

Effective Problem Solving

Susannah Robertson and Gordon Tinline

Robertson Cooper Ltd

October 2007

Introduction

Problem solving is a broad area and there is a wealth of psychological research covering the different aspects of problem solving, from group problem solving and models for effective problem solving to problem solving styles and the stages of the problem solving process. For the purpose of this project we have focused on the factors that are likely to influence an individual's effectiveness when solving business problems, in order to generate an equation that can be used to assess problem solving effectiveness.

Following a search of the relevant academic literature (using databases such as Psychinfo and Business Source Premier) and a broader internet search, it was found that the key factors that are likely to impact on problem solving effectiveness can be broken down into three broad areas:

- Person related factors
- Situation factors
- Learned problem solving skills / techniques

These areas can then be further broken down into a number of different variables that are likely to affect problem solving effectiveness. These are outlined and discussed below.

Person related factors

Aspects of an individual's personality will have a large bearing on their problem solving ability. The key person related factors in relation to problem solving are listed below:

- Positive problem orientation¹ - the literature suggests that having a positive problem orientation (Nezu et al. 2001) will be important in terms of solving problems effectively. Individuals that have a realistic sense of optimism, a belief that problems can be solved given adequate time and effort and view problems as challenges, are more likely to be successful. This is likely to be an underpinning factor that will impact on an individual's experience and the sustainability of their efforts during the problem solving process. The belief that a problem can be solved may well be influenced by previous problem solving success with similar issues.
- Rational problem solving style – the extent to which an individual approaches a problem in a systematic, planful, organised manner is likely to impact on how effectively they can solve a problem (Nezu et al. 2001). This will be largely dependent on inbuilt personality characteristics, but individuals may also be able to learn to behave in this rational way when required though it won't come as easily as if it would if part of their personality make-up.
- Commitment / motivation to solve the specific problem - goal setting theory (Locke, 2001) suggests that if an individual believes that a problem is important / significant then they are more likely to be committed to solving it. How motivated and committed an individual is to solving a specific problem will have a large impact on the effort and determination they will apply in trying to solve it and ultimately how successful they are.

¹ *This quality helps an individual to be a resilient problem solver in the long term. It is a characteristic often associated with entrepreneurial drive in the sense that people who have it are very proactive and driven, are able to put failure behind them and move on optimistically to the next business challenge. There is also a strong likelihood that this positive problem orientation becomes an integral part of the individual's identity and motivational need. Serial entrepreneurs are a good example of a group of individuals who are very likely to be high in positive problem orientation. The type of person who gets savaged in the "Dragons' Den" (BBC) reflects on the experience and then goes back for a second attempt is a good illustration of this quality.*

Situational factors

Whilst person related factors will be critical in determining problem solving effectiveness, there is likely to be a complex interaction between these factors and other factors related to the specific situation or environment that an individual finds themselves in when trying to solve a problem. The situational factors likely to be particularly pertinent to problem solving effectiveness are detailed below:

- Distractions / interruptions² – the more often an individual is distracted or interrupted whilst trying to solve a complex problem, the less focused they are likely to be on the problem. This will ultimately impact on their effectiveness.
- Challenging deadline - research from work on innovative problem solving suggests that a certain level of time pressure will be an important factor in effective problem solving³. If an unlimited amount of time is available to solve a problem, an individual may struggle to become motivated, focused and driven towards the goal and they may not be as innovative as they might have to be under time pressure. However, this has to be a challenging but realistic deadline. If the time pressure is too restrictive there may not be sufficient time to define and formulate the problem properly, leading to an inappropriate solution.
- Challenging but achievable goal - It will be important that the goal (i.e. the solved problem) is challenging, but achievable - goal setting theory (Locke, 2001) suggests that goals need to be difficult in order to achieve high performance. If goals are more easily attainable, evidence suggests that performance will be

² *In the modern open plan office environment people frequently report finding it difficult to concentrate and think clearly with constant distractions around them. The effective problem solver will create time and space to think creatively when they are at the stage where the need is to ensure the problem is clearly defined and initial options are generated for tackling it. Organisations should consider the benefits of flexible working (e.g. home working) in allowing individuals periods with fewer distractions to think clearly at critical times faced with complex business problems.*

³ *As an anecdotal example recall the innovative problem solving by the mission control staff in the movie Apollo 13 faced with the need to solve problems under severe time pressure.*

lower. The problem must also be perceived to be solvable, or the individual may question the purpose of even attempting to solve it.

- Extent to which problem is well-defined – if a problem is well-defined it essentially equates to a specific goal. Again, goal setting theory suggests that a goal needs to be specific in order to positively impact on performance. A well-defined problem will also save the individual time, as they will be able to get straight into solving the problem.

Learned problem solving skills / techniques

There are many skills and techniques that can be learnt in order to improve problem solving ability and there is strong evidence that learning problem solving skills actually does lead to more effective problem solving (e.g. Duckworth, 1983). The key factors to be considered in relation to learned skills and techniques are listed below

- Exposure to skills / techniques - a list of different problem solving techniques are detailed below (taken from Huitt, 1992). Knowledge and awareness of these are likely to improve problem solving.
- Application of skills to different stages of problem solving process - there are four main stages to the problem solving process (input stage, processing stage, output stage, review stage; Bransford & Stein, 1984). See below for further detail on the different stages. In terms of problem solving effectiveness, knowing when and how to apply learned skills and techniques during the different stages of a problem will be important in terms of the outcome.
- Awareness of own primetime and downtime – individuals differ in terms of the time of day they are at their best – the time of day when we are at our best is known as primetime, and downtime is when we are not at our best. An awareness of primetime / downtime is likely to lead individuals to choose the best time of day to solve a difficult problem. Obviously none of us will be effective when we are over tired, but we all know individuals who seem to be at the best early in the day (larks) as well as those that don't seem to start functioning until after lunch (owls)!

It is important to note that there will be other factors that influence individual problem solving effectiveness, but for the purpose of this project only the factors thought to be most important have been covered.

Problem solving phases:

- 1) Input phase – a problem is perceived and an attempt is made to understand the situation or problem;
- 2) Processing phase - alternatives are generated and evaluated and a solution is selected;
- 3) Output phase - includes planning for and implementing the solution;
- 4) Review phase - solution is evaluated and modifications are made, if necessary.

Most researchers describe the problem-solving/decision-making process as beginning with the perception of a gap and ending with the implementation and evaluation of a solution to fill that gap.

Input phase

1. Identifying the problem means describing as precisely as possible the gap between one's perception of present circumstances and what one would like to happen. 4 types of gaps: something is wrong and needs to be corrected; something is threatening and needs to be prevented; something is inviting and needs to be accepted; something is missing and needs to be provided.
2. State the criteria that will be used to evaluate possible alternatives to the problem as well as the effectiveness of selected solutions.
3. Gather information or facts relevant to solving the problem.

Processing phase

1. Develop alternatives and or possible solutions
2. Evaluate the generated alternatives vis-à-vis the stated criteria.
3. Develop a solution that will successfully solve the problem
4. Diagnose possible problems with the solution and implications of the problems

Output phase

1. Plan developed and solution implemented

Review phase

1. Evaluating implementation of the solution - ongoing
2. Evaluating effectiveness of solution
3. Modifying the solution if necessary

Problem solving techniques / skills

- Logical, critical thinking techniques
 - analysis
 - backwards planning
 - categorization / classifying
 - challenging assumptions
 - evaluating / judging
 - inductive/deductive reasoning
 - thinking aloud
 - network analysis
 - plus-minus-interesting (PMI)
 - task analysis

- Creative, lateral, divergent thinking techniques:
 - Brain storming
 - Imaging / visualization
 - Incubation
 - Outcome psychodrama
 - Outrageous provocation
 - Overload
 - Random word technique
 - Relaxation
 - Synthesizing
 - Taking another's perspective
 - Values clarification

The Equation

In order to generate an equation to calculate problem solving effectiveness, the key factors discussed in this report have been included.

Given that the person related factors and situational factors are going to interact when an individual is solving a problem, these two areas are multiplied by each other. The learned skills / techniques are then added on, as these will further enhance problem solving effectiveness.

(Person Related Factors	x	Situational Factors)	+ (Learned Skills)²
(PO + RS + 2CM)	x	(D + 2CG + WD)	+ (E+A)²

All variables should be scored on a scale from 1-10 when generating a score from the equation. The maximum score on the equation is 2,000, representing perfect problem solving. The minimum score is 20. To simplify the overall rating the result from the equation can be divided by 20, giving a rating on a 1 to 100 scale.

Person related factors

PO = Positive Problem Orientation – this includes whether you have a realistic sense of optimism, a belief that problems can be solved given adequate time and effort and view problems as challenges. 1 = do not have a positive problem orientation at all; 10 = have a very positive problem orientation

A person high on PO is resilient, not easily put off by setbacks, and persists when others without this quality feel like giving up. As noted earlier the serial entrepreneur is a good example. The advantage of being high on PO is that faced with particularly difficult complex problems you are still likely to maintain your belief that you can find a way through. This quality is quite trait based in terms of personality and difficult, though not impossible, to develop.

RS = Rational Problem Solving Style – this is the extent to which you approach problems in a systematic, planful, organised manner. 1 = do not have a rational problem solving style at all; 10= have a very rational problem solving style.

The person high on RS will tend to be an analytical critical thinker. Someone who is good at getting through the noise that may surround a problem in terms of emotional reactions and spurious agendas and cut to the chase, getting to the heart of the problem. Generally this is a positive quality in solving complex business problems. However, there is a risk that an individual high in this quality may not pick up important emotional factors. For example, if the problem faced is a people one, say how to manage someone who failed to get a promotion and feels aggrieved about it, the high RS person may not offer a solution that takes account of the strength of the other person's feelings. As with PO this is very much a personality trait based factor.

CM = Commitment / Motivation to solve the specific problem – this is about how committed and motivated you are to solve the problem at hand. 1= not all committed / motivated to solve the problem; 10= extremely committed / motivated to solve the problem

This is the most important person related factor. Obviously it is related to PO but is less of an underlying personality trait, and much more specific to the problem at hand. The CM factor will essentially be driven by how much is at stake for the individual in finding a solution to the problem faced. For example, the finance director in a business is likely to have high CM to solve a problem relating to cash flow difficulties. However, he or she will probably have much lower CM if asked to help solve a problem that they largely regard as a people management issue. Similarly a problem that an individual perceives as critical in terms of their career development will generate a much higher CM than deciding what to have for lunch!

Situational factors

D = Distractionsⁱ – this is the extent to which you are going to be distracted and interrupted during the problem solving process. 1= lots of distractions and interruptions; 10= no distractions / interruptions at all.

The most important aspect of distractions is probably frequency of interruption. If you are sitting in an open plan office, your phone is ringing regularly, people keep “dropping in” for a chat about what you are doing at the weekend, e-mails keep arriving demanding a quick response, there is very little chance you will be able to concentrate to solve a complex business problem effectively. Reducing distractions usually means taking and exerting control. Prioritising the problem properly and doing whatever is needed to get away from distractions to think clearly, particularly in the early stages of getting to grips with the problem. However, this area shouldn’t be confused with people who offer information or ideas relevant to the problem, it is all the other noise that needs to be eliminated.

CG – Challenging, but achievable goal - this is the extent to which the goal is difficult but achievable given the deadline. 1= inappropriately challenging (i.e. too difficult or too easy) and not achievable; 10 = appropriately challenging and achievable.

CG is the most important situational factor in effective problem solving.

Frequently business problems are not solved effectively because the goal or objective is not well enough defined or not thought achievable. For example, if the problem is that sales revenue is declining, presenting the problem just as the need to increase sales revenue is probably not sufficiently clear. The goal needs to be clearer, such as increase revenues back to target levels from product x, in the target sector, by the end of the next quarter. This level of clarity allows the problem solver to focus properly on the aspects that will make a difference if they understand and influence them (e.g. product life cycle, sales and marketing activity in the target sector, realistic campaigns that may produce increased sales within the target timescale). Deadlines should be challenging, or stretch, but the problem solver must also regard them as achievable, otherwise they will not engage fully with the problem as they will not believe it can be solved.

This factor is the most important to try to influence. The person presented with the problem must question the objective to ensure they are very clear on what the requirement is and clarify, and if necessary challenge, the deadline presented. The temptation not to be difficult at this stage and demonstrate a “can do” attitude may get in the way of spending time at the front end of the process understanding properly what is required and ensuring that you believe you can achieve the goal. Such an approach will almost certainly back fire. The key here if presented with a problem to solve by your boss, is to show you are keen to find a solution but emphasise that because you are so motivated to do so is important you spend a bit of time with them upfront clarifying the requirements.

WD – Well-defined problem – this is the extent to which the problem is well-defined and understood. 1= poorly defined problem; 10 = very clear well-defined problem.

Some business problems are by their nature ill-defined. A classic example is trying to understand what to do to change the organisational culture. Usually, with such problems there are so many influences on them and, interactions between these, it leads the problem solver to not knowing where to start. The requirement here is to do whatever is possible to define the problem in a way that the problem solver can begin to find a logical route through in their mind (sometimes referred to as the “problem space”). It usually means trying to work out what causes what, and creating a model or structure for the problem. Obviously poorly defined problem will take longer to solve.

Learned skills / techniques

E = Exposure to skills / techniques – this is the extent to which you have been exposed to the problem solving skills and techniques listed. 1=not exposed to any skills / techniques; 10 = exposed to the majority of the skills / techniques listed.

There are clear advantages to being exposed, usually through training, to a range of problem solving techniques. This allows the problem solver to build up a better tool box for solving the problem. It is the difference between having a full tool kit to work with as opposed to always going at it with a hammer!

A = Application of skills / techniques to different stages of problem solving process – this is the extent to which you have experience in applying the skills and techniques listed to the different stages of the problem solving process, including the best time (primetime / downtime) to apply them. 1 = no / very little experience of application of skills and techniques; 10 = a lot of experience of application of skills and techniques.

Exposure to problem solving techniques is never sufficient. Many of us have been on training course to “learn” things we don’t apply. Use it or lose it is the underlying principle here. You become a more effective problem solver through applying techniques and working out for yourself what works in different circumstances.

Becoming a More Effective Problem Solver

It is argued that the two most important attributes for effective problem solving are a high level of commitment to solving the problem faced and a problem which is seen as challenging but achievable, these factors are the most heavily weighted in the above equation. With this and the other factors in mind the following are suggested as tips for more effective business problem solving:

- You need to have a passion for your work – if you don’t have this you are unlikely to be sufficiently motivated to solve the problems you face there day after day, and you will find it difficult to sustain the commitment you need to solve problems effectively;
- Understand the principles of goal setting – the powerful effect that a specific challenging but achievable goal can have on you, look for problems to solve that fit this description;
- If you are one of life’s pessimists (Hint – you probably think you are a realist), learn about attributional / explanatory⁴ styles and how adopting a positive attributional style can help you develop a more optimistic orientation to business and life problems;

⁴ *Attributional or explanatory style refers to the variation in the way people attribute causes to events. A positive attributional style is one where success is internalised as being a result of the individual’s actions and is thought about as a permanent quality that can be applied to other situations. For example, if you solve a difficult business problem you believe it was solved as a result of your actions, and that this achievement will stay with you and can be applied successfully to other problems. Attributional style is based on personality (optimism) to some extent but we can all learn, via exposure to the right techniques, to adopt a more positive attributional style.*

- Learn to negotiate time and space free from irritating distractions to apply objective well-structured analysis to the problem at hand, particularly in the early stages of trying to grapple with the problem;
- Learn formal problem solving techniques (e.g. inductive / deductive reasoning) and how to apply them effectively.

References

Bransford, J. & Stein, B. (1984). The IDEAL problem solver. New York: W.H. Freeman

Duckworth, D.A. (1983) Evaluation of a programme for increasing the effectiveness of personal problem solving. British Journal of Psychology, 74: 119-127

Huitt, W. (1992) Problem solving and decision making: consideration of individual differences using the Myers-Briggs Type Indicator. Journal of Psychology Type, 24: 33-44

Locke, E.A. (2001) Motivation by Goal Setting. Handbook of Organizational Behaviour, 2: 43-54

Nezu, A.M., Nezu, C.M. and Lombardo, E.R. (2001) Managing Stress through problem solving, Stress News July 2001 Vol.13 No.3

Speier, C., Valacich, J.S, and Vessey, I. (1999) Influence of Task Interruption on Individual Decision Making: An Information Overload Perspective. Decision Sciences, Spring 1999.

ⁱ Distractions have a significant impact on problem solving and this is an area the problem solver may be able to influence quickly and directly. For example, if we consider distractions rated at 1 (perhaps trying to think through a complex problem on a noisy busy building site with constant interruptions), 5 (say an average open plan office environment) and 10 (a quiet space with good lighting and temperature control, where the problem solver is comfortable and is not interrupted), and we hold all other variables in the formula at an average 5 rating, the score differences would be:

Distractions = 1 (building site):	Equation score (1 to100) =	21
Distractions = 5 (open plan office):	Equation score (1 to100) =	25
Distractions = 10 (quiet place):	Equation score (1 to100) =	30

If we take the 1 to 100 scale as essentially a percentage score (more accurately a percentile), this suggests that the absence of distractions typically gives a 5% problem solving advantage against a typical open plan environment and a 9% advantage compared to situations with maximum distractions. This might equate to a significant business advantage in a competitive industry where facing complex business problems is an everyday reality.