wash their hands do not become ill. If you want to know what causes AIDS, compare people who do and don't have HIV and observe the people

for several years. If you want to know what causes violent crime, compare the intelligence of individuals who have and have not been convicted of violent crimes.

Consider multiple causes and interactions

Consider multiple causes and interactions. Sometimes two or more variables or influences cause a problem to occur. For instance, level of drunkenness depends on many factors, including the amount of alcohol consumed and the body weight of the person. A harmful level of carbon monoxide gas may flow into a house only if the wind is blowing hard in a certain direction, the heat exhaust pipe is less than a metre above the roof, and the heat is on high. If we do not look for all the causes of a problem, we may never find them. So if you want to determine what causes autism, wood rot in a house, or the cause of someone's death, consider multiple causes and interactions.

Consider non-linear effects

Consider non-linear effects. Variables sometimes cause problems in a linear way, e.g., the more lead a child eats, the greater the harm. However, some variables have curvilinear effects. For instance, some arousal aids human performance, while a great deal of arousal impairs performance. So, if you want to determine what causes a problem, consider non-linear effects.

Strategies involving the use of external aids to help you identify possible solutions

Ask someone, especially an expert

Ask someone, especially an expert. If we look hard enough we can usually find someone who knows more about how to solve a particular problem than we do. The fastest way to solve the problem may be to ask that person. So if you don't know how to fix a leaking faucet, or help your child act more outgoing, or improve your job interviewing success, ask an expert.

Seek the answer in written material

Seek the answer in written material. Written materials exist that show how to solve many problems. New devices often come with instruction manuals. Libraries and bookstores are loaded with "How To" books. The Internet offers answers to many problems – if we ask the right question and use judgment about which web sites are credible. So if you want to learn how to improve the appearance of your nose, you could look up "cosmetic" or "nose" surgery in an Internet search engine and in a medical encyclopaedia in the library.

Use a tool or technology

Use a tool or technology. Some problems require the right tool, which could be a hammer, a computer, or a metal detector. So whenever you have a problem to solve, consider whether some type of technology might help you.

Apply a theory

Apply a theory. Good theories can point us in the right direction to find a solution to a problem. For instance, Albert Bandura's social learning theory suggests that if we want to teach a child to act altruistically, we would set an altruistic model in our behaviour, talk about our altruistic goals, and reward the child (perhaps with praise) when she

acts altruistically. Other theories in fields as different as economics and physics provide possible solutions to various types of problems.

Apply the scientific method

Apply the scientific method. The scientific method has helped to produce many of the great accomplishments of recent human history, such as doubling the average human lifespan, putting a human on the moon, and discovering planets orbiting other stars. The method involves systematically collecting data to test a hypothesis, applying certain types of research design and analysis methods to the data, and being sceptical about the results. For more information, see:

http://teacher.nsrj.rochester.edu/phy_labs/AppendixE/AppendixE.html

Use mathematics

Use mathematics. Mathematics is essential to solving some problems, such as how to put an exploring robot on Mars, how to determine whether one treatment is generally more effective than another for pancreatic cancer, and how to defend an area from enemy missiles. There are many types of mathematics, but even the simplest can be helpful in problem solving. For example, if you want to make yourself happier, you might start by counting the number of days in the next 14 that you feel happy. Then you have a baseline to use as a comparison after you make some behavioural or situational changes in pursuit of more happiness. If you wanted to determine whether a new treatment for diabetes is better than the usual treatment, you might use a t test to compare the blood sugar levels are of the group of people using the new treatment with a group of people using the usual treatment.

Use a formula

Use a formula. Sometimes, a formula can help solve a problem. The formula could be a recipe, a set of chemicals, pressures, and heat levels, or an established method of doing something else. So, if you want to develop a permanent way of marking the right lens for contact lens wearers, start with the formulas for permanent pens and markers. If you want to create a better toothpaste, start with a typical formula and try altering its components.

Strategies involving the use of logic to help you identify possible solutions

Reason by analogy in using what you have learned about similar problems

Reason by analogy, using what you have learned about similar problems. Going through life we solve many problems. Often the problem solving methods we used and the actual solutions we found effective in the past can work to solve a current problem. So, if you have solved before a problem with a neighbour's dog barking all night, the same solution may work with another neighbour who plays loud music all night. In fact, the same solution might be something to try with anyone who is chronically annoying.

Use deductive reasoning

Use deductive reasoning. Deductive reasoning involves going from a general rule to an application in a specific instance. So, if we assume that people commit murder only if they have a motive, then we look for murder suspects among people who had a motive. If we start with a premise that people do what they think is in their best interest,

we try to provide employees incentives to work productively. If we believe causes must occur prior to effects, we can conclude that a huge grass fire did not cause the high level of asthma attacks that started two days before the fire.

Use inductive reasoning

Use inductive reasoning. Inductive reasoning involves drawing on specific instances to form a general rule. So, if you want to know whether your child will leave your yard if left outside alone, one thing you could do would be to set up that situation and covertly observe the child on several occasions. If you want to find out whether eating chocolate causes you acne, eat chocolate every day for two weeks, then not at all for two weeks, then every day again for two weeks, then not at all for two week, and record the state of your skin every day. If you want to know whether a genetically altered microbe will reproduce in field settings, put a specific number of the microbes in field settings and later count the number.

Question assumptions

Question assumptions. Our thinking contains many assumptions or beliefs that have never been well tested, such as that our religion or ethnic group is the best one. If you want to reduce inter-group conflict, questioning these assumptions might help. If you want to stop children from starting to use illegal drugs, question the assumption that educating them about the effects of the drugs will discourage use. If you want to develop close relations with your supervisor, you may benefit from questioning your assumption that all supervisors are power hungry and self-centred.

Strategies using a possible solution as a starting point to help you solve a problem

Guess, check, and adjust

Guess, check, and adjust. It may work to guess at a solution, especially if the range of possible solutions is limited as in a multiple-choice test. You can check to see whether your guess is right, and then eliminate the option if it is not. As Sherlock Holmes said, once you have eliminated all the possibilities except one, that one must be the solution. Sometimes guessing can help us even when the range of possible answers is unlimited. For instance, in solving for x in $x + y = 12$ and $2x - y = 3$, if there are no answers from which to choose, and you don't know how to solve simultaneous equations, you can guess at what x is, and if you miss, you can use how much you miss by to make a better second guess, and so on, adjusting your guessing as you go. That, in essence, is how software for structural equation modelling proceeds to a solution.

Work backward

Work backwards. In solving a printed maze, looking at the goal area and working backward sometimes offers the fastest solution. That may occur because the maze maker did not expect you to use this strategy. Also, if you want to recreate the events involved in a crime, you could start with a possible perpetrator and the available evidence, work backward in time, and see what makes sense.

Strategies to help you determine which possible solution is best

Estimate the likely costs and benefits of possible solutions

Estimate the likely costs and benefits of possible solutions. Use deductive and inductive reasoning and the scientific method to estimate the costs and benefits of each possible solution. For instance, if you have a wart on your hand, one option is to buy a commercial product that slowly disintegrates the wart. The costs include the financial cost of buying the product, the time spent in applying it daily, the cost of bandages to cover the area, the inconvenience of wearing bandages, the possible embarrassment of being asked why you are wearing a bandage, and the possibility of a life-long scar. On the benefit side the wart is very likely to be eliminated.

Choose one or more options to implement

Choose one or more options to implement. Solving a problem usually involves doing something. So, use deductive and inductive reasoning and the scientific method to choose one or more options to implement. This usually involves weighing the costs and benefits of each option according to your values. For instance, if you want to eliminate a wart, you might choose to do nothing and bet on the significant chance the wart will go away on its own and leave no scar. You might choose this approach because you have strong feelings against creating a life-long scar, such as those caused by more active approaches.

Implement the best solutions and collect information about the effects of it

Implement the best possible solution and collect information about the effects of it. Use deductive and inductive reasoning and the scientific method to determine the effects of the chosen option. So, if you want to eliminate a wart, you might wait a year and see whether it goes away on its own. If it doesn't, you could choose a more active option.

Strategies using geometry for problem solving

Do the opposite of what you have been doing

Do the opposite of what you have been doing. This 180 degree shift in approach is often essential for helping individuals reduce anxiety about specific situations, such as public speaking or seeing someone bleeding. Phobics tend to avoid the situation, thereby making their anxiety increase. The best way to reduce anxiety is to expose oneself, gradually or not, to the feared situation. This principle also comes into play when a physician notices a patient is getting worse and worse. That may be the time to decrease the medication rather than increase them -- if the medications are causing the worsening.

Try a totally different approach

Try a totally different approach. If many individuals have tried to solve a certain problem and failed, it might be helpful to try an approach that is not just somewhat different but very different. One might describe this method geometrically as moving the attack to a different plane. Einstein did that with his theory of general relativity.

Most such efforts will eventually be considered crackpot; some will be called a work of genius.

Strategies to help you function optimally while problem solving

Think of options without immediately evaluating them

Record and fully consider options. It is often wise to consider a range of solution options when engaged in problem solving. Several options may solve a problem, but one may solve the problem more completely or cheaply. Individuals may squelch their own good ideas or the good ideas of others by immediately rejecting ideas. Hence, it may help to record possible solutions and consider them fully. Even a very bad idea might point in a useful direction if it is not pushed aside too quickly.

Set a goal with a purpose you value

Set a goal with a purpose you value. Setting a goal with an outcome we value tends to help us achieve more. So, if you have an assignment of math problems to complete, you might set a personal goal of completing all of them correctly for the purpose of earning an "A" on the assignment and in the course so that you can improve your chances of gaining admission to medical school, so you can spend your life helping ill children. If you have a problem of getting your research approved by an ethics board, set a goal of gaining approval so that you can do the research and help others with your findings.

Avoid distraction

Avoid distraction. Distractions slow the problem solving process. Distractions can include environmental events such as phone calls and machinery noise. Distractions can also include repeated intrusive thoughts ("This is a terrible situation!"). One way to avoid external distractions is to go somewhere peaceful where no one can find you. Another way is to disconnect the phone and put up a "Do not disturb, please" sign. One way to reduce intrusive thoughts is to tell yourself that you will think about these emotion-laden matters at a specific later time, but for now you are going to yell "STOP!" every time the thought intrudes. Another way to reducing intrusive thoughts is to write them down or to tell someone close to you about them.

Work in a new setting

Work in a new setting. New settings sometimes prompt new types of thinking that can be useful in solving hard problems. For instance, go sit and think in the quiet park across from your headquarters, in a forest cabin, or in a different library.

Adjust time limit to optimum

Adjust time limit to optimum. Some problems are easy to solve but tedious. It may facilitate efficiency to set an artificially brief time frame for completion, e.g., "I'm going to finish these math problems in 30 minutes." For difficult problems, increasing the time frame for solution may help by reducing distraction-provoking anxiety. So if you are asked to solve a difficult problem, ask for an amount of time that will be sufficient to eliminate time pressure but still not so long as to induce inefficiency.

Work with someone

Work with someone. All else being equal, several people working on a difficult problem tend to produce a better solution than one person. Some efficiency may be lost, so working with someone may best be reserved for very difficult problems. So, if you want to clone a bonobo, work with someone. If you want to end your dependency on tobacco, work with someone.

Create a positive mood with an optimum arousal level

Create a positive mood with an optimum arousal level. People work better when they have a positive mood and a moderate arousal level. To create a positive mood, you could engage in some activity you greatly enjoy, such as listening to music or reading a book, or you could think back about huge triumphs and outstanding moments in your life. To avoid excessive arousal, you could use a relaxation method such as deep breathing, tensing and relaxing muscle groups, and telling yourself to stay calm.

Think of the problem as a challenge or opportunity

Think of the problem as a challenge or opportunity. No one wants to have "problems." So we often think of problem solving as an unfortunate, unpleasant task. Such a negative view of the problem solving may impair our performance at the task. In order to keep a positive mood and keep working on a problem, it is helpful to think of the problem as a challenge or opportunity. So, if the barking of your neighbour's dog is driving you batty, look at the situation as an opportunity to practice your assertion skills. If your PC won't come on, look at the situation as an opportunity to challenge yourself, as you might with an anagram. If your investments go sour, think of the situation as a challenge: Do you still have what it takes to make yourself rich through earnings or investment?

Think confidently

Think confidently. Confidence helps us persist in problem solving, and confidence comes most powerfully from problem solving success. So, think about past problem solving successes or solve another problem to boost your confidence about solving a specific problem. Useful thoughts include "I have solved more difficult (or similar) problems," "I know how to approach this problem," and "I can solve this problem if I try hard enough."

Take a break

Take a break. People can get fixed on a certain way of thinking about a problem or a specific class of possible solutions. It sometimes helps to take a break and think about matters unrelated to the problem in order to open the mind to new ideas. Some people benefit from sleeping on a problem.

Persist

Persist. Persistence in problem solving often pays off. It took many years to build the Great Wall of China. It may take you some time to solve a problem. Your odds of success often go to 0 when you give up. With continued effort, you have a chance. So, whether you want to become a millionaire or you want to eliminate the use of land mines, persist. If one possible solution fails, try another one or try another problem solving strategy. Note though that persistence can become maladaptive if the goal is

unrealistic. In some cases, the best course is to accept a problem as presently unsolvable and focus (with persistence) on other, solvable problems.

Strategies to help you solve multiple problems

Adopt a problem solving orientation

Adopt a problem solving orientation. People who look for problems to solve have a decided advantage over others. These individuals can often identify problems when the problems are small enough to be easily solved and when enough time is available to allow the use of good problem solving strategies. For instance, it is far easier to lose a few kilograms of weight than to lose 50 kilos. Individuals who wait for problems to become unbearable or unavoidable before dealing with them may experience unnecessary stress when circumstances force them to tackle a problem. Naturally, looking for problems to solve will tend to lead to more problems solved. A math student who does all the problems in a textbook rather than just the half assigned is an example of that principle. So is an executive who looks for problems that keep her workers from being productive.

Apply triage

Apply triage. Often there are multiple problems a person could try to solve at any one time. Emergency room physicians have developed the custom of triage, which is assessing the urgency of the health problem of each of the current patients. In problem solving, it is wise to consider during triage which problem has (1) the most important outcome, (2) the greatest chance for solution, and (3) the nearest deadline. So, if you lose your 3-year-old child in an outdoor crowd and your 8-year-old child has a headache, you focus on the lost child because the risk of harm is greater with that child. If you have two problems to solve, and one, such as developing a method of time travel, seems currently unsolvable, work on the other problem first. If you have two important problem-solving assignments, with one due tomorrow and one due in a week, focus first on completing the one due tomorrow. Sometimes the problem with the most important outcome is different from the problem with the best chance of solution or the nearest deadline. Then you have to apply your own judgment in weighing the triage considerations.

Solve one problem at a time

Solve one problem at a time. When faced with multiple problems, individuals may panic or lose hope and then quit trying. When facing more than one problem, to the extent possible, focus on solving one at a time. So if you are overweight and smoke, choose one of these problems to work on at a time. If you dislike your job and your roommate, choose one to work on. If you want to improve your writing and speaking skills, choose one with which to start.

Sources of the list

The strategies in this document come from a variety of sources, many of which have long since faded from my memory. Some of the ideas were previously described in the following references, which provide a wealth of examples:

D'Zurilla, T.J., & Goldfried, M.R. (1971). Problem solving and behaviour modification. *Journal of Abnormal Psychology*, 78, 104-126.

Fabian, J. (1990). *Creative thinking & problem solving*. Chelsea, MI: Lewis.

More information about Problem Solving

Harris, R. (2002). [Problem solving techniques](#).

McNamara, C. (1999). [Basic guidelines to problem solving and decision making](#).

Wikipedia (2006). [Problem solving](#).

About the author

John Malouff, Ph.D., J.D., earned a law degree from the University of Colorado in 1979 and a Ph.D. in clinical psychology from Arizona State University in 1984. He currently works as an associate professor of psychology at the University of New England, in Armidale, Australia. He has co-authored five books and several dozen articles in scientific journals. He writes a blog on [Using Psychology](#) in day-to-day life.