Chapter 4

Thinking:
Further Developing Capabilities

Introduction

As other chapters show, successfulbehavior depends upon many factors and activities. Few, however, are as important as our ability to think. We must think in order to identify what we need to learn in terms of abilities, information, and other inputs to successful behavior or performance in various roles. Equally if not more important, we must use what we have learned in order to cope, adjust, solve problems, and make decisions. Using what we have learned generally involves thought. (Also, learning depends upon thinking abilities, since problem solving is a major mode of learning.) Whereas learning information of one sort or another may not always take conscious thought, behavior adjustment should. Thought is required to analyze problem behavior and to determine how to adjust it.

Are our thought processes ever 100% effective and efficient? Are our solutions and decisions ever 100% appropriate? Hardly. We are, after all, only human. Thus, we have a tendency to analyze situations and arrive at solutions or decisions rather simplistically. We even tend to implement our plans, solutions, and decisions rather ineffectively and inefficiently much of the time. There are as many causes of these phenomena as there are factors that influence how well we solve problems and make decisions. We are all aware of many of these causes. There are some causes or influences, however, that we may not be aware of and may give relatively little thought as we attempt to solve problems and make decisions.

This chapter presents an established, comprehensive, integrated system for more effective thought processes.

Part 1 identifies numerous factors or variables that influence problem-solving and decision-making effectiveness and efficiency. Many of these factors are potential limitations to effective, efficient thought. Some are beyond our control; but this does not mean that we cannot influence them or compensate for them to a significant degree. Therefore, Part 1 also discusses how to improve or deal with the various factors that influence thought.

Ourpurposesin Part1are three-fold. First, thebackground information and perspectives presented in Part 1 help make the discussion in Part 2 more meaningful. Second, Part 1 constitutes the rationale for using a more systematic approach to problem solving and decision making. You will be more likely to use the principles and methods discussed in Part 2 if you understand and appreciate the need to use them. Third, and most important, we describe ACTIONS to take regularly or continuously to improve some factors and compensate for others.

In Part 2 we will present principles and methods for (a) structuring one's own thinking situations, (b) channeling thought processes, and (c) compensating for mental limitations. Each principle or method will be directed toward influencing one or more factors that affect the effectiveness and efficiency of thought processes.

Recommendations

Remember to take (and reinforce in memory) these Preparation Phase Steps:

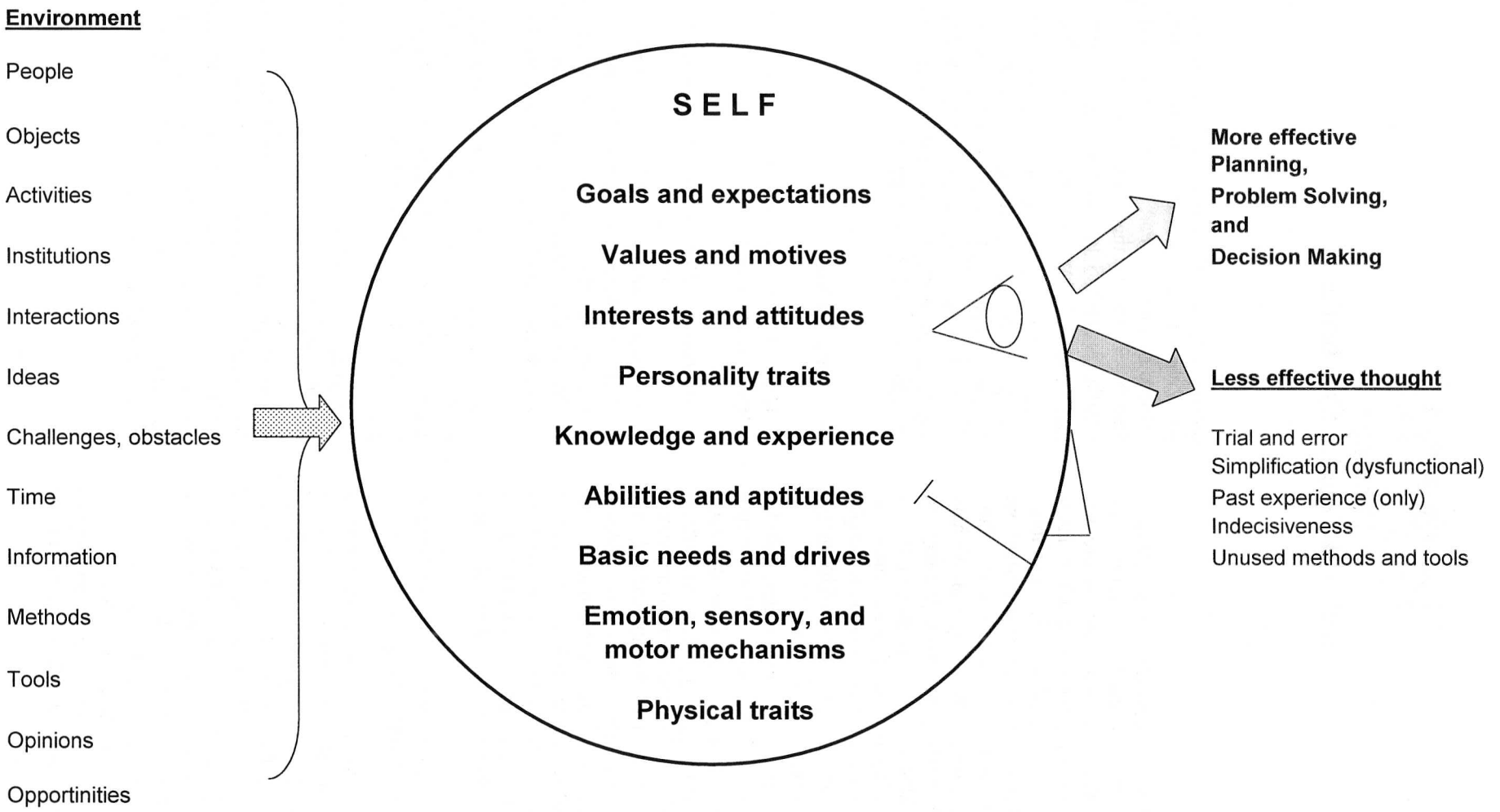
1. **Awareness – Think what you're doing** and how to do it well
2. **Increase Motivation –** Why is this important to you?
3. **Seek a conducive learning environment**
4. **Get organized –** get everything you'll need together
5. **Preview the material –** for gist, key words and ideas
6. **Recall and structure Preview impressions**

As you read, try to anticipate or formulate principles or methods that might be used to affect each factor that influences thought. Consider the order in which you would use these principles or methods during a problem-solving situation.

Again, we remind you to make notes to yourself as significant insights occur to you.

This chapter can be presented in lecture form, wherein the material is condensed. Again, important points are underlined. The decision to abbreviate the presentation, however, should depend upon the desired depth of listeners' understanding and appreciation of the need to use the principles and methods in Part 2.

Figure 4.1: Factors that Influence Thought



Part 1

ACTIONS to Take Regularly/Continually to Improve or Compensate for Factors That Affect How Well We Think

Thinking skills are among the most necessary inputs to successful performance. It is through thought (as well as learning) that we successfully cope with and adjust to our environment. Thought enables resolution of conflicts and obstacles to need fulfillment and goal attainment. In addition, problem solving is a major mode of learning and an important part of behavior adjustment.

There are a number of major factors or variables that influence how well we can think. To think most effectively and efficiently, we must maximize some, minimize some, and compensate for others.

Most formal approaches for improving problem-solving and decision-making processes focus upon the "analytic (scientific) approach." The basic phases of this approach are: (1) analyzing the situation; (2) formulating alternative solutions; and (3) testing alternative solutions and choosing one or more to implement (decision making). As you will see, using this approach can compensate for certain human mental limitations.

Here in Part 1, however, we discuss many factors that influence the effectiveness and efficiency of thought, including an ability to apply the analytic approach. Regardless of the degree to which each of these factors affects thought, in order to maximize our effectiveness and efficiency in thinking situations, we must purposefully control the influences of all these factors—not just one, two, or three. We must deal with thinking situations as systems of variables and principles.

Some readers may consider Part 1 material to be "theoretical," but it is not. As research has shown, all of the factors we will be discussing do influence thought to a greater or lesser degree. In fact, much of the discussion is "common knowledge," to which we will add a few useful insights and perspectives. The material, however, is *conceptual*. It deals with mental processes that cannot be seen and must, therefore, be described and discussed in verbal terms.

Reviewing What You Already Know

1. How do mental processes affect problem solving and decision making?
2. How can the breadth and depth of one's repertoire of knowledge and experience influence problem-solving effectiveness?
3. What "modes" of problem solving do we generally tend to use? Why?
4. How do specific abilities and aptitudes affect thought?
5. How do "basic needs and drives" affect thought?
6. How might thought be affected by each specific value in your value system?
7. What is the role of motivation in a thinking situation?
8. How is thought influenced by your personality traits? In problem-solving situations? In decision-making situations?
9. Lack of time can be a limitation. When it is, what are you likely to do in a problem-solving or decision-making situation?
10. How do environmental stimuli affect thought processes?
11. Does physical discomfort or an emotional disturbance affect thought? How?

General

A problemsituation is that which obstructs arriving at some goal or intended purpose. Thinking of a problem-solving nature occurs when learned or conditioned responses are not adequate for coping with a new or unexpected situation.

Problem solving is undoubtedly the most complicated of all types of human behavior. It involves sensory, interpretive, and motor areas of the brain. Sensory and interpretive areas are involved in becoming aware that a problem situation exists. Interpretive areas are involved in analyzing the situation and arriving at a solution or decision. Motor areas are involved in implementing the solution or carrying out the decision. Thinking effectively and efficiently also involves personal characteristics such as needs or drives, abilities and aptitudes, knowledge, experience, values, interests, personal goals, expectations, and personality traits. In thinking situations just as in any other situations, human beings are systems of interacting factors.

Enhancing Conscious Awareness of Problem-Solving (and Other Thinking) Situations

(So That One Will Stop to Think About What One Is Doing and How to Do It Better)

Becoming aware of a problem situation requires that unconscious levels of mental activity select certain environmental stimuli for conscious attention. *Examples*: (1) You are driving your car and are approaching a gentle curve to the left. Since you have followed many such curves before, you respond to visual stimuli representing the curve by habitually turning the steering wheel to the left. As you turn it, you expect to perceive visual stimuli indicating that you are continuing to follow the road. However, let us say that this time the stimuli are not altered as you intended, and, instead of perceiving your car turning left and following the road, you perceive the car going straight ahead—toward the right shoulder of the road. At this point, actual stimuli are being mentally compared with intended or expected stimuli. If they compared, you would not perceive a problem situation. But they do not compare, and you become aware that you are in a problem situation. (2) Perhaps you are perceiving that you are skidding on a slick patch of pavement, and, out of habit, solve the problem by steering in the direction of the skid. Here, then, as in most cases, you become aware of a problem situation when something is occurring that was neither intended nor expected.

We are constantly confronted by problems involving our jobs, our families, and our various interpersonal relationships. These "curves in life" are generally much more complicated than they seem. However, we do not always become aware of these problem situations because we tend to consider a situation a problem only when it is an obvious exception to more or less "normal" circumstances. In effect, we treat many situations as gentle curves in the road, since they appear to be similar to many of the other curves with which we have already dealt. Thus, we tend to respond to these situations almost unconsciously, using habitual responses we have learned in seemingly similar situations. When we react habitually, however, we do not think out solutions that could be much more appropriate than past responses to similar situations.

How would you go about increasing your ability to become aware of problem situations? If you answered, "By setting goals and formulating plans, and by writing them down and crystallizing them," you were right. Goal setting and planning implant clear intentions or expectations into memory regions of the mind, which subsequently helps us become aware that something is occurring that was neither intended nor expected.

ACTION: Formulate Goals and Plans to "Program Your Mind" For Awareness of (Goal-Related) Problem Situations

The psychological basis for recognizing or being aware of problem situations is the process through which interpretive areas of the brain compare actual stimuli with intended or expected stimuli. Intended or expected stimuli can be recorded in long-term memory by writing them down. Thus, you will become aware of a greater number of problem situations if you do the following:

1. Define, crystallize, and write down (better record in memory) what you want to happen in terms of long-, intermediate-, and short-term goals (rather than just thinking about them). Did you do that in Chapter 3?
2. Imagine future situations the way you would like to see them occur or unfold.
3. Anticipate possible obstacles, conflicts, or problems that may arise, and then record them in memory by writing them down.

In addition to helping you recognize when you are in important problem-solving situations, these steps help to make your problem-solving activity (and all other activity as well) more goal-oriented.

Intended or expected stimuli can also exist in (be recorded in) short-term memory. You can "program your mind" for greater awareness of problems in the short term by anticipating what might happen next. There are additional "cues" that help to signal a problem situation. Unanticipated visual sensitivities (perceptions) are such signals. Hearing the following verbal phrases should also cue conscious awareness of unanticipated problem situations:

a. .____ doesn't work right.
b. How would you . . .?
c. Why didn't . . . ?
d. I can't seem to . . . ?
e. I don't understand why . . .
f. What a mess!
g. We're in trouble on . . .
h. . ____ didn't work out.

Cues that should signal problem situations also include emotions such as fear, guilt, frustration, anxiety, tension, and disappointment. These emotions result from negative feedback from the environment and signal that behavior has been inappropriate, unadjusted, or otherwise unsuccessful—and, therefore, is problematic and/or has caused a problem.

Make the following association in memory and constantly reinforce it:

Unexpected, Unintended, or Dissatisfying Perceptions and Emotions	=	THINKING SITUATION

Programming your mind for greater awareness of thinking situations has several other important advantages.

A. Awareness makes you conscious of what you are doing. It helps to say to yourself, "I am in a thinking situation and can be more effective by . . ." Again, we would remind you that you do things better when you stop to think about what you are doing and how to do it well.

B. By identifying important goals and potentially important problems related to these goals, you not only become more aware of obstacles to goal attainment, but you are also more aware of the importance of the situation to you. Awareness tends to increase your motivation to solve problems as effectively as possible. It also enables you to determine the priorities among the many problems that you may be facing at any one time.

C. A complaint we often hear is, "I appreciate what I should do in a problem situation, but problems come up quickly and there isn't always enough time to really think things out." If you often find yourself in this position, ask yourself if you shouldn't take a few hours or even days to stop and take time to think ahead. By anticipating obstacles, you give yourself time to consider the many factors involved, collect necessary and relevant facts, arrive at effective *preventive* solutions, and begin implementing them before the problem situation actually develops. Furthermore, as you look ahead for problems, you can find others that might never have been anticipated. Thinking ahead and anticipating possible problems gives you time to deflate or even eliminate them before they develop, become worse, and cause additional problems. "An ounce of prevention is worth a pound of cure."

To recap: "Programming your mind" (by writing down goals and plans) has many important advantages: (a) greater awareness of problems; (b) more consciously controlled thought; (c) greater motivation; and (d) more time in which to use the analytic approach.

Increasing Knowledge and Use of The Analytic Approach

The main steps of the Analytic approach are: (1) defining/describing a problem situation, (2) analyzing the situation to identify the system of (interacting) causal variables; (3) collecting and analyzing facts; (4) formulating alternative solutions (including plans for their implementation); and (5) testing the various alternatives and choosing the one(s) to implement. You have probably learned these steps at some time. But the questions are: (a) have you made a habit of using them; and (b) do you use them when you should? If not, you may not use them at all, especially if you are not consciously thinking about using them during important problem-solving situations. If your answers were "yes" to both questions, you are very likely getting results that are superior to those we obtain from the more simplistic approaches we generally tend to use

Less Than Fully Effective Approaches and Why We Too Often Use Them

Even though we unconsciously reduce the proportions of problems and decisions to mentally manageable basics, we also do it consciously.

Problem solving is a complicated process, which, if conducted properly, can consume considerable time and psychic energy. These are additional reasons we generally do not think as well as we have the potential to think. Then, because we do not (or can not) handle complicated problems with great success, we tend to develop a negative attitude toward thought. The result? We often tend to think as little as possible—or just enough to get by. Thus, it is little wonder that various experts have called us "the mindless society."

Several phenomena can occur as a result of the above thought-limiting factors.

Relying Only on Past Experience

First, rather than think a problem or decision out fully, we tend to simply consider our past experience, which is limited. We often respond to problems by using responses that we have used in previous, somewhat similar situations. Even though these "programmed solutions and decisions" may not be fully effective in the present situation, they are an "easy way out" of expending time and energy.

"Cutting Through the Detail"

Second, even if learned responses are seen as being inadequate, we still consciously and unconsciously reduce the proportions to manageable "basics" that we believe to be most important. Some call this "cutting through the detail" or "the common sense approach." However, if you are inclined to solve problems and make decisions based upon a few seemingly important variables and corresponding facts, you can (a) overlook the real, underlying causes of more obvious causes, (b) overlook factors and facts that could add up to be more important than those you are considering, (c) be influenced by a negative attitude toward thought, (d) be influenced by expediency rather than rationality and objectivity, and (e) use an inferior approach.

Trail and Success Approach

Third, the use of past experience and short-cut methods are not the only ways out of doing in-depth thinking. Using the trial and success method (formerly called the "trial and error method") is another way out. It involves attempting various solutions—some thought out, some not—until one finally works.

We are not saying that these more simplistic approaches have absolutely no place in problem-solving situations. However, using them is more justifiable in situations where (a) immediate action is required, but too little time is available for more in-depth thought; (b) necessary facts are either unknown or unattainable; (c) the problem must be solved in one's head due to lack of aids such as paper and pencil, calculators, whiteboards, or flipcharts; or (d) the only way to determine whether or not a possible alternative will work is to try it.

The point is this: "Common sense," "cutting through the detail," "using past experience," and "trial and success" are not particularly powerful approaches to problem solving. These more simplistic approaches are used too often when the complexity and/or importance of a problem or decision warrant the use of the far more powerful analytic approach. Even so, there is actually more to effective, efficient problem solving and decision making than just using the analytic approach. We describe in detail a more comprehensive approach in Part 2.

ACTION: Learn, Practice, and Make a Habit of Using the Analytic Approach

The analytic approach is part of the comprehensive, systematic approach we describe in Part 2. When you come to the next section, read about it to remember it—not to simply know that it exists. Learn it and then practice its use until using it becomes a habit. This approach is a necessary discipline (methodology) that channels thinking abilities and compensates for various mental and other limitations.

Increasing Repertoire (Available Store) of Knowledge and Experience

We use knowledge (information previously recorded in memory—including information obtained through experience) to analyze problems and understand them in all their aspects. Therefore, how much we already know partially determines (a) how many causal factors or variables we are able to identify, and (b) how many facts corresponding to those factors we can use to analyze a situation. Solving problems is a matter of using what we know (and also can find out).

But no one has "perfect knowledge" (100% of all the relevant information). In fact, no one has 100% of the knowledge related to any particular subject or area. As a result, most of us might only be able to identify and consider, say, 50% of the variables involved in a problem situation. Similarly, most of us might know only 50% of the facts involved in a situation. Obviously, therefore, we possess definite limitations with regard to how well we can analyze situations and arrive at appropriate solutions or decisions.

Experience is also useful when formulating solutions, selecting one (or more) for implementation, and then implementing plans or decisions. Experience helps us answer the question, "What might happen if . . .(I use alternative A, B, C, or all three)?" Here again we are limited. No one has all the experience that might be necessary to solve a particular problem. In addition, experience can be misleading. What happened or what worked in a previous situation undoubtedly occurred within the context of a particular set of circumstances or variables. Even though two situations may be similar, there are always differences that can limit the validity or appropriateness of previous experience (previously used solutions). This perspective is all too often forgotten.

ACTION: Increase Repertoire of Knowledge and Experience

Having identified goals, plans, possible problems, and future activities, you now have the time and motivation to learn the specialized or specific information that will be useful for solving problems and making decisions related

to areas important to you. By doing so, you will begin to minimize one of your major limitations in thinking situations. At this point, then, it might be advisable for you to review the areas wherein acquiring more knowledge would be to your advantage. (Refer as necessary to the planning work you did in Chapter 3.)

Byincreasingyour vocabularyand knowledgeof concepts related to areas of importance to you, you further develop your ability to reason concerning those areas.

Then, use your expanded visual, verbal (vocabulary), and other learning to (a) describe in greater detail what you perceive; (b) look for similarities and differences among objects, people, activities, events, places, and ideas; (c) identify complex interrelationships among things; and, as a result, (d) learn even more.

Further Developing Mental (Logical) Abilities

Howwell you are able to analyzeandsolvemanyof life's other problems is largely a function of your levels of "academic intelligence" and "social intelligence" (or "social insight").

Howwell you can analyze and solve mechanicaland spatial problems depends to a great extent on your levels of "practical or mechanical intelligence" and aptitude for "spatial thinking" (or "mechanical visualization").

The higher your levels of a particular type of intelligence, the better your abilities to reason (juggle information back and forth between memory and reasoning areas of the brain).

Logical Abilities (Associated with Academic Intelligence)

Research suggests that human beings are born with potential "ranges" within which various types of intelligence can be developed. Thus, one individual may be born with a slightly higher "potential range" of academic intelligence than another individual, but if the first individual has not developed various mental capabilities, his or her "usable intelligence" may be lower than that of the person who had a lower potential range but has experienced greater mental development.

Tests designed to measure academic intelligence actually measure several mental "capacities." To a large extent, they measure one's amount of visual and verbal learning (compared to other people in a certain group/population). They also measure an individual's abilities for processing information (juggling information back and forth between memory and reasoning areas of the brain). These abilities are actually patterns of brain cells that develop over time and enable the processing of information. That processing involves juggling visual, verbal, and other types of information between reasoning areas and short- and long-term memory regions of the brain.

Class logic is the abilityto (1) define or describe objects or activities in terms of various characteristics; (2) compare or contrast the objects or activities based on their characteristics; and (3) determine similarities and differences between the objects or activities.

Deductive logic is directlyrelated to class logic. Using deductive logic, one draws a conclusion—based on given or accepted general principles, statements/facts, or assumptions—that something (e.g., a fact) must be true. Conclusions are certain because they are implied by the givens or assumptions. *Example*: Given the premise that all monks are poor, and also given the premise that some Englishmen are monks, one arrives at the conclusion that some Englishmen are poor. Notice that the conclusion is arrived at by putting these people into groups based on characteristics that they share (class logic).

Propositional logic deals with things as they might or could be (as opposed to class logic, which deals with things or activities as they are). In other words, it deals with uncertainty and the future. Using propositional logic is a matter of asking "what if" or "what might happen if." In effect, it is a matter of mentally testing alternatives and their outcomes (based largely on past experience). *Examples*: If A is true, and if B is true, then C is or is not true. If I have solved a certain problem successfully in the past using this solution, and if this problem is similar to the past problem, then the same solution should solve the present problem. (Remember, however, that the latter conclusion may or may not be true.)

Inductive logic is directly related to propositional logic. Using inductive logic is a matter of drawing a conclusion that something is or may be operating—such as a principle or theory. In this case, the study and comparison of accepted facts leads to the derivation of a theory. Often, one is seeking to provide a true statement concerning all objects in a class by examining a sample of objects in a class. *Example*: Given the fact that there has been a test every Tuesday so far this semester, and given the fact that there has been no apparent reason for this policy to have been changed since last Tuesday, then one can conclude that there will probably be a test this coming Tuesday.

The better these logicalabilities have been developed, the better we are able to solve problems and make decisions. Remember, though, that these mental abilities are not necessarily fully developed in any of us.

ACTION: Improve or Further Develop Thinking (Logical) Abilities

How well you are able to solve problems and make decisions depends to a great extent on the extent to which your logical abilities have been developed. Logical abilities can be further developed in several ways.

1. Class logic (deductive logic): Literature, physical science, and social science courses help develop these abilities by increasing one's vocabulary and improving one's mental abilities (processes) for defining/describing, comparing/contrasting, and identifying similarities and differences among objects and activities.
2. Propositional logic (inductive logic): Taking science, logic, and math courses develops these abilities. Math courses such as algebra, trigonometry, and calculus, which involve working with equations, help individuals develop an inclination to think "What will happen if I ____." *Example*: "What will happen to one side of the equation if I change a certain factor on the other side."
3. You can **practice** solving complex problems. The more difficult the problems, and the more of them you tackle, the more your reasoning abilities will improve.
4. Get into the habit of asking yourself, "What will happen if I . . ." **Practice** the use of propositional logic.
5. To help increase your ability to juggle information back and forth between reasoning and memory areas, you can **practice** thinking out relatively simple problems in your head—without the aid of paper and pencil—trying to "keep as many balls in the air at one time" as possible. As you develop a greater facility for juggling information, take on slightly more difficult problems. The more difficult the problems and the more of them you tackle, the more your mental abilities will develop. We do not mean to suggest, however, that you practice this activity on really important problems. For these, you should use the approach that we outline in Part 2. Human beings simply cannot solve problems most effectively in their heads. Without visual and other aids, the mind cannot handle a great deal of complexity.

Adjusting or Compensating For Values, Personality Traits, and Interests

These motive/attitudinal traits can influence what we think about and how well in many ways. Some are functional for thought in general, while some are dysfunctional. Below we give several examples of how being high or low in various values and personality traits can influence one's thinking processes.

ACTION: Adjust Motive-Attitudinal Traits (Values, Personality Traits, Interests)

As part of personal goal setting and planning in Chapter 3, you identified various personal characteristics that may need adjustment or improvement (in order to reach personal and/or organizational goals). Before you begin to adjust or improve them (based on suggestions in Chapter 8 on Behavior Modification), you should consider whether or not the responsibilities you perform in various roles require constant and/or complex analysis, planning, problem solving and decision making. If so, pay particular attention to those values, personality traits, and interests that may interfere with effective thinkwork. You may not wish to try to modify your levels, but at least be aware of them so that you can attempt to mediate their influences when appropriate.

Values

A relatively high theoretical or intellectual value can be very useful to a problem-solver. A predisposition to ask "why" means that one will probably be more analytic, dig into the situation to find underlying as well as superficial causes, and think things out more fully. It also means that one will probably be more inclined to anticipate and consider the results or consequences of alternative solutions. However, if this type of person is not careful, he or she can tend to get bogged down in detail, which can result in indecisiveness. On the other hand, a less theoretical (less conceptual) individual can tend to be higher in other values—values that may be more real-world oriented and practical. Consequently, such a person may be better at implementing solutions through other people. A balanced approach is generally most effective. Problem solving requires analysis, but it also requires effective action to actually improve a situation.

One's value system also affects one's repertoire of knowledge and experience. Both knowledge and experience tend to be greater in those areas or activities that are most important to us. Stop for a moment to consider your highest and lowest values and the implications for your ability to solve problems in areas that are significantly less important to you.

If, for example, you are higher in the economic value (concern for money, financial success, material things) and the political value (concern for power, authority, or influence), you will tend to know more about and think more about the task-related and organizational factors that may be causes of a problem in your surroundings or organization; but you will probably tend to know less about and think less about people-related and social factors.

On the otherhand, if you are higher in the social value (altruism or love of and concern for people), you will tend to know more about and think more about people's characteristics and social interactions than about the "mechanics" of what is going on socially and politically around you.

Whatare the implications of your levels of these values for your problem-solving and decision-making processes?

Personality Traits

The more adaptable you are, the more honestly and objectively you will tend to think about and solve your own attitudinal and behavioral problems. On the other hand, if you are too adaptable, you may acquiesce to others' solutions even though you may disagree with them. You may also be too self-critical when thinking about your own behavior.

The more sociallyconscientious you are, the more you will tend to consider how your own solutions, decisions, or behavior will affect others' needs and feelings. This can make you more effective when working with other people or when implementing your solutions or decisions through them.

If you are a highly self-sufficient person, you may tend to seek and verify information for yourself. However, if you are too self-sufficient, you may be inclined not to seek the benefit of others' knowledge, thoughts, or opinions—regardless of the fact that two heads are better than one. In addition, you may want to implement your solution yourself—when others' help would yield better results.

The more self-confident you are,the morepositively and assuredly you will tend to confront problems. Self-confidence in problem-solving and decision-making situations can reflect well-developed thinking capabilities. It can also aid in the implementation of solutions or decisions through others. If you are confident of your solutions, you will probably be more persuasive and more successful at getting others to help you implement your solution(s). On the other hand, one can be too self-confident and not thoroughly consider the aptness of one's own analysis, solutions, or conclusions.

If you are a highly dominant person, you may seem too "pushy" to others and lose their cooperation when implementing solutions. On the other hand, if you are not aggressive enough, you may not be inclined to stand up for your own conclusions, solutions, or decisions when you should.

If you are highly introverted, you may tend to be a good thinker, but you may also keep good ideas and solutions to yourself. If you are more extroverted, you may be somewhat less analytic, but you will probably be able to implement solutions through others more effectively (unless you are too highly extroverted).

The more emotionally stable you are, the more your repertoire of knowledge and experience will tend to be logical and objective. In addition, you will tend to approach problems with more objectivity and less waste of emotional energy.

The more self-controlled (self-disciplined) you are, the better you will concentrate and sustain attention and effort on a problem—even though your interest and motivation to do so may be relatively low.

What are the implications of your levels of these personality traits for your problem-solving and decision-making processes?

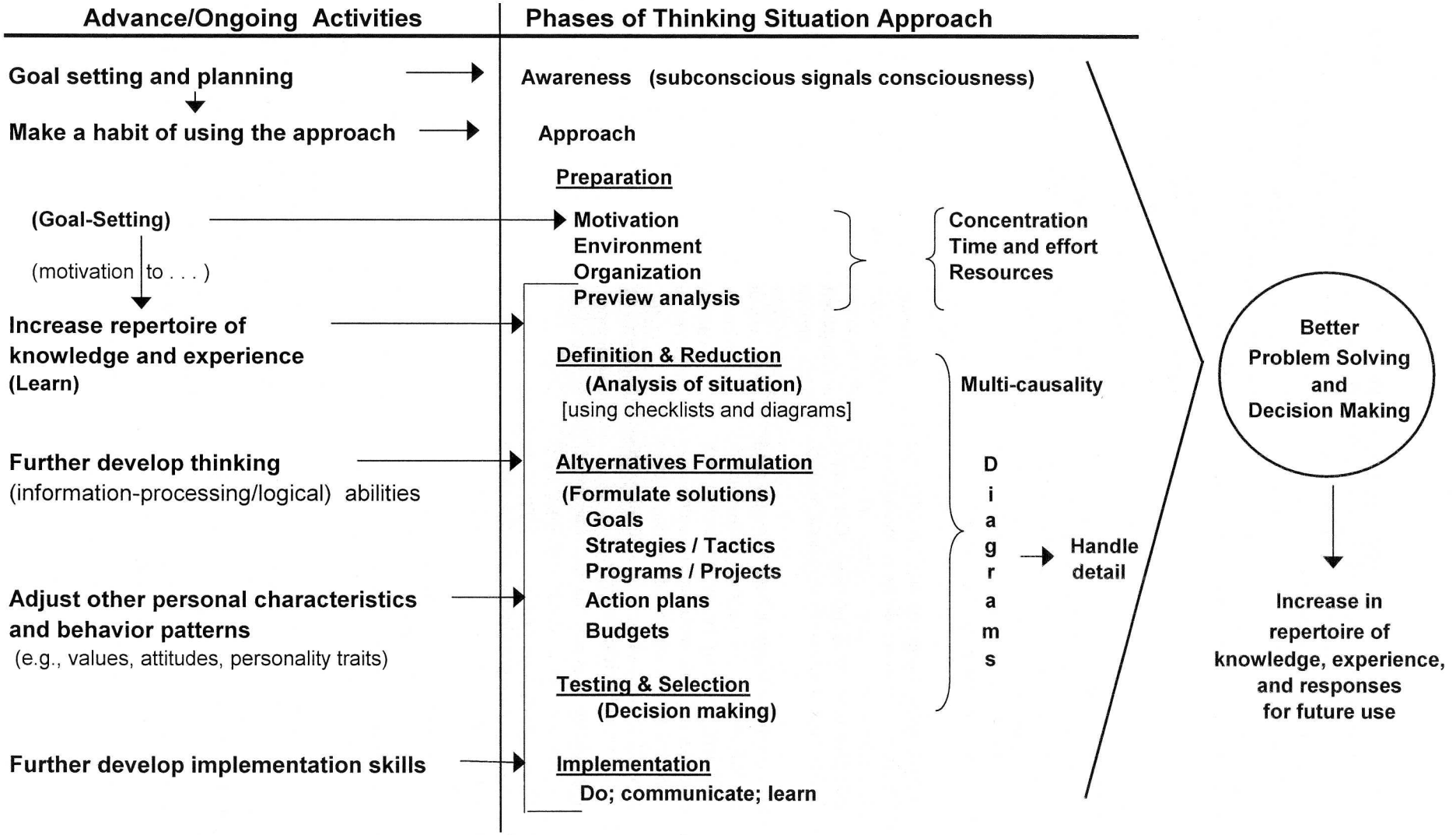
Interests and Other Attitudes

Interests, beliefs, ethics, and cultural attitudes all affect what one has learned—or will learn. As in the case of values, interests and other attitudes can maximize knowledge and experience in some areas, but limit them in other areas. They can increase awareness of some problems and impede awareness of others. They can make important problems seem unimportant. They can eliminate some variables and corresponding facts from thoughtful consideration. They can make facts stated by other people seem like assumptions or opinions. Not only can attitudinal characteristics hinder the effectiveness of analysis, but they can also hinder the effectiveness with which solutions are identified and planned. In addition, they can hinder the entire problem-solving or decision-making process by reducing objectivity.

Increasing Motivation

Motivation is one ofthe foremostinfluences on how well you do anything. The intensity of personal motivation ("motive strength") is a function of levels of needs/drives, values, interests, and goals and expectations. If you are highly motivated to solve a problem, you will focus, concentrate, and sustain greater attention and effort on it. Also, you will tend to be more conscientious in your use of problem-solving and decision-making methods. Furthermore, high motivation can compensate for a bad mood, impatience, distracting environmental stimuli, physical discomfort, and other limitations on effective concentration and thought.

Figure 4.2: Advance/Ongoing Activities for Continually Improving Problem-Solving and Decision-Making Processes



ACTION: Increase Motivation (and Situation Awareness) Through Personal Goal Setting and Planning

If you have not already done so, perform the personal goal-setting and planning processes outlined in Chapter 3.

Time

Having the time to consider all the important variables, collect necessary facts, analyze the system of factors and corresponding facts, and formulate and choose solutions that will solve the problem is a common problem in itself. However, using the time you do have to fullest advantage is a matter of motivation, better use of mental capacities, greater knowledge, goal setting and planning, and numerous other factors.

Environment

Quite often, the environment is not conducive to concentration and deep thought. There may be many distracting stimuli such as noises, confusion, heat or cold, abrupt movements, and poor lighting. There can be many other demands on your time and energy. You can be faced with many other problems and decisions having higher priorities. You may be under pressure at home as well as at school or work. You may be experiencing constant interruptions. These environmental factors, and many others that are probably occurring to you, can all be limitations on the effectiveness and efficiency of your thought processes.

Manyenvironmental factors mustalso be accounted for when considering how to go about implementing your solutions. And, as you implement solutions, there will be unanticipated obstacles or conflicts with which to deal.

These are all reasons why we emphasize seeking a conducive environment in preparation for tackling important planning, problem-solving, and decision-making situations.

Physiological Factors

Bodily discomforts, especially to the point of pain, can be stimuli that consume attention and block thinking processes. In addition, psychological factors such as mood, tension, and anxiety can limit the effectiveness and efficiency of thought processes. Be aware of these limitations so that you can better deal with them.

Begin to Solve Anticipated Problems

Now, with more time, greater motivation, more information, and increasingly sharpened thinking abilities, you can more effectively tackle anticipated problems. You can identify important variables, collect necessary facts, formulate alternative solutions, select the most effective solution(s), and implement solutions even before problems actually surface. In addition, you can identify behavior patterns of your own that require adjustment in order to solve problems and implement solutions more effectively and efficiently.

If you have analyzed yourself and have set goals and planned, you may appreciate the benefits of these activities even more at this point. Also, if you have learned personal motivation and learning techniques, you may have begun to notice how they, along with problem-solving principles and methods, are interrelated and how they can be used together systematically for maximum performance and increased success.

Summary of Part 1

We human beings are systems of brain mechanisms, emotion mechanisms, needs or drives, abilities and aptitudes, knowledge and experience, physical traits, values, personality traits, interests, and goals and expectations. All these factors influence what we think and how well we think in problem-solving and decision-making situations. Many of these variables represent limitations to effective think-work. In addition to these motive-attitudinal influences, our thought processes are also affected by external factors such as time, distracting stimuli, and unavailability of information. If we add all these limiting variables together, it is little wonder that problem solving and decision making are difficult, unpleasant activities. Nor is it any wonder that we tend to use relatively simplistic approaches rather than a more powerful approach.

Nonetheless, all of these factors can be influenced to some degree in order to help make us more efficient and effective in thinking situations. ***Figure 4.2*** visually summarizes the advance and ongoing activities you can perform to improve your thought processes.

What you have learned in Part 1 will help you to understand, appreciate, and learn the "Systematic Analytic Approach" presented in Part 2.

Part 2

A Systematic Analytic Approach (for Structuring Your Thinking Situations and Dealing with Influential Factors)

Here we describe our approach in terms of some situation that has already been recognized. We will concentrate on the basic phases and steps of the Analytic Approach, but will add our own insights, perspectives, and recommended practices.. As we have pointed out before, this is a necessary methodology for dealing with, maximizing, minimizing, or compensating for various factors that influence the effectiveness and efficiency of thought processes. As shown in ***Figure 4.3***, we have conceptualized the approach as having five phases: (**1**) Preparation; (**2, 3, and 4**) Use of the Analytic Approach in its three phases; and (**5**) Implementation of the Decision (Chosen Solution or System of Solutions).

Recommendations

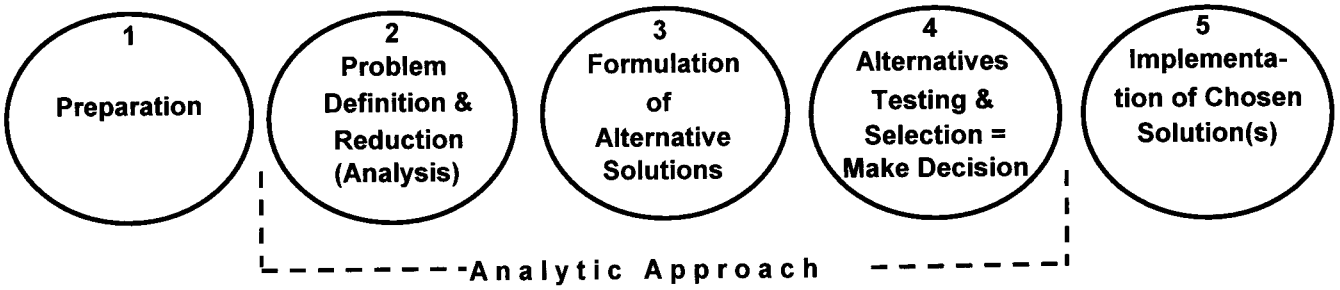
Can you remember the Preparation Steps—and perform them now?

Important: In Chapters 2 and 3 you filled in standardized formats as you read. We cannot provide such a format for you to use here. However, we do offer this suggestion: Pick out a problem that is highly important to you at this time. Next get paper and pencil ready to help you better deal with information and thoughts. Then, as you read, use the step-by-step method outlined in the following pages. Actually solving a pressing problem in depth as you read will make this a much more meaningful, effective learning situation. It will also help to (a) provide you with an effective solution to your problem, (b) increase your appreciation of the method, and (c) increase your motivation to use it again in important planning, problem-solving, and decision-making situations.

Reviewing What You Already Know

1. The psychological basis for problem recognition is mental comparison of actual stimuli with _____ stimuli or results. Thus, _____ _____ _is an important activity that increases awareness of problem situations.
2. What steps do you presently take in order to solve a problem?
   1. 3.
   2. 4.
   5. 8.
   6. 9.
   7. 10.
3. The three basic phases of the Analytic Approach to Problem Solving are:
   1.
   2.
   3.
4. List five preparatory steps you should take (once you are in a problem-solving situation) to improve your effectiveness—even before using the analytic approach. (What factors that influence thought might you want to control or influence before analyzing the situation?)
   1. 4.
   2. 5.
   3.
5. Is there ever a single cause for a problem situation?
6. What is "multi-causality?" What is its importance in problem solving?
7. Why should one try to anticipate problems before they occur?
8. Using diagrams, models, and other visual aids during a problem solving process has several important advantages. Can you list four?
   a. c.
   b. d.
9. An integral part of any alternative solution is a _____ for its implementation.
10. What should be considered when deciding which alternative solution(s) to choose?
    a. c.
    b. d.
11. What will happen when you change one causal variable in a problem situation as you implement your solution(s)?
12. If a system of causative variables is responsible for a problem occurring, then a system of solutions aimed at all the variables would be appropriate. True / False
13. Are you basically an analytically-oriented person or an action-oriented person? What are the implications for your problem-solving effectiveness?
14. Which phase of the Analytic Approach to Problem Solving do you feel is the most important? Why?
15. Perhaps the most difficult part of using effective problem-solving principles and practices is recognizing that you are in an important problem-solving situation

Figure 4.3: Major Phases of a Systematic Approach to Problem Solving



and stopping to purposefully think what you are doing and how to do it well. True / False

16. Why do you want to be able to solve problems and make decisions more effectively and efficiently?

General

There are as many principles for effective, efficient problem solving as there are factors that influence it. Some principles and procedures maximize the effects of positive influences, while others minimize or compensate for the effects of negative or limiting influences. Since all these principles and procedures cannot be applied at the same time during a problem-solving process, they must be applied in an appropriate order. Another of our purposes, therefore, is to present a recommended order that makes use of each principle at the most appropriate point in the problem-solving process.

Below we segment the problem-solving process into particular phases and steps, each of which calls for the use of particular principles and procedures. Learning the phases and steps can help individuals identify what they are doing right—and why. It can also help them identify what they could be doing better—and how. Again, as in the case of any mental activity, we can do it better if we think about what we are doing and how to do it well.

PHASE 1: Preparation

Step 1: Awareness — Think What You're Doing (and How to Do It Well)

Because you have already performed several of the actions recommended in Part 1 (especially the personal goal setting and planning), you will now be able to become more consciously aware that you are in a problem situation. When you become aware of unintended or unexpected stimuli, this should cue you to say to yourself, "I am in an important thinking situation and will consciously control my thought processes. I am going to use a systematic, analytic approach in order to think this problem out more effectively." When you consciously think what you are doing, you will do it better. The following Steps (2 through 15) constitute the most powerful approach. To think most effectively and efficiently, one must use them consciously, purposefully, and conscientiously.

Step 2: Increase Motivation

You want to increase motivation to solve the problem or make the decision as much as possible. Motivation is a key to increased concentration and effort, two factors that, in turn, influence how well you will apply yourself to the problem-solving process. The level of motivation to initiate, concentrate, and sustain attention and effort can be increased in several ways.

First, motive strength can be increased if you stop to consider for a moment just which of your goals (personal or organizational) you will be helping to attain. Try to determine how important the problem is to you. Ask yourself what you will get out of solving it as effectively as possible.

Second, imagine how you will feel when the problem has been solved and you eventually reach the goal that the problem is obstructing.

Third, increase motive strength in the knowledge that you have been improving your problem-solving abilities and can expect to solve the problem more effectively than you could have before.

Exhibit 4.1: An Abbreiviated Checklist of Factors That Influence Organizational Behavior

TASK FACTORS
Job descriptions
- Objectives
- Activities
  - Technical or functional
  - Managerial / supervisory
    - Analyzing, goal setting
    - Planning, budgeting
    - Problem Solving
    - Decision making,
    - Organizing, staffing
    - Directing, coordinating
    - Reporting, evaluating
- Equipment or tools
- Material inputs and outputs
- Information inputs and outputs

Work load - work flow
Communication facilities
Working conditions
Task interrelationships
Technology
Job input requirements
- General or basic abilities
- Specialized skills
- Knowledge and experience
- Other behavior patterns

General natures
(Mechanistic or Organic)
- Complexity
- Variability
- Clarity of definition
- Amount of change
- Certainty of information
- Time to outputs or results
- Tangibility and measurability (of outputs or results)

ENVIRONMENTAL INPUTS
Business-oriented factors
- Customers; suppliers
- Competitors
- Industry associations
- Worker unions

Institutions
- Government agencies
- Religions
- Capital markets
- International institutions

People-oriented factors
- Families; peers
- General public, community
- Social norms and customs
- Religious affiliations
- Social & recreational groups
- Interest groups

Other
- Technology; economy
- Transportation facilities
- Nature, weather, energy
- Goods and services

INDIVIDUALS' CHARACTERISTICS
Motivators
- **Basic needs or drives**
  - Physiological, safety
  - Social, self-image
  - Self-actualization
- **Values**
  - Intellectual, economic
  - Social, political
  - Aesthetic, religious
  - Practicality, achievement
  - Variety, goal-orientedness
  - Orderliness, decisiveness
  - Support, conformity
  - Recognition, independence
  - Benevolence, leadership
- **Interests (occupational)**
  - Mechanical, outdoor
  - Computational, scientific
  - Clerical, persuasive
  - Artistic, musical, literary
  - Social service
- **Goals and expectations**

Capabilities
- **Abilities**
  - Academic intelligence
  - Vocabulary, social Insight
  - Mechanical visualization
  - Mechanical intelligence
  - Clerical speed & accuracy
  - Physical coordination
  - Reading, communication
- **Specialized (job) skills**
- **Knowledge & experience**
- **Physical traits**

Personality traits
- Self-confidence
- Dominance, sociability
- Social conscientiousness
- Adaptability, maturity
- Original thinking, vigor
- Responsibility, self-control
- Emotional stability

SOCIAL VARIABLES
Group formation
- People's needs & drives
- Tasks' interdependence
- Proximity & work flow
- Frequency of interactions
- Members' characteristics
- Valued or shared traits

Intra-group relationships
- Group norms & customs
- Members' status & roles

Group maintenance
- Enforcing sanctions
- Conflict resolution
- Image reinforcement
- Membership norms

Sources/frequency of conflict
Interaction w/ other groups
Influence on organization

ORGANIZATIONAL INPUTS
History and traditions
Key elements of success
Objectives and strategies
Resources
Structures
- Key integrative points
- Key decision-making points
- Formal structure
  - Units or departments
  - Vertical relationships
  - Horizontal relationships
  - Levels and spans of control
- Informal structure

Policies, rules, procedures
- Formal
- Informal

Inter-unit interactions
- Sources of conflicts

Contacts with environment
Systems
- Information systems
- Control systems

Practices
- Performance evaluation
- Wages, salaries, benefits
- Hiring, selection, promotion
- Training and development

Natures of tasks
Natures of people
Managerial or leadership styles and practices
- Authority base (position vs. expertise)
- Formality to subordinates
- Nature of communications
  - Advice and information
  - Instructions and decisions
- Degree of control
- Specificity of subordinates' responsibilities & authority
- Conflict resolution
- Subordinates' participation:
  - Goal setting & planning
  - Problem solving
  - Decision making
  - Development of methods, procedures, policies
- Assumptions/facts about subordinates
- Task orientation
- People orientation

General nature of organization (mechanistic to organic)

Step 3: Seek a Conducive Environment

Environmental factors such as noise can definitely limit how well you will be able to solve a problem. Distracting noises and interruptions can disrupt concentration and your "train of thought." Therefore, if possible, find surroundings that are relatively free of distractions and interruptions. Although this can mean closing a door or finding a quiet room, it can also mean saving a block of time during which there is less chance of being interrupted. In some problem situations, though, you may want to go directly to the place where the problem is occurring, even though there may be noise or confusion. This is not ideal, but "being on the scene" often enables you to get any needed facts more readily. What you decide to do at this point should depend upon the situation; but in any event, you will want to control the effects of the environment as much as possible.

Step 4: Get Organized

If you think you will need materials such as paper and pencil, get them. Pull together sources of information to which you may wish to refer. Get other persons to join the problem-solving process if this would be appropriate. Getting organized cuts down on having to interrupt your train of thought to obtain necessary information, materials, or equipment.

Step 5: Do a Brief Preliminary Analysis (Preview)

You probably having many problems facing you at any one time. Is this one important enough to put the others aside temporarily? What will be the basis of your decision concerning the order in which you will attack them? Will it be the immediacy of the action required? The relative difficulty of the problems? The relative importance of the problems? The time you have available to work on them? All of these considerations will affect the order in which you tackle this and other problems.

Problems may seem simple, unimportant, or not too immediate at first glance. However, many if not most times we do not really know just how complex, important, or immediate they actually are until we have analyzed them to some initial degree. By doing a brief preliminary, "thumbnail analysis" of the problems facing you, you can better determine the following:

a. the relative order (rank) of their importance;
b. the relative order of their immediacy;
c. their relative complexity;
d. an estimate of the time, money, and effort that may be involved in the analysis and solution of each;
e. overall priorities.

An additional result is greater organization of your time and effort. Furthermore, because you recognize the actual importance and immediacy of problems, motivation to solve them can be increased.

You have probably noticed that Steps 2 and 5 cannot always be performed in this exact order. Circumstances may dictate what you can do and when. Remember, though, that environment, motivation, and organizational factors can all influence how well you approach and solve a problem. The important point is that the time to control these influences as much as possible is before launching into the analytic approach—because these factors' influences can determine whether or not you use the analytic approach.

Increasing motivation, getting into a conducive environment, and getting organized take only a few moments —and they are not at all difficult to do. The problem lies in remembering to do them. But even this is made easier for you if you have programmed your mind to make you aware that you are in a thinking situation. Then you will be aware that you must consciously structure the thinking process for maximum effectiveness.

PHASE 2: Problem Definition, Reduction, and Analysis

Assuming that a situation has been perceived as requiring more than casual attention, the first analytic phase involves defining or describing the situation, reducing the situation to the potentially causal factors involved, and analyzing the system of causes (using the facts that correspond to the variables involved).

Step 6: Describe the Unintended or Unexpected Events or Effects

A problemis an event or effect brought about by various causative factors or variables. Defining the problem first requires describing the events or effects that have occurred that were unintended or unexpected. For example, exactly what did one person say or do that resulted in an interpersonal conflict? What exactly is wrong with an improperly manufactured part? What has occurred that you did not intend to occur? The important point here is that if you incorrectly describe what has happened, you may end up looking for the wrong causes.

Step 7: Identify the System of Factors/Variables (Possible Causes) Involved (See ***Exhibit 4.1***)

Effects or events occur because various factors or variables such as people, objects, forces, or phenomena have

Table 4.1: Mental Constraints and Their Effects on Think-Work

		What should do
150	Major factors or variables actually operating	
- 50	Unknown factors	Use factor checklists
= 100	Factors left to consider	
- 50	Factors thought unimportant (due to values, interests, goals)	Use factor checklists
= 50	Factors left to consider	
- 25	Factors for which associated facts are unknown or unavailable	Get information
= 25	Factors left to consider	
- 15	Factors for which there is not enough time to consider	Take time (if important enough)
= 10	Factors left to consider	
- 5	Factors that the mind cannot handle at once	Use diagrams
= 5	Factors left to consider	
- 4	Factors eliminated due to cultural tendency toward single causality ("the problem is")	
= 1	Factor actually considered	

been operating in the environment, causing events. Solving a problemrequiresdetermining the factors that *actually* caused the effect. In most situations, there are many factors that could have been involved in some manner. Discovering which of these were the actual causes requires initially listing all the possible variables that might have been involved. This amounts to "lining up the ducks" so that they can be eliminated from consideration if facts indicate that they were not responsible.

Exhibit 4.1 lists over 150 factors (variables) that affect people's behavior in organizations. (The list is conceptually based on Eric Trist's "Socio-Technical Systems" Model.) To varying degrees, every single variable is influencing what is going on—some directly and others indirectly. Each relates to and tends to influence others (in a cause-effect manner). In any given problem situation, the question is: Which of these factors have influenced people's attitudes, activities, and interactions—and are therefore actual causes of the situation?

Asyou read through the listofvariables, you will undoubtedly think of more. Many may be more specific or detailed than the basic factors listed. You may wish to write these additional factors in on the checklist as they occur to you.

Since mostofthe manyfactorson the listare self-explanatory, we will not elaborate on them. Our purpose here is not to discuss organizational behavior. Rather, it is to demonstrate that the number of variables one should consider in a problem situation is quite large. (Actually, the one-column checklist of factors we have developed for analyzing organizational behavior and problems is 74 pages long. And by the way, your vocabulary and understanding of individual traits was vastly increased by reading about those traits and filling in Chapter 2's Personal Inventory.)

But even ascertaining all of the variables that may have been causative is not enough. Variables often interact interdependently with other factors, together causing an event or effect. In fact, the environment is a system of interrelated, interdependent, interacting forces and factors. So, in lining up the factors involved, one must also consider the interrelationships and interactions among them.

How The Mind and Brain Mechanisms Limit Handling So Much Detail

Because the world around usisso phenomenallycomplex, we are constantly bombarded by innumerable visual, auditory, tactile, and other stimuli. Although our minds are just as phenomenally complex, they cannot filter tremendous amounts of information without also reducing all the possible perceptions to manageable proportions. In other words, for us to be able to deal with and live in our world, our minds must simplify our perceptions of and reactions to our environment. **The mind's inability to handle tremendous amounts of detail at one time may pose the single greatest limitation on our thought processes**. Let us explain.

Look again at ***Exhibit 4.1***. on page 4-14. Since most of the factors in the list can be broken down into many, more finite factors, what we are looking at are ***extraordinarily complex systems of interacting factors or variables***. ***All these factors are operating in or on every organization—and on every person. The facts or information associated with each factor, however, can differ from person to person, group to group, company to company, or industry to industry—but they are* ALL *operating***.

Now look at the top of ***Table 4.1***, which helps illustrate what human beings actually tend to do in many if not most thinking situations—and why. The following paragraphs describe how various "limitations" tend to eliminate one chunk of factors after another from people's consideration.

Letusassume that"person A" is confronted with an organizational problem, and that only twenty of the 150 factors have been working together to cause the problem situation.

Limited Knowledge of Factors to Consider:

Most people are not going to know all the factors in ***Exhibit 4.1***, although they might understand or at least recognize many of them. As Will Rogers said, "We're all ignorant, just on different subjects." In fact, ***no one*** can possibly know ***all*** the variables that may be involved in any given situation.

Unfortunately,we human beingsusuallydo notknow what or how much we do not know. That is why checklists of factors are so useful. They help us "fill in the blanks."

So, as shown at the top levelof **Table 2**, let us say—rather conservatively—that "person A" does not know 50 of the 150 variables. That leaves 100 that "A" is able to consider.

Limitations Due to Values, Interests, and Goals:

Becauseof the levelsof peoplešV"valued matters," for example, they are certain to know more about, say, one or two areas than the others. The same can be said about their interests. As a result of these motive and attitudinal constraints, many if not most people, including "person A," might think that, say, 50 particular factors are not important enough to consider. That would leave 50 factors (out of the original 150) that "A" can think about. (Has it occurred to you that you might very well be "person A.")

Here again, checklists of variables are useful because they get you to think about factors that, because of their

(lower) values or interests, they might not otherwise consider.

Limited Knowledge of Associated Facts:

It is highly unlikely that anyone could have all the facts or information that relate to the remaining 50 factors. This can result in several undesirable consequences. First, they may not bother to analyze the factors for which they have no information. Second, if they do not bother to obtain information relating to particular factors, they will not be able to analyze them.

Therefore, let us say that "A" skips over another 25 factors. That leaves "A" with only 25 factors that can be analyzed effectively.

Limited Time:

Time is almost always a problem. With so many other things to do, let us say that "A" is unwilling to take the time to consider, say, another 15 factors. So now "A" is down to 10 factors.

The Mind's Oversimplification:

Can the average person deal with ten factors and their corresponding facts at the same time—analyzing them, formulating solutions to improve the influences of each of them, and planning how to implement each alternative? The answer is an unequivocal "no." Our minds simply cannot keep track of and juggle so many things at one time. Research by G.A. Miller (1994) showed that **human beings can mentally handle only five to nine chunks, bits, or items of information (or variables) at a time—with the average being seven, but often fewer**. As a result, we very often end up considering only four or five factors at the most—regardless of how much we know and could otherwise consider. So now "A" is down to possibly considering just 5 factors.

A Cultural Limitation – Saying "The Problem Is" and Citing a Single Cause:

Then there is a final hurdle the tendency to identify only one cause rather than many causes (single causality rather than **multi-causality**). This is a cultural, human, and social phenomenon. Have you noticed in many of life's situations that we have a tendency to say, "I think '**the problem**' is (X), and here's what we ought to do about it." In other words, we basically cite ***one single cause***. Also **associating "the problem" with a single cause**, another person might disagree, saying, "No, I think '**the problem**' is (Y), and this is what should be done to correct it." The second person has also cited **one single cause**. The irony? They are probably both right. Both causes could easily be involved. But the individuals will probably argue back and forth about ***who's right rather than what's right***. And they are both going to be wrong to the extent that they did not identify at least 148 other possible causes of the situation. It could very well be that a number of factors could stand some correction or improvement in order to *maximize* the motivation, attitudes, behavior, interactions, performance, and ultimate results of the people involved.

All of the above are constantly occurring in many if not most of our problem-solving situations. We are quite often "*satisficing*" rather than *maximizing*.

The bottom line? What do you think is likely to happen when we deal with even four or five factors involved in a situation? If there are actually another twenty or thirty significant variables also involved, and we do not take action to correct them even though their influences may be relatively slight, then these can be the major consequences:

A. **Washed-out results**: The solutions we do implement to deal with the four or five factors we did address can be **overwhelmed if not contravened** by the operation of those we did not address.

B. **Constant fire-fighting**. Too many times we are all too busy re-fighting the previous fires that we never entirely put out. As a result, many of those problems will keep coming back over and over again—but often in slightly different guises.

C. **Unsolved problems generally cause even more problems**. When confronted with problems, we often become upset, which generally (a) leads to interpersonal conflicts (problems), and (b) interferes with our own and others' performance of their tasks or responsibilities, thereby creating even more problems.

A Major Rule: Think "Problem Situation" and "Multi-Causality"

Have you noticed that we constantly say, "problem situation" or "problem-solving situation?" We do so because, given the discussion above, **we would like to see everyone get into the habit of saying "problem situation" instead of "a (the) problem," so that they will think in terms of "multi-causality" rather than "single causality."**

Another Major Rule: Use (Visual) Diagrams or Models to Handle Details

Even if we identify a number of possibly causal or influential factors in a given situation, can we keep track of all the possible causal variables at one time? Can we imagine all of the variables and their interrelationships in our

heads? Can we do both of those and also keep track of all the facts or information associated with the variables? No. No. And no. Period. Our minds cannot handle this degree of complexity and amount of detail by themselves. More discouraging, even the most intelligent, motivated, knowledgeable person cannot mentally envision a problem situation in its entirety—from an analysis of interrelated variables all the way through the testing and selection of appropriate solutions. No one can solve a problem or make a decision most effectively in his or her head. But this is exactly what we try to do most of the time. The obvious consequences, such as those mentioned above, are alarming.

We must assist our mental processes by using aids such as pencil and paper, a whiteboard, or a computer. However, to envision and work with many specific/detailed variables and their interrelationships, we must **diagram them**. This amounts to creating a visual model of the problem situation. These are some of the important advantages:

A. Diagramming makes many bits of information visible at one time. Diagramming enables us to compensate for the mind's tendency to reduce detail to manageable proportions. It lets us thoroughly consider factors, their relationships, and associated facts or information that would be impossible for our minds to handle (juggle, keep track of) on their own. Also, by modeling a situation, we are actually committing what is in our memory to paper so that individual bits of information will not have to be juggled in continuous back-and-forth cycles between memory and processing regions of the brain.

B. When we are using diagrams to handle details and are not simply keeping our minds busy juggling information around, we **free our minds** to analyze complexity, relate information, and gain insights.

C. Because we can see all of the aspects of the problem situation on paper, the variables and their interrelationships become more meaningful and understandable. The more meaningful the situation, the better we can understand what has happened, why, and how to remedy the undesirable results or effects.

D. Whenever we write something down (or otherwise make it visual), we record the information in memory far more effectively. As we diagram factors, their interrelationships, and corresponding facts, we are not only recording the information in memory, but we are also recording the results of our thought processes—our insights, new ideas, etc. This is important because, as mentioned earlier, what we think is not necessarily recorded well in memory. Writing information, insights, and ideas down in a diagram/model etches them more firmly in memory, expanding our repertoire of knowledge and experience for use in subsequent problem-solving and decision-making situations. Actually, **problem solving is a major mode of learning**. In other words, the more thought that goes into problem solving, and the more we write down and diagram, the more we will get out of the situation—both in the short term and the long term.

E. Another advantage is that, as we write down and model the system of variables operating in a situation, additional variables and their relationships tend to occur to us.

F. Perhaps the greatest advantage of diagramming or modeling lies in its making us use the analytic approach. As we write down factors and their interrelationships, we automatically tend to begin formulating solutions. We also think about whether or not these solutions would work effectively.

G. Diagramming also helps us to keep factors, their relationships, thoughts, insights, and ideas organized.

Type(s) of Problem Situations and Identifying Which Is/Are Involved

As you begin to analyze a situation, it will start to become clear what type or types are involved. That realization will help you to channel your thoughts in the right direction(s). (We are saving the most common and onerous of the three types for last.)

Improving or Innovating Something:

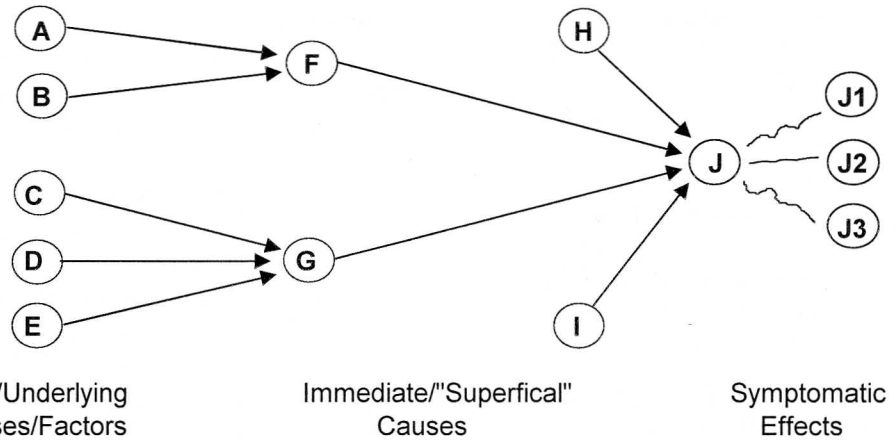
Here are two simple examples: You might wish to improve your interpersonal relationships. A company might want to create and introduce a new product, or to improve production processes. In both cases it is necessary to identify the variables involved and then determine how best to influence them to get the desired results.

Preventing a problem from Occurring At All:

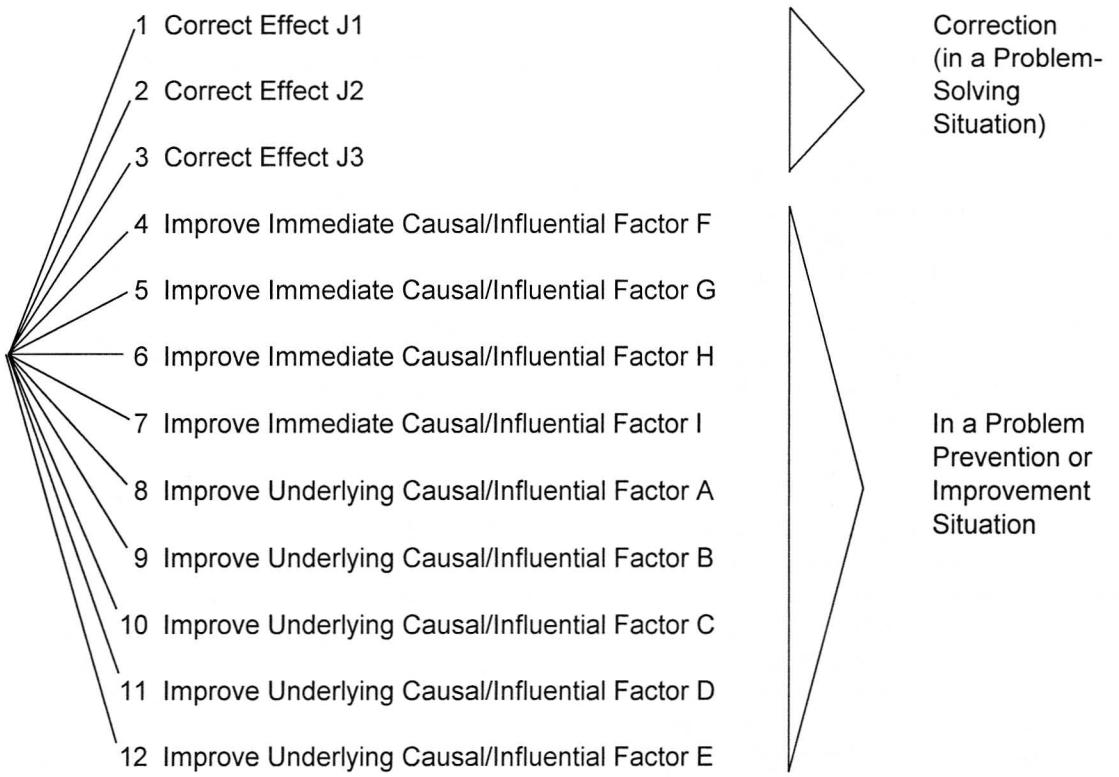
This involves anticipating a possible or potential problem, analyzing the variables involved, arriving at possible solutions, and beginning to implement preventive solutions—including improvements—to keep the problem from ever developing. Remember that "An ounce of prevention is worth a pound of cure." Preventive problem-solving saves the considerable time and effort required by situations that have already occurred. So, for example, how might students (or parents, teachers, and friends) help in this situation?

Figure 4.4: Example of a Multiple-Choice Decision in Problem Solving and Problem Prevention or Situation Improvement Cases

Chain of Causes and Effects Involved in a (Simplified) Problem Situation



Act Fork Indicating Various "Non-Exclusive" Alternative Courses of Action for Solving a Problem (or Preventing a Problem or Improving a Situation)



Problems That have Already Occurred:

In this mostcommon case, something unexpected or unintended has already happened. "The cat is already out of the bag. As shown in ***Figure 4.4***, there are actually several "sub-problems" with which to deal: The **first** is what to do now to remedy the immediate consequences (J, J1, J2, and J3). The **second** is what to do now to correct or solve for the immediate or obvious causes of the situation (F, G, H, and I). The **third** is what to begin doing now to improve or deal with the underlying causes or influences in the cause-effect chain (A through E) so as to prevent the problem situation from occurring again.

Because we do not ordinarily do much preventive problem solving, this latter case is the one we must deal with most often.

The preventive type is the one we will use here to describe the use of the analytic approach. Our example deals with helping students to stay away from harmful drugs. We are using it because believe that it is the type of problem that many people would like to address—and should. We must point out, however, that the analytic approach can be used in any problem-solving or decision-making situation.

Letus begin byillustrating what we mean by"identifying a system of variables." What are some of the possible factors that might cause a young person (student) to start using drugs? How are these variables interrelated?

Using ***Exhibit 4.1***, we have drawn a diagram, ***Figure 4.5*** (page 4-22), to illustrate a greatly simplified system of variables that applies to the student in the figure—and to his or her parents, teachers, and others who might help keep the student away from harmful drugs. These variables include, but are certainly not limited to, the following:

a. *Individual Variables*: the needs/drives, abilities and aptitudes, knowledge and experience, values, interests, goals, attitudes, personality traits, and other characteristics of the student—and also other individuals in his or her world.

b. *Task-Related Factors*: the responsibilities of (a) the student, and (b) other individuals, such as peers, parents, or teachers.

c. *Social Factors*: the norms of various groups with which the student interacts (and also the characteristics of individuals in those groups).

d. *Organizational Factors*: administrative structure, history and traditions of the school, teachers' instructional styles, courses and course materials, and many others.

e. *External Factors or Forces*: those outside the home and school with whom the student has contact (e.g., social groups), religious institutions, entertainment media, the justice system, and drug dealers.

As you look at ***Figure 4.5***, you will undoubtedly want to add even more factors—and perhaps more finite, detailed, or "granular" factors—to the diagram. Go ahead and do so. Also, begin to imagine how many of these and other factors interrelate. The individuals involved are systems of variables operating within larger and larger systems. All of the factors in such systems can be causes of, or at least influences on, the problem situation that we would hope to prevent.. It is useful, therefore, to identify cause and effect relationships among these variables with arrows. So, using ***Figure 4.5***, draw arrows from factor to factor, showing cause-effect relationships that you believe to be very important in this situation.

Before going further, we must acknowledge to the reader that we are not experts in the type of problem being addressed here. So we are not qualified to offer our own analyses and solutions. Therefore, we leave it up to the students, parents, and teachers who may be taking and delivering this course to do better what we should not even attempt to do. We hope that, in the process, you will identify and begin to implement preventive solutions. In other words, please use this example as an opportunity to accomplish something very worthwhile.

Step 8: Collect Important Facts

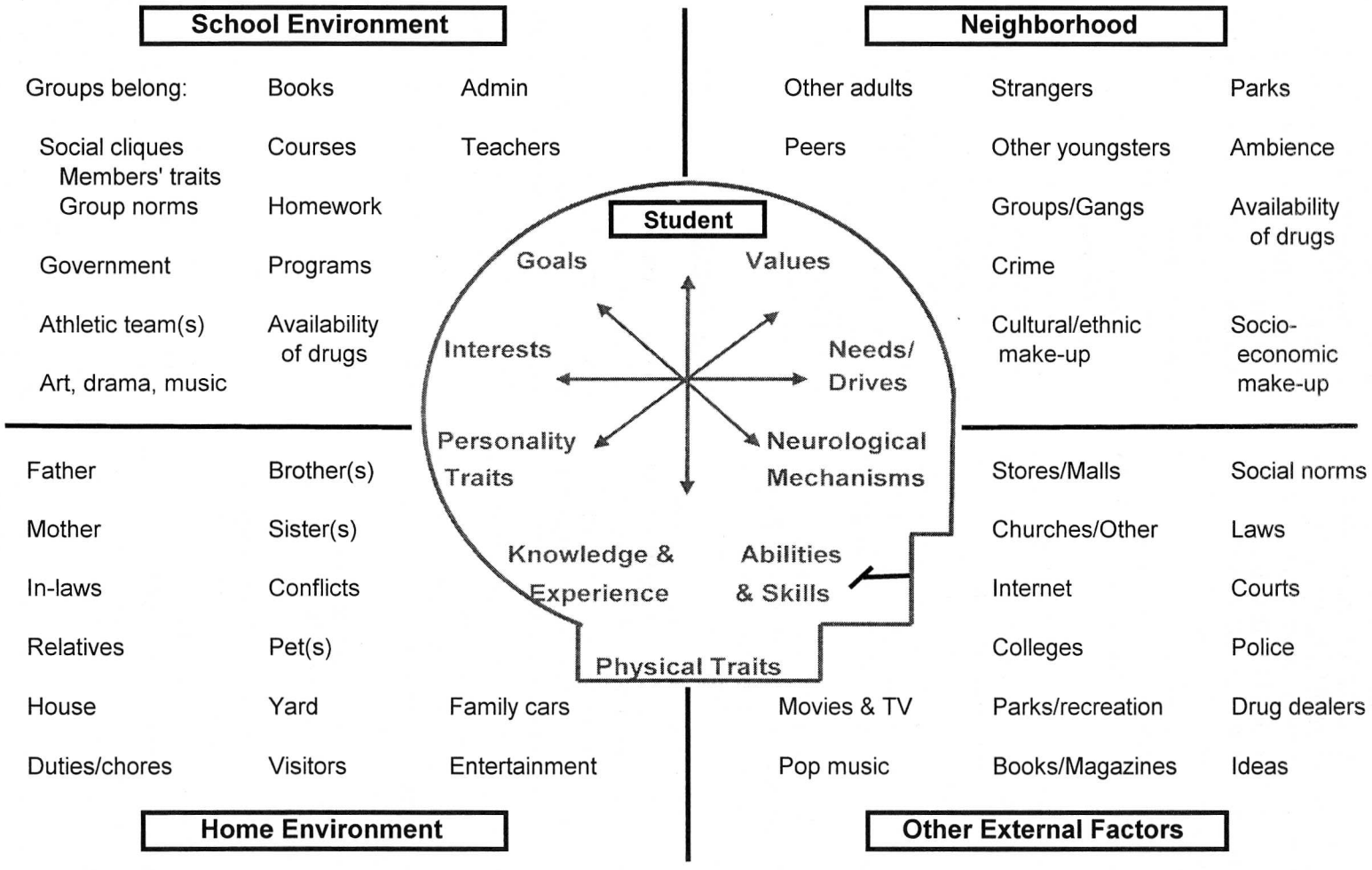
Once having enumerated potentiallycausative variables and their interrelationships, the next step is to determine which are important enough for further consideration (are necessary in order to analyze the situation well). Determining the factors and their interrelationships has very likely started you thinking about and determining what facts or information you should find out about them.

What do you think is worth finding out? (If you do this well, you will probably need more space to write on.)

a.
b.
c.
d.
e.

As you collect important facts, be sure to ask yourself whether or not the "facts" you are assembling are actually facts, or, someone else's opinions, assumptions, or conclusions. Also ask yourself if the sources are reliable and credible. How could the "facts" they provide be colored by value judgments, attitudes, biases, knowledge and experience, and personal goals? Also ask yourself whether or not and to what extent your interpretation of what you are being

Figure 4.5: Many Factors Affecting a Student *(but not all)*



told might be adversely influenced by your own knowledge and experience, values, interests, biases, goals, and expectations. Furthermore, if you are dealing with statistics, you might consider how the statistics were compiled, what assumptions might have been made regarding their compilation, how they were interpreted, and whether or not they have been arranged in order to "prove" a particular point. Statistics can be very misleading. So can other people's assumptions, conclusions, and opinions. Some call this "critical thinking."

Manytimes facts are unavailable or uncertain for one reason or another. It may be necessary, therefore, to fill in unknown or unverified facts with "working assumptions." Working assumptions, however, should be based upon known facts and actual experience as much as possible. In other words, you must deduce (use deductive logic) that since you know X and Y are true, that Z can pretty much be assumed to be true, also. The deduced conclusion is the working assumption.

You must,however,keep straightin your mind which are facts and which are working assumptions. Conclusions, solutions, or decisions based on analysis of important variables whose facts have only been assumed can be extremely faulty. One reason you estimate the importance of factors or variables and their interrelationships is to make a special effort to discover the actual facts corresponding to them, rather than build solutions on assumptions. Assumptions about less consequential factors or less important facts are a bit more justifiable.

Collecting important facts helps to minimize the limitations imposed by your own incomplete knowledge and experience. Because you are actually expanding your repertoire of information, collecting facts is an extremely important learning situation.

Tohelp you recalland use thesefacts, tokeep them organized, and to help your mind process them, write them down on your diagram or problem model next to the variables to which they relate. (You can use ***Figure 4.5***.)

Step 9: Analyze Information (Factors and Data) and Identify Actual Causes

A mistake we often make is attributing an effect (problem) to a single cause—usually the one most obvious to us. But, as we have shown, there is generally a multiplicity of causative factors which result in an event or effect. Furthermore, each contributing cause is also an effect of previous causes. It is possible to trace causes and effects back into time almost ad infinitum. As shown in ***Figure 4.4***, there are always sequences of causes and effects in problem situations.

Obvious causes are notalways the real causes. Identifying the real or actual causes is the process of first determining not one cause (or one causal variable), but some number of interrelated causative factors. These interrelationships often are a result of one variable affecting another in some cause and effect sequence. Therefore, many less observable, less obvious causes all too often lie further back in a complex cause and effect sequence—as shown in ***Figure 4.4***. Thus, analyzing a problem situation effectively requires identifying which variables affected which variables and in what cause and effect sequences.

Keeping the above perspectives in mind, you are ready to begin analyzing the variables you have identified and the facts you have collected that relate to (are associated with or correspond to) those variables. This involves considering each variable and its associated fact(s) in its turn and asking, "Could this variable have influenced an event directly; or because of its relationship with another variable, could it have been an indirectly causal factor that influenced a directly causal variable earlier in some cause and effect sequence?" As you perform this process, you will undoubtedly find that the problem situation is an end result of a system of causes both operating together and in cause-effect sequences..

Of course, as you identify actual direct and indirect causes of a problem situation, it is a good idea to illustrate these relationships with arrows on your problem diagram. Illustrating these phenomena will become very useful later, when you are considering how to "solve the problem" and implement solutions. Implementing solutions effectively and efficiently often involves influencing causal factors in ways that account for factors' interdependencies and cause-effect relationships..

Step 10: Establish Criteria for Phase 4 Decision Making (Choosing Among Alternatives)

Use the insights gained from your analysis to identify appropriate criteria for testing the effectiveness of alternative solutions that you will be considering (testing and selecting) when making a decision (choosing which to implement). These criteria can define factors that you want to remain unchanged. They can also constitute limits that you wish to impose on solutions—such as the time in which they should resolve the problem, or the amount of funds that will spent on implementing a solution.

Solutions should be tested mentally (or on paper) before they are actually implemented—by comparing expected results with chosen **criteria**. See ***Table 4.2*** on the next page for examples of quantitative (numerical) and qualitative (subjective) decision-making criteria.

Table 4.2: Examples of Decision-Making Criteria

Quantitative / Objective		
Time span to plan completion	Cost savings	Liquidity (cash availability)
Time span to results	Debt incurred	Investments
Time span of commitment	Resources conserved	Safety
Profitability	Overall expected value	Growth
Total revenues generated	Return on investment (ROI)	Working capital
Total costs incurred		Net worth
Qualitative / Subjective		
Probability of success	Know-how	Vulnerability to . . .
Certainty of results	Financial stability	Economic phenomena
Compatibility w/ other	Keep up with technology	Technological change
goals and plans	Legal acceptability	Medical/health problems
Ease of implementation	Environmental effects	Local crime
Degree of change involved	Personal safety	Climate change
Complication of situation	Personal development	Resulting relationships with
Disruption of situation	Impact on family:	Family
Control of results	Welfare	Relatives
Precedent set	Safety / security	Friends / peers
Flexibility (to modify plan)	General happiness	Neighbors
Reversibility of action	Development	Co-workers / colleagues

Problem definition and analysis is not necessarily performed as a completely separate phase all by itself. Our minds have a natural tendency to jump ahead and start (a) coming up with possible solutions, and (b) mentally testing their viability even as possible causes (variables) are still being identified. This mental activity is advantageous because it can lead to recognition of additional variables for inclusion in the problem model. In short, thinking leads to more thinking—and insights. However, there is a downside: we may stop trying to identify other possible causes and just go with the more obvious solutions that are coming to mind.

The more detailed and comprehensive your Phase 2 analysis, the more comprehensive and effective your alternative solutions will be—and the more effectively you will be able to test their appropriateness before implementing any of them. Thus, problem definition and analysis, when performed as described here, makes the analytic approach more powerful than, and superior to, any other approaches we are inclined to use.

Before going on to Phase 3, let us review the steps of Phase 2 — Problem Analysis (Definition and Reduction):

Step 6: Describe Unintended or Unexpected Events or Effects

Step 7: Identify the System of Variables (Possible Causes) Involved . Remember to think "multicausality"; and diagram your analysis

Step 8: Collect Important Facts (add to model)

Step 9: Analyze Information, Identify Actual (System of) Causes

Step 10: Establish Criteria for Phase 4

PHASE 3: Formulate Alternative Solutions

Step 11: Identify What Needs to Be Done (Changed, Adjusted, or Improved)

If you have analyzed the problem situation comprehensively and insightfully, you will have recognized (a) the variables that have been the real, underlying causes of a situation that has already occurred, (b) poten-

Exhibit 4.2: Limited List of Various Possible (Preventive/Remedial) Solutions (Activities) Aimed at Discouraging Teen Drug Use

School Environment

A. Teachers research materials on the dangers of various types of drugs.
B. Science (biology and chemistry) courses have students do research projects on drugs and their dangers. Students learn by doing (learn through "project activity").
C. Students use teachers' research as well as their own.
D. School classes and/or media club(s) create articles and videos covering results of student research.
E. Articles and videos stress the dangers (negative consequences) of using drugs (chemical/biological harm). Examples: "This is your brain on drugs." "This is the harm drugs can do to your liver, heart, brain, etc."
F. Art students (and others) compete in a project to create anti-drug posters (for display at school and out in the community).
G. Based on articles, videos, and posters, school sponsors development of a course (or some umber of lessons) on drugs (possibly a joint parents, teachers, students effort).
H. School distributes articles, videos, and course to local institutions: City Hall, police, juvenile courts; jails, churches, library, neighborhood groups, families, TV stations, etc. for availability to read, watch, listen put on the air.
I. Teachers all take course first (so know even more what talking about).
J. High school makes multi-media program(s) available to elementary schools.
K. Schools adopt a "see something (e.g. a drug deal occurring), say something."
L. Schools adopt a "no tolerance" policy regarding drug sale and use on campus.

Neighborhood Environment

A. Parents in neighborhood join together to enforce drug intolerance in neighborhood.
B. Parents in neighborhood form pact to educate their children about the dangers of drugs.
C. Parents agree to share information about drug activities in neighborhood with other parents.
D. Households with outside surveillance cameras review observations and video tapes with rest of neighborhood and the police.
E. Parents in neighborhood establish a "neighborhood drug watch" program.
F. All individuals must be careful not to spread falsehoods or unsubstantiated rumors, especially about other people.

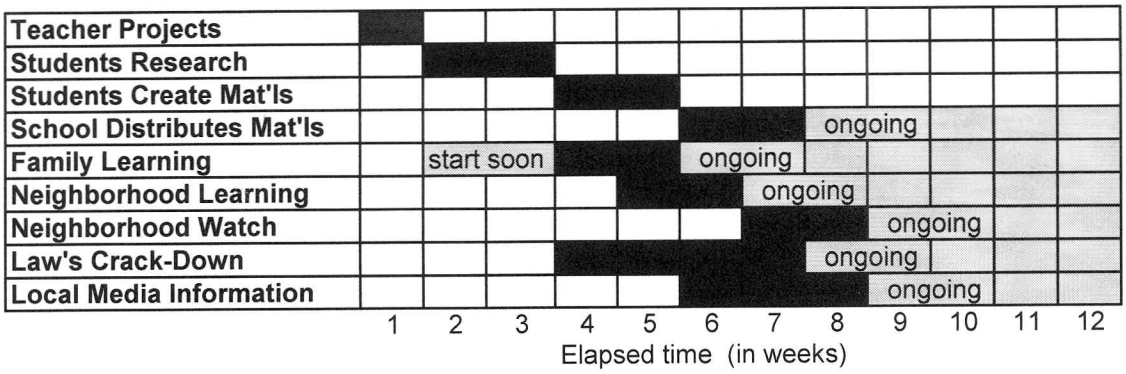
Home Environment

A. Parents learn what they can about various drugs and the dangers.
B. Parents share their knowledge about drugs with all their children—even the younger ones. (Teaching youngsters is better than having to change the attitudes and behavior of older but still young)persons.
C. Parent/children projects regarding drugs..
D. Parents participatively establish a pact with their children to (a) not take or even try drugs, and (b) be open with their parents about school and neighborhood drug activity that they witness.
E. Parents conscientiously help their children to develop knowledge, abilities, morals, ethics, empathy, compassion and other worthwhile characteristics so as to imbue them with the greater self-confidence and more functional self-images that can help keep them from trying and using drugs.

External/Community Environment

A. Police and courts crack down on drug sales and drug use in community.
B. Municipality establishes local ordinances that are anti-drug (to be followed in stores, malls, parks, and other public places.
C. Municipal officials back and even take part in many of the programs and activities mentioned above.
D. Local media (TV and radio stations) air drug information articles and videos created by students and teachers.
E. Local institutions make available and display materials and posters created by students.
F. Here, too, all individuals must be careful not to spread falsehoods or unsubstantiated rumors about other people.

Figure 4.6: Simplified Gantt (Bar) Chart of Drug Prevention/Remediation Activities



tial causes of a situation you wish to prevent, or (c) the factors that, when resolved or improved, could be either key to, or influential in, bringing about resolution of the situation.

In effect, you have already identified what must be changed, adjusted, or improved. Now you must determine what must be done to bring about that system of changes, adjustments, or improvements.

You can think out various possible solutions based upon (a) the facts you have collected, and (b) experience regarding what has worked or not worked in similar situations. For instance, given how a teenager might be influenced to try drugs, (a) what remedial or preventive solutions has your analysis brought to mind, and (b) what approaches (solutions) have you already read or heard about?

Remember this: In situations where you want to prevent something from happening, or make something happen more or less as you wish it to, the "ideal solution" is not a single solution. Rather, as indicated in the incomplete list in ***Exhibit 4.2*** (previous page), which is based on ***Figures 4.4*** and ***4.5***, it is a combination or **system of either corrective or preventive solutions, each dealing with a system of specific causal factors**. In other words, the more comprehensive the (system of) solutions, the more effective that problem prevention efforts will be. Even if the problem has already occurred, remedying the situation will still mean influencing or adjusting many causal or influential variables and their relationships in a systematic manner.

Once again, using diagrams or models helps to keep track of solutions and how they interrelate. Keep using your initial analytic diagrams, filling them in as you progress from step to step. This keeps your information and thoughts organized, helps keep the situation visual so that your mind can juggle the many bits of information, and helps record information and thoughts in memory for future use.

Step 12: Plan How to Implement Solutions

This step is really an extension of Step 11. It is not enough to simply formulate alternative solutions, test them mentally, and then respond to the situation. A very necessary part of any system of solutions is a plan for their systematic and organized implementation.

Again going back to our illustration: Obviously, waving a magic wand will not change the many factors involved and prevent a teen from trying drugs. You must perform various activities (take specific steps) to bring about changes to or adjustments in the appropriate variables. And generally, the activities that you undertake, or the behavioral responses to the situations that you make, must be effected over time—in some sequence of acts and in some orderly, systematic manner. You must (a) set goals (the desired end results of improving or adjusting variables), and then (b) plan actions to take for their attainment (plan action steps —or first, if an organization is involved, formulate programs and projects that can be translated into planned, coordinated, specific steps or activities).

As you consider these realities, what is happening? In effect, you are identifying more variables that are a part of the problem situation—variables involved in bringing about changes or improvements that might well have been identified during the analytic phase. Thus, again, "a problem" is not really "a (single) problem" at all. It is a "problem situation" involving many interrelated problems. Not only should you ask what must be changed and how (as in Step 11), you must also ask yourself how do I also resolve the problems that confront me as I go about changing and adjusting causative variables? This really involves adding more detail to the results of Step 11. Unfortunately, this step (how do I actually go about accomplishing what needs to be done) is all too easily overlooked by all of us in many problem situations.

Diagrammatic Planning Tools

Deciding what to do, and in what order, is not particularly easy when there are many variables and activities to arrange in some logical, coordinated sequence. Here, too, diagrams or models can help. You can, for instance, mark certain activities on your original diagram, and then number them in the order that you intend to carry them out. Better yet, you can use several diagrammatic tools.

Gannt (Bar) Charts

Figure 4.6 is an example of this type of diagram. Although it deals with the teen drug situation, it is greatly simplified and hardly lists the many additional activities possible, some perhaps far better. Note that basic activities are listed in the left-hand column. To the right is a grid showing that those activities are performed over time. It also shows the following:

a. activity time—i.e., during which time frame or frames (here a matter of a week or weeks) each basic activity might be performed; and
b. dependencies among basic activities—i.e., which activities must be competed before one or more others can be started.

P.E.R.T./Critical Path Diagrams

P.E.R.T. is the acronym for Programed Evaluation and Review Technique. It is widely used in various formats to keep track of industrial and military projects and the sequences of coordinated activities that must be accomplished over time. It is also used to determine the "critical path" of activities—that is, the longest chain or path of connected/dependent activities from the project's start to its completion. Because these tools are rather sophisticated, and designing and using them can be very complicated, we will not discuss them further here. We mention them because some readers might want to learn about and use them.

A Hybrid

Here, however, we present an example of a synthesized or "hybrid" tool that we prefer to use in many situations. ***Figure 4.7*** on the next page shows how a school might improve student knowledge about drugs by outlining activities involved in designing and implementing a school anti-drug program, complete with a special course.

As do P.E.R.T./critical path diagrams, our hybrid helps you plan and keep track of the following:

a. who is responsible for, or involved in, which activities (left column);
b. activities to be performed by each person or group (stated in the shaded and unshaded areas to the right);
c. activities that can be accomplished simultaneously (as shown in the second half of Week 1);
d. activities that must be completed before another or others can begin (as shown by arrows); and
e. starting and completion points (these "milestones" could be dates) and the (probable) amount of time in between—here, estimates of one or more weeks).

Not only does this type of diagram help you to set up a schedule of activities for implementing factor-related solutions, keep track of all the activities, and determine what must be done before what and when, but it also gives you a way to measure progress toward the desired end result (goal of problem resolution or prevention). If, for example, school personnel determined that it might take longer than a week to accomplish some activity, then they would be able to identify which other activities could be affected by the delay. As a result, they could attempt to reduce the delay or reschedule activities accordingly.

Just as during the analysis phase, there is a tendency during this phase to not only think back to your original analysis, but also to think ahead and begin mentally testing hypothesized solutions—i.e., begin to perform Stage 4, the decision-making process. While doing so does have the advantage of helping you to recognize additional, previously unrecognized factors related to the problem situation, it is more advisable to put off beginning that process until all solutions have been identified and associated plans for their implementation have been formulated.

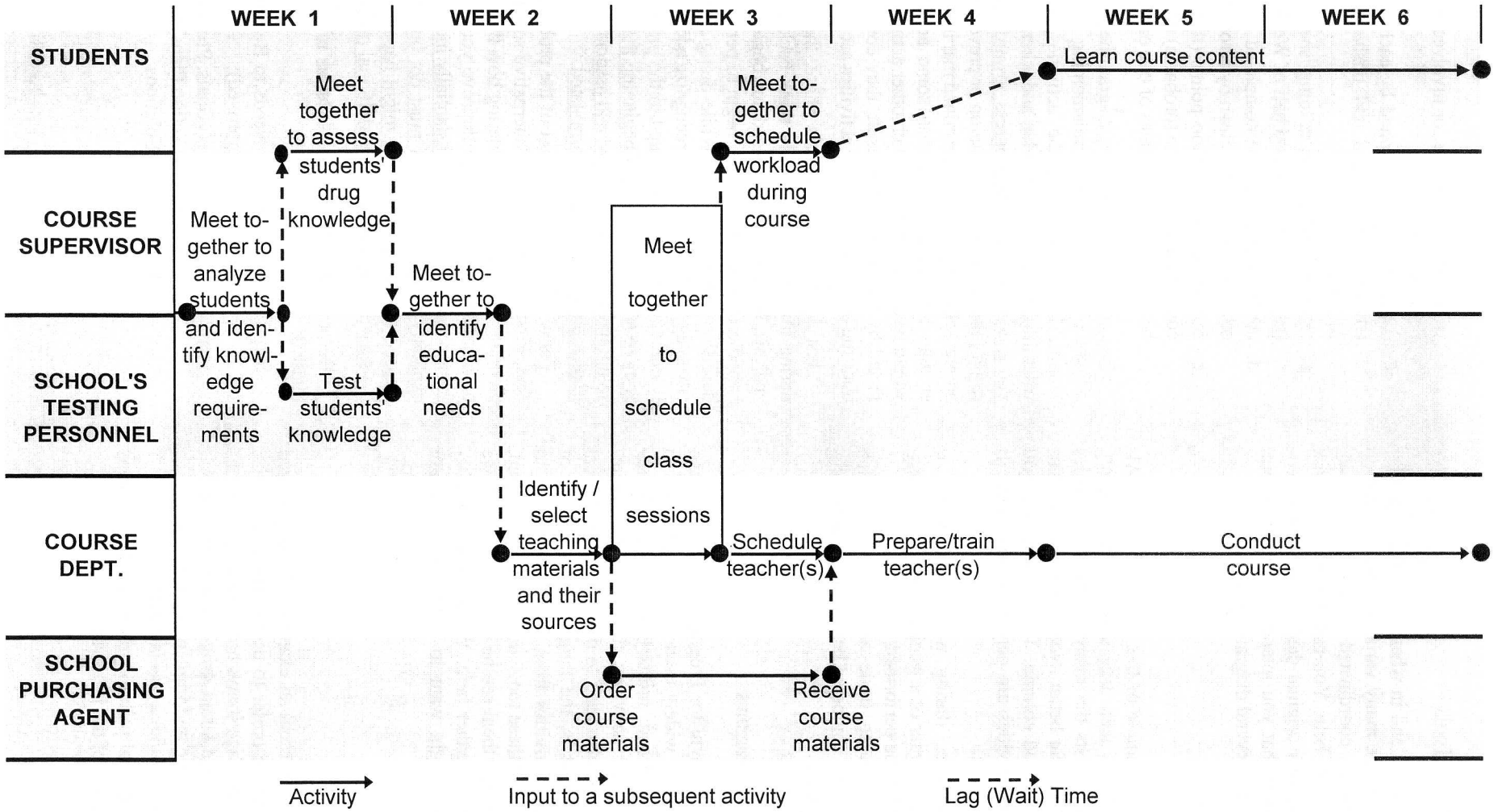
Phase 3 is an essential part of the problem-solving process. First, you hypothesize alternative solutions. Then, by planning ahead and by considering how these solutions can be implemented, you vastly improve your ability to carry them out. Performance is substantially increased when you explicitly identify what you must do; but it is further increased by anticipating what might happen when you do it—such as possibly generate additional problems.

Before going on to Phase 4, let us review the steps of Phase 3:

Step 11: Identify What Needs to Be Done (Changed, Adjusted, or Improved)

Step 12: Formulate Plans (Goals, Programs/Projects, and especially Action Plans) for Implementing Solutions

Figure 4.7: Example of a Hybrid Network or "Planning Diagram" (for Preparing a School Course)



PHASE 4: Hypothesis Testing and Selection (Decision Making)

Step 13: Anticipate Possible Outcomes of Alternative Solutions

Many problems are only solvable by "trial and success (error)"—that is, alternative solutions are tried until one of them succeeds. However, in many situations, trial of a solution can create more problems than it solves. Why? Remember that a problem situation is a system of many variables. Since these variables are often interrelated and interdependent, then changing, adjusting, or otherwise influencing one will probably also affect others—either directly or indirectly. Since implementing various solutions will cause desirable events or effects and possibly negative or undesirable effects as well, now is the time to predict and analyze the possible outcomes of various solutions before they are chosen for implementation and then actually implemented. In effect, you will be evaluating and testing the chain of causes and effects that **might** occur. The idea is to use trial and success **mentally** (and on paper) rather than doing something that might adversely affect the system you want to improve or correct. As psychoanalyst Sigmund Freud said, "**Thought is action in rehearsal**."

Keep the following in mind as we elaborate: **Actions** generally result in various (more than one) possible **events** (outcomes or effects). Each of those events, in turn, generally requires you to take (make a choice among) several possible **subsequent actions.** Those, in turn, generally result in various possible **subsequent events**, which, in turn ..... etc., etc., etc. The future, given its uncertainties, is extremely complicated and very difficult to envision.

A Diagrammatic Decision-Making Tool:
The "Decision Tree"

Because there can be so many possible scenarios (sequences of acts and resulting events) and so many associated bits of information to consider when analyzing each of one's alternative solutions, the mind simply cannot keep track of them all on its own. So here again, as in Analyzing a situation in Phase 2 and Formulating Alternative Solutions in Phase 3, diagrams can be very useful—even absolutely necessary.

Designing and using a sophisticated, complex tool like a decision tree is an extremely involved process. In fact, it takes months to learn about (a) designing trees, (b) anticipating events that can occur, (c) assessing probabilities of events and using probability statistics, (d) using various accounting and financial methods, and many other aspects. Even though we cannot come close to providing you with all the background that you should have, we describe trees and how to use them here so that you will be aware of, and have a basic understanding of, them. Even with a basic knowledge, someone can still use a decision tree to help keep track of large amounts of information about the alternative solutions under consideration.

In order to understand how such a diagram might be used, refer to ***Figure 4.8*** on the next page. It is a simplified example of a decision tree that a student going off to college might want to use. As we describe what is on the tree, we also discuss various procedures and rules for using trees. We recommend that those who wish to use this tool pay very close attention. Misuse of a decision tree can lead to mistakes and undesirable consequences.

In our example, the student has determined that the problem situation is "how to get back and forth from home to school." At the left side of the tree the student has drawn an **act fork** with five **branches**, each indicating one of the several alternative **acts** from which to choose (make the decision under analysis):

Act **A**, buy a used car to drive to and from school.
Act **B**, use the old, hand-me-down family car.
Act **C**, take public transportation (e.g., the Metro).
Act **D**, ride back and forth with fellow students.
Act **E**, a mix of C and D.

Note that from the end of the all the acts are "branches" showing (a) possible events that could follow acts, (b) acts that might have to be taken following events, and (c) the amounts of money (either **cash outflows** or **inflows)** that would be associated with acts and events**.** In this example the student has determined each will cost (in ride-sharing contributions to the drivers, or in fares). That leaves C, "buy used car," to consider further.

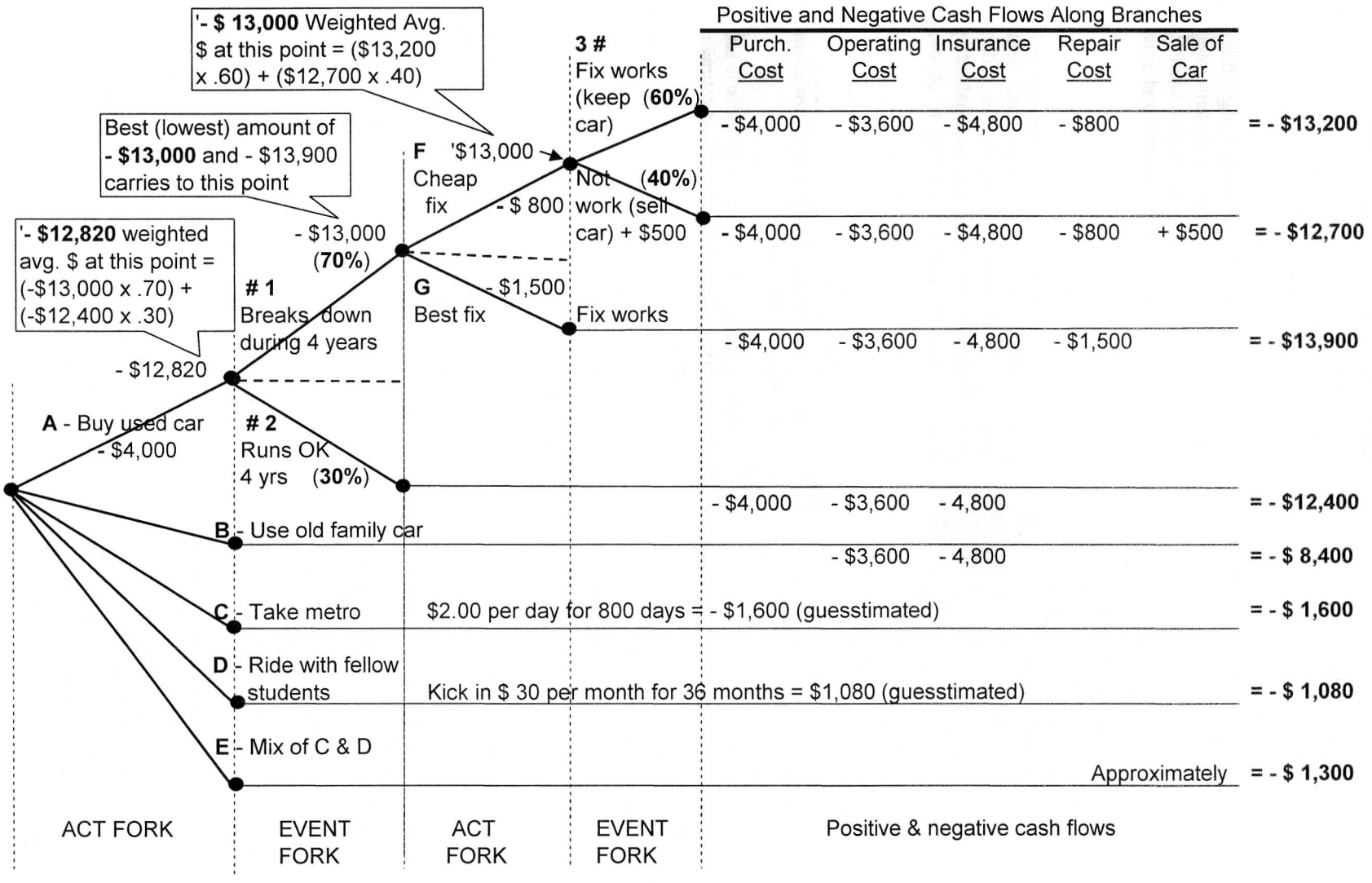
As shown in the figure, purchasing the used car results in an immediate cash expenditure or **outflow** of $4,000 (shown with the minus sign -). Once the car has been purchased, several possible **events—**among even more possibilities (- - - -)—can occur.

Event **# 1**: the car breaks down during the four years.
Event **# 2**: the car lasts for all four years—luckily.

(Other events could have been, for example, breakdowns in the first, second, third, and/or fourth year.)

One rule for designing trees is that, where a choice among acts must be made (at a decision point), additional act forks should not follow (be attached to the ends of) any act's branch on the act fork. All variations of acts must be recorded on a single fork. Similarly, event forks should not follow (be attached to the ends of) event forks. All possible events that might take place as the result of any particular act must be shown on a single event fork (at the end of that act's branch).

Figure 4.8: Simplified Example of a Decision Tree



Acts (on act forks) have been bold lettered. Events (on event forks) have been bold numbered.
Base cost to run own used car or old family car for 4 years = $3,600 (guesstimated)
Insurance for four years = $4,800 (guesstimated)

Not onlyare two or more possible events (once an act has been performed), but they also have varying probabilities (chances) of occurring. This is an important distinction: **Possibility** of an event occurring is one thing, the **probability** that it will occur is another. In other words, although an event may be possible, the probability (chance) that it will actually occur may be higher than, equal to, or lower than the probabilities of the other events on a fork occurring—since each event on the fork has a probability assessed for its occurrence. Note in ***Figure 4.8*** that there is a % probability on or near the line for each possible event. Here are a few points regarding the **assessment (estimation) of probabilities**:

The ability to make realistic oraccurate estimates may depend to a great extent on your past experience, available historical data, and other people's estimates. Be careful when assessing and using past experience. Remember that no two problem situations are exactly alike, and that what once occurred did so under a particular set of circumstances that may not be operating in the situation under consideration.

Also be careful that you do not mix your preference for a particular event (outcome) with your estimate of the probability of that event taking place. *For example*: As you estimate the probability of "X"occurring, ask yourself which of these two types of people you are: Those who are "risk averse" will tend to assign a lower probability (say, 30%, or 3 out of 10 chances) to events that they would rather not have happen. Conversely, those who would prefer to have something happen will tend to assign a higher probability (say, 80% or 8 chances in 10), largely because of "wishful thinking." However, if someone were more objective and did not let preferences (attitudes) get in the way, they might estimate a more realistic probability of, say, 50% (or whatever). Thus, if "preferences are mixed with probabilities,"preference for an outcome may be high when the probability (of success) is actually much lower. And vice versa. If preferences are mixed with probabilities, the solution(s) or act(s) you finally choose may be implemented instead of another (or others) that actually had a greater chance of success. This extremely important point is too often forgotten. Think about the times you have already done this(mix preferenceswith probabilities) and resolve to remember this concept.

Nownote that, if the car were to break down (Event #1), the student would have to choose between at least two (or possibly more) acts:

Act **F**, pay ($800) for a quick, less expensive fix; or
Act **G**, pay ($1,500) for a better, longer-lasting fix.

This scenario or chain of acts and events could go on and on. But at least note the following decision tree procedures.

A. Show possible acts on the act forks.
B. Show possible events on a fork that follows each act (branch) on an act fork.
C. Show your best estimate of the probability that each event on an event fork will occur. Note: The probabilities on any event fork must add up to 100%, since *something* will happen as a result of any act.
D. As shown in ***Figure 4.8***, for each act on an act fork, and for each event on an event fork, show on its branch the cash inflow (+) or outflow (-) associated with it.
E. As also shown in ***Figure 4.8***, for every chain of branches on the tree, add up the positive and negative cash flows. Start on the left at the point where you must choose (make a decision) between or among the acts you are considering. Then, between the start and the ends of each chain in its turn, add the positive and negative cash flows and write the net total at the end of each chain (end of the final branch, next to that terminal point). As you can see, we have done this for you in ***Figure 4.8***.

Once these steps have been performed, a tree can be solved mathematically this way:

1. Starting on the right side, and for each of the end points following the farthest event fork(s) toward the right, multiply the total/net cash flow at the end of each point by the probability (% or 0.xy) assessed for that branch, and then add the (two or more) results. *For example*: In ***Figure 4.8***, (-$13,200 x .60) plus (-$12,770 x .40) equals -$13,000. That figure, which we have shown at the point of the event fork, is the value for that event fork.
2. The same procedure is performed for the event fork with "breaks down" versus "runs OK."
3. You end up with Act (alternative) A having a value of -$12,820, Act B with a value of -$8,400, Act C with a value of -$1,600, Act D with a value of -$1,080, and Act E with a value of -$1,300. In this case, then, the best alternative should have the lowest value (least expense). That would be Act D, "ride with fellow students." Do you think that "D" would actually make sense to a college freshman? By considering more factors and by using additional tools and methods, the final decision could easily be different. As you will see.

Again, the description of how to use a decision tree has been tremendously simplified. By not being thoroughly trained in the details, you could make serious mistakes and

Exhibit 4.3: Simple Example of a Table of Advantages and Disadvantages

ALTERNATIVES	ADVANTAGES	DISADVANTAGES
A. Buy a car	a. Have independence. Can go where want to when want to. b. Can take friends and dates anywhere wish to go. c. Can sell later. d. Family can afford to buy or help buy	a. Purchasing costs money. b. Operating costs can be high. c. Purchasing and operating costs limit money that can be spent on other things. d. Repairs and maintenance can put a car in the shop when you really need or want to use it.
B. Use old family car	a. Not have to spend to buy b. Have independence. Can go where want to when want to. c. Can take friends and dates anywhere wish to go.	a. Operating costs can be high and limit money for other things. b. Repairs and maintenance can put a car in the shop when you really need or want to use it.
E. Not buy a car, take Metro and/or ride with friends	a. Not incur purchase and financing costs; save money for other things.	a. Not have independence. b. Must rely on others for rides. c. Must pay for transportation.

create more problems. Therefore, we **do not recommend** that you use a decision tree to find mathematical solutions to really important decisions.

However, you should use some sort of basic diagram, such as a simple tree, to (a) identify, organize, keep track of, and think about important acts, possible events, and even probabilities, and (b) record your information and thoughts better in memory. You might also consider using a PERT-type diagram to make note of acts, events, and probabilities. Determine what works best for you—then use it. Using some sort of diagram is what really counts. It helps you to make decisions in the face of uncertainty(ies).

As you consider and weigh bits of information while testing and selecting among alternatives, you will be asking yourself, "What will happen if I (or we) do ____?" In other words, you will be using abilities involving propositional logic. Your mind will also be going back and forth between problem analysis, formulation of solutions, and testing of solutions. During this process, you may well decide to modify solutions in view of what you think might happen. In doing so, you would be increasing the probability of success.

Table of Advantages and Disadvantages

As you test your hypothesized solutions, there is yet another important point to keep in mind. Nothing is perfect. There is no product, for instance, that is "all purpose" and can do all the things it is supposed to do equally well. That is why we have specialized tools for specialized jobs. Everything has advantages and disadvantages. This applies to our hypothesized solutions as well. We have a natural tendency to overlook advantages and disadvantages (especially disadvantages) because of our attitudes toward (preferences for) particular solutions. Take special care not to do so. **If you don't find something disadvantageous about an alternative, then there may well be something wrong with your analysis**. What you really must decide is: Do the advantages (plusses) outweigh the disadvantages (minusses)?

While a designing and using a decision tree can be extremely complicated, a Table of Advantages and Disadvantages is much simpler and easier to use for the same purposes. It also enables you to take what you learned using a decision tree one step further: it enables you to consider (weigh) each alternative solution in terms of the criteria you chose for evaluating alternatives (decision making).

Exhibit 4.3 is a simple example of such a table. Note that the alternatives still being considered are listed in the left column. Advantages ("pros") of each alternative are listed in the first column to the right. Disadvantages ("cons") of each are listed in the far right column.

By considering the pros and cons of each alternative, its is not too difficult to see that, wanting to have a car for school and be independent, ...

A. A student whose family might be able to buy (or pitch in for) a car would probably choose to "buy."

Exhibit 4.4: Example of a Comparison (Decision-Making) Matrix

(A) Criteria / Parameters	(B) Priority Rank	(C) Weight Factor	Alt A: Buy Car Data	Alt A: Buy Car Raw Score	Alt A: Buy Car Wghtd Score	Alt B: Use Family's Data	Alt B: Use Family's Raw Score	Alt B: Use Family's Wghtd Score	Alt C: Rides/Metro Data	Alt C: Rides/Metro Raw Score	Alt C: Rides/Metro Wghtd Score
Musts / Limitations / Needs											
Independence (ability to go wherever whenever)	1	20	0	3	60	0	2	40	0	1	20
(Save) purchase cost	2	18	4,000	1	18	0	2	36	0	3	48
Have a car for dating	3	16	0	3	48	0	2	32	0	1	16
Sub-Total Score:					126			108			84
Wants											
(Save) insurance costs	4	10	4,800	1	10	4,000	2	20	0	3	30
(Minimum) car troubles	5	8	800	1	8	500	2	16	0	3	24
(Minimum) operating costs	6	7	3,600	1	7	3,600	2	14	0	3	21
(Not take) public transport	7	1	0	3	3	0	2	2	1,080	1	1
Sub-Total Score:					28			52			76
Total Weighted Score =					154			160			160

B. A student whose family could not help monetarily might be willing to use the family's old car.

C. A student and family with very little money or credit might settle for public transportation and rides with friends.

Comparison Matrix

A bit more involved than a table of advantages and disadvantages, a comparison matrix is still far less complicated than a decision tree. Using this tabular tool can be a third step in weighing (analyzing) alternatives. It enables consideration of the following:

a. in Column A, the criteria chosen for evaluating alternatives;
b. in Column B, the priority or rank of each criterion relative to the others;
c. in Column C, the more "calibrated" weight (level of importance) one attaches to each criterion;
d. in the columns for each alternative:
   * the data associated with each criterion;
   * a raw score given; and
   * the calculated weighted score.

Here are the steps for using this tool:

1. In Column A: Fill in the decision-making criteria that you chose (during Step 10 in Phase 2).
2. In Column B: Assign (assess) what you believe to be the priority or rank of each criterion, with the highest at the top (1) to the lowest at the bottom (in this case, 7).
3. In column C: Fill in a weight factor for each criterion (under column A) in column C, essentially "refining" the relative importance that you wish to attribute to each criterion. Note: It helps if you have already re-listed the criteria, putting the criterion with the highest rank at the top down to the lowest rank at the bottom. The highest weight factor (for the highest priority) can be any number, usually from 10 up to no more than 100. The higher the number, the more difficult it is to range the weight factors from highest down to lowest.
4. Fill in data: For each criterion in its turn, and working across the table, fill in the applicable data —if any—for each alternative in that alternative's data column.
5. Determine the raw scores: For each criterion in its turn (from top down), rate/rank the alternatives. Since in this example there are 3 alternatives, the alternative with the best (most desirable) data (most profit, least cost, or whatever) gets a 3; the next best gets a 2, and the least desirable gets a 1.
6. Calculate weighted scores: For each criterion in its turn (and working across the table), for each alternative multiply the criterion's weight factor times the alternative's raw score and write the result in the alternative's "weighted score" column.

7. Find the alternative with the highest Total Weighted Score: Simply add up the weighted scores in each alternative's "weighted score" column. The most desirable alternative should have the best (highest) "Total Weighted Score."

In our example, "use the family car" and "use the metro and get rides" are tied. Even so, having been teenagers ourselves, we would be willing to bet that our teen is now thanking Mom and Dad for the use of the old family car!

You should be able to construct a matrix byfollowing the guidelines above.

Step 14: Select Appropriate Solutions for Implementation

Given all that one has been considering, finally having to make a decision can be tough. Usually, when most people are in the process of making a decision, they think, "Should I do _____, or shouldn't I?" "Should I buy a new car, or shouldn't I?" "Should I talk to my teenage son about drugs, or shouldn't I?"

The "Dual Option Syndrome"

Unfortunately, many if not most people have fallen into the habit of either recognizing, or reducing possible solutions to, just two options: "Do X, or Not do X." This has been called the "Dual Option Syndrome." Why do you think this tendency is so common? Because we cannot handle a great deal of complexity? Partly. Because we try to solve most of our problems in our heads? Partly. Because we have not really been taught how to go about solving problems and making decisions more effectively? Partly. Because we tend to recognize and deal with only one cause of a problem situation (single rather than multiple causality)? Partly to largely.

We grantthatthere are manytimeswhen the possible solutions or options are rather limited. The limitations may be time, money, and many other factors. However, as we have said before, there is not one problem situation that is caused by a single variable. All problem situations are systems of interrelated, interacting variables. Therefore, solving them most effectively means solving them comprehensively—that is, adopting almost as many solutions as there are causative or influential factors.. We like to put it this way: **We must learn to solve systems of causes with systems of solutions**.

Compatibility of Solutions

Even so, we mustfirst decide whether or not to implement one or more solutions somehow independently of the others. Making this choice requires reviewing each alternative's advantages and disadvantages, its estimated probability of success, whether or not it meets the criteria established in Phase 2, and how and to what extent individual solutions might have conflicting or otherwise limiting affects on each other.

As youask yourselfthese questions, youarealmost certain to modify your alternatives at least slightly. *For example*: If you think that a particular solution might get in the way of one or two others, you might want to toss aside that solution—unless you think more about the situation and recognize that you could lay the groundwork for implementing it more compatibly. In other words, effectively influencing causative variables is often not just a matter of whether or not to use a particular solution, but rather, HOW to use them so that they will all work effectively together. Even if the use of any particular solution seems to be somewhat questionable for the above and other reasons, you may still be able to use it by either modifying it and/or its plan for implementation.

Having reviewed andmodified allof youralternative solutions for compatibility, are you now ready to implement those that still meet criteria, will probably be successful, and whose advantages outweigh disadvantages? Not necessarily. Why? Because each alternative solution deals with a particular causal factor or group of factors. Change any one variable or group of variables that affect other variables and you may adversely affect the system you are trying to resolve or improve. You can deal with this issue in several ways. First, you can return to your initial analytic diagrams and trace the effects of all your alternatives to see if (a) this combination of solutions deals comprehensively and effectively with the system of causes, and (b) does so without particular solutions working against each other.

If any solutions might conflict, make choices among them based upon the following considerations:

A. Do the overall advantages of one outweigh the overall advantages of the other(s)?
B. Do the disadvantages of one outweigh important advantages of the others?
C. Which have the highest probability(ies) of contributing to successful resolution of (or prevention of) the problem situation?
D. Which, working together, best meet the selection criteria established in Phase 2?
E. Which alternatives best fit into an overall system of solutions?

Afteranswering these questions, stand back fromthe trees and look again at the forest. Ask yourself one more time, "Does this system of solutions now seem to work together effectively in dealing with important aspects of the

situation?" If your answer is "Yes," you are ready to go on to Phase 5, Implementing Solutions/Decisions.

Before we begin discussing Phase 5, letusreview the basic steps of Phase 4: Hypothesis (Solution) Testing and Selection):

Step 13: Anticipate Outcomes of Alternative Solutions

Step 14: Select Solutions for Implementation (**Make Decision)**

PHASE 5: Implementing Solution(s)

Problem solving is not only thinking, it is also a matter of doing....something. Thinking is extremely important, otherwise you may do the wrong things. But action is just as necessary—or the right things will not get done. The following discussion offers several perspectives on the implementation of solutions.

Indecisiveness

Some personsare veryanalytic and can see a problem situation in all its complexity. They recognize and weigh complex interrelationships among variables. They wrestle with solutions' advantages and disadvantages and the uncertainties involved. However, they can become indecisive and hesitate to take action when action is required. The more uncertainty they recognize, and the more disadvantages they anticipate, the less convinced they can become that their solutions will work. This phenomenon has been called "paralysis by analysis" and the "55-45 Syndrome." (55% of the analysis indicates doing something, while 45% indicates not doing it.) The closer to 50-50 one's analysis, the less that one regards solutions or decisions as being conclusive. Obviously, this would not be a problem if 100% of one's analysis said "do" and 0% said "don't do." Unfortunately, 100%-0% is unrealistic. Life corresponds more closely to the 55%-45% situation. It is usually more gray than black and white.

On the other hand, there are those who tend to see problems as being simple and requiring simple answers. These people tend to recognize only one or two causal factors involved, and thus, tend to arrive at simplistic solutions. They do not burden their minds with many possible causes, relationships among various factors, advantages and disadvantages, and uncertainties (probabilities). Thus, they are inclined to make up their minds what to do relatively quickly and take more immediate action.

Being Thought-Oriented vs. Being Action-Oriented

While more thought-oriented individuals will probably come up with better solutions to problems, more action-oriented individuals can sometimes bring about quicker if not also better results. While the thought-oriented people are still trying to explain their complex solutions to others, the action-oriented people can already have explained their simple approach to others, persuaded them of its success, and generated some results. Unfortunately, the action-oriented people may not have remedied the situation and may even have made it worse. As a result, causal factors will continue to operate, sooner or later causing virtually the same problem to occur again. Such people tend to be constantly fighting fires as a result.

The question is: How do you get a person who is more thought-oriented by nature to be more action-oriented—and how do you get someone who is more action-oriented by nature to be more thought-oriented?

One way is for each type of person to practice the orientation of the other, taking the following approach:

1. Develop thinking abilities and the use of the analytic approach in order to better analyze problem situations, arrive at more comprehensive and effective (synergistic) solutions, and plan more appropriate, systematic responses.
2. Then, in the knowledge that one has done one's best in Phases 1, 2, 3, and 4, "shift gears" and resolve to be committed to one's decision and to forge ahead more decisively and persuasively.
3. Implement planned solutions wisely. Because one has recognized the disadvantages as well as the advantages, and is more aware of the uncertainties involved, one can better monitor activities' progress during implementation and be ready to deal with anticipated "bumps in the road."
4. Purposefully adjust personal characteristics and behavior patterns so as to be better able to implement solutions.

Interpersonal Skills

Manytimes oursolutions mustbe implemented either through others or with their help. This often means that others must be persuaded that our analysis and solutions are feasible and effective—uncertainties notwithstanding. How persuasive you are is a function of several factors. The more obvious it is to others that your solutions are well thought out and that you have "covered all the bases," the more convinced they will be. The more confident you are that you have indeed covered all the bases and have arrived

Table 4.3: Problem-Solving Phases and Steps -- and Their Beneficial Effects

A C T I O N S	B E N E F I C I A L E F F E C T S
Phase 1: Preparation	
Step 1: **Awareness / think what you're doing** (awareness based on brain's comparison of actual with	Consciously structure process & channel thought. planned or intended stimuli)
Step 2: **Describe** situation -- i.e., the unintended/unexpected events or effects that signalled the problem situation	Initial conscious recognition of problem situation; perform a more effective analysis
Step 3: Increase **motivation**: Determine importance in terms of personal and organizational goals and plans	Focus attention; increase concentration; initiate & sustain effort; take necessary time.
Step 4: Seek a conducive **environment**	Minimize distractions and interruptions.
Step 5: Get **organized** (materials, references, etc.)	Minimize distractions; be better organized.
Step 6: **Preview**: do a brief preliminary analysis	Determine real importance and priority of situation; budget time/money, more effort; be organized.
Phase 2: Analyze -- Define and Reduce the Problem Situation	
Step 7: Do an initial **qualitative analysis**. Identify system of possibly causal variables involved and the relationships among them (not just a single cause)	Increase repertoire of knowledge; help minimize influence of dysfunctional attitudes; *multi-causality*; keep from quickly jumping to solutions phase.
* use checklists to augment knowledge of factors	Help minimize effects of dysfunctional attitudes.
* diagram/model variables and their relationships	Enable mind to handle complexity.
Step 8: Collect important **facts** (associated with factors)	Increase repertoire; use objective (factual) inputs to
* use facts and observations (rather than opinions); use "working assumptions" as necessary	thought; increase objectivity.
* add facts or data to situation model	Enable mind to handle complexity; elicit continuing use of the analytic approach.
Step 9: **Analyze** information and identify the real, underlying, multiple causes (in chains of causes and effects)	True "problem identification."
Step 10: Formulate **criteria** for Phase 4 (Decision Making)	Improve testing/weighing of alternative solutions.
Phase 3: Plan -- Alternatives (Solutions) Formulation	
Step 11: Formulate **goal(s)/objective(s)**: identify the desired end results of implementing solution(s)	Assures going in right direction(s) toward some consciously identified target(s).
Step 12: **Plan**: Identify what must DO to improve, change, Correct, or adjust variables and their relationships	System of solutions for system of causes (in cause-effect sequences); fix situation and prevent future occurrence.
- Formulate alternative sets of strategies/tactics	
- Formulate alternative sets of courses of action	
- Budget time and resources	Effective use of time and resources.
* use appropriate diagrams	Enable mind to handle complexity.
Phase 4: Decision Making -- Test and Select Alternatives	
Step 13: Identify possible **outcomes** of alternative solutions (anticipate scenarios/sequences of actions & events)	Anticipate what could occur during implementation. Increase use of propositional ("what if") logic.
Step 14: Assess realistic **probabilites** of possible events	Minimize wishful thinking about what might occur.
Step 15: **Test and compare** alternatives	Mental trial and error (action in rehearsal);
- Identify & compare advantages & disadvantages	inputs to making final decision.
- Weigh each alternative against criteria	
- Also test/weigh combinations of alternatives	
* use appropriate diagrams	Enable mind to handle complexity.
Step 16: **Select** appropriate solution(s) for implementation	Final decision making.
Phase 5: Implement Chosen Solutions	
Step 17: As implement, monitor and evaluate feedback	Check on progress; assure getting desired results.
Step 18: Adjust plans or behavior	Effective response to obstacles and contingencies.

at an effective system of solutions, the more decisive and persuasive you will be. A positive attitude tends to be contagious.

Another factor is meaningfulness. The more meaningful the problem situation is to you, the more meaningful you can make it for others. If, for example, you have made the situation, the factors involved, and your thoughts visual by diagramming them, then you can use your diagram(s) or model(s) to help others follow your reasoning more easily and convincingly. In addition, using diagrams also encourages others to contribute more information and thoughts that may not have occurred to you.

These are the main points we want to reemphasize::

A. Begin to implement your solutions/decisions confidently, decisively, and enthusiastically.

B. Monitor their implementation, anticipating the development of implementation problems and continuously updating and utilizing contingency plans.

C. As you monitor progress, adjust your own attitudes and behavior as may become advisable..

Summary

General

There are no magic keys to betterproblemsolving and decision making. Even so, there are principles and procedures that can make thought processes more effective and efficient—and in many ways easier. These are reviewed for you in ***Table 4.3*****. It illustrates how to influence a system of factors using a comprehensive, systematic approach. We recommend keeping it handy for regular use**.

In Part1 we setthe stage for describing various principles and methodologies by discussing the various factors that influence how well we solve problems and make decisions. These factors were: a person's (a) ability to become aware of problem situations; (b) knowledge of and ability to use the analytic approach; (c) repertoire of knowledge and experience; (d) motivation to concentrate and sustain effort and attention; (e) vulnerability to environmental influences (constraints); (f) thinking (logical) abilities (for juggling information back and forth between memory and reasoning areas); (g) time available to think and act; and (h) personal characteristics, attitudes, and behavioral tendencies.

All of the principles and procedures described in Part 2 are aimed at improving the use of some factors, minimizing the effects of some, and compensating for limitations posed by others. As shown in ***Figure 4.2*** on page 4-10, **certain factors should be influenced or improved on a continuing or regular basis**.

The six actions are:

A. Set Goals and Plan—to increase awareness of problem situations and the motivation to concentrate and sustain attention and effort on the problem-solving or decision-making process.

B. Make a habit of using the Analytic Approach—to better structure thought processes and use the principles and procedures involved.

C. Increase Repertoire of Knowledge and Experience —to increase the identification of factors involved, recognition of relationships among factors, recall (and compilation) of facts that correspond to factors, and development of possible solutions or responses.

D. Further Develop Thinking Abilities—to think more logically and juggle information back and forth between memory and reasoning areas of the brain more effectively and efficiently.

E. Adjust Thought- and Action-Related Traits, Attitudes, and Behavior Patterns—to compensate for any limitations due to values, personality traits, etc.

F. Begin to Solve Anticipated Problems—to give oneself time to collect information, analyze it, formulate preventive solutions, and begin preventing a number of problems from occurring.

In Part2 we discussed the principles and procedures that should be used once people find themselves in important thinking situations. We conceptualized the problem-solving situation as having five major phases:

PHASE 1:	Preparation
PHASE 2:	Problem Definition and Reduction (Analysis)
PHASE 3:	Formulation of Alternatives (Plans or Solutions)
PHASE 4:	Hypothesis Testing and Selection (Decision Making)
PHASE 5:	Implementation of Solution(s)

All of these phases were broken down into one or more steps. You will better recall and use these steps if you recall the phases. One mnemonic device for remembering the sequence of phases is the following:

Preparation
Definition and Reduction
Alternatives Formulation
Testing and Selection
Implementation

or -- "**P**repare for **D R A F T S** and **I**mplement"

Table 4.4: Relationships Among the Managerial Process, Personal Goal Setting and Planning, and the Analytic Approach to Problem Solving

	Managerial / Integrative Process	Personal Motivation (Goal Setting & Planning)	Analytic Approach to Problem Solving
	Preparation Steps	**Preparation Steps**	**Preparation Steps**
What has happened, or what is going on —and why?	**Analyze Situation** (including evaluation of past results and performance)	**Analyze (SELF)** Analyze personal characteristics and behavior. Analyze (interactions with) the environment.	**Analyze Situation** System of possibly causal of influential factors/variables and their interrelationships
What needs to be done, or what might be done —and how?	**Set Goals and Plan** **Set Goals**: what accomplish **Formulate Plans** (how to): Strategies and tactics, programs and projects, action plans **Budget** resources	**Set Goals and Plan** **Set Goals**: what accomplish **Formulate Plans** (how to): alternatives involving.... Strategies and Tactics, Programs and Projects, Action Plans **Budget** resources	**Formulate Solutions** **Set Goals**: what accomplish **Formulate Plans** for Implmenting Solution(s): Strategies and Tactics, Programs and Projects, Action Plans **Budget** resources
What course of action should be taken?	**Make Decision(s)** Analytically test, compare, and select among alternative [sets of] goals, plans, budgets, policies, and procedures	**Make Decision(s)** Analytically test, compare, and select among alternative [sets of] goals and plans	**Make Decision(s)** Analytically test, compare, and select among the alternatives
Take action; do something	**Implement Plans to:** **Organize** **Staff** **Guide, coordinate activity** **Guide control processes**	**Implement Plans to:** **Reach life goals** Obtain & evaluate **feedback** **Revise** plans as approp.	**Implement Chosen Solutions** Obtain & evaluate **feedback** **Revise** solutions as approp.

Special Emphasis

Several points and perspectives deserve emphasizing.

First: Using this comprehensive, systematized problem-solving approach takes some time and effort. You undoubtedly will not use it in all problem-solving and decision-making situations. Particularly in the cases of relatively simple problems and inconsequential decisions, you undoubtedly will not use it in its entirety. However, it should be used to solve those problems or make those decisions that are really important to you.

Even though the system will not always be used in its entirety, there is a way to compensate for the resulting limitations and make maximum use of one's time. That is to take an entire weekend (or several evenings) to work out an important problem in each of several areas—such as (a) home life, and (b) job. If this is to be done most effectively, it will mean analyzing the roles/jobs of, traits of, relationships among, and external influences on, the individuals involved. By considering many variables and corresponding facts, and by arriving at in-depth insights concerning them (and their interrelationships), you will have accomplished the analysis, formulation, and testing phases of many subsequent or potential problems. In effect, you will have increased the informational inputs to these problems and will save time later. Perhaps more important, having analyzed these areas in detail, and having begun to identify solutions, you may be able to begin minimizing if not

alleviating previously unrecognized and/or potential problems.

Another practical means for dealing with the time limitation is to **think ahead**. By looking for early symptoms of impending problems, and by anticipating obstacles or conflicts, you give yourself time to use a system of analytic principles effectively. Thinking ahead can be accomplished as you review your personal and organizational goals and plans on a regular basis. In fact, how to reach your goals is a problem situation in itself. The planning part of "means-orienting behavior" involves Phases 3 and 4 of the problem-solving process. Therefore, **we strongly recommend that, immediately after finishing this chapter, and given what you now know about the analytic approach, you go back to the goals and plans you wrote down on the fill-in formats for Chapter 3, and rethink the plans for reaching your goals.**

Second: Most people use at least some of the principles discussed above to some degree. Using them is not all that difficult. What is difficult is to stop and think what we are doing and how to do it well. If we do not use the principles and steps consciously and purposefully, our problem-solving effectiveness and efficiency cannot be maximized.

Whether or not we do stop to think about what we are doing—and how to do it well—is largely a function of prior goal setting and planning, which increase the probability that we will.

Third: Using the analytic approach matters less if a problem or decision is unimportant. But remember that, by doing an initial or preliminary analysis of a seemingly unimportant situation, you may discover that it is actually important and warrants further use of the entire analytic approach. Therefore, we recommend doing at least thumbnail analyses of unintended, unexpected, or undesirable situations to determine just how important they may really be.

The following are points that relate to specific steps of the process described above:

Fourth: Problem situations must be regarded as systems of many interacting, interrelated, and interdependent variables. There is always more than one causative variable in any problem situation. This is the concept of **Multi-Causality**. Also, obvious causes are often not the real, underlying causes, which may be "hidden" further back in some cause-and-effect sequence.

Fifth: Obtaining accurate, reliable facts is an important step. But even more important is the initial identification of possibly causal or influential variables and their interrelationships. **First be qualitative**. Identify the system of factors/variables that could be involved, so that you collect facts about really important variables. **Then be quantitative and push the numbers**.

Sixth: The importance of **using diagrams** cannot be over-emphasized. Their use compensates for one of our most significant mental limitations—the mind's inability to handle the complexities of solving problems and making decisions effectively and efficiently entirely on its own. In addition, **developing a model or diagram of the problem situation during the analytic phase assures the use of the rest of the analytic approach**.

Seventh: An important part of any solution is a plan for its implementation. Effective planning requires identification of factors' cause and effect relationships. In addition, a plan must include who should do what, when, and how.

Eighth: Before deciding which solutions to implement, test them mentally or with the use of appropriate diagrams. Identify the possible outcomes of possible acts. Also assess the probabilities of those outcomes/events. Next, analyze (weigh and compare) alternatives' advantages and disadvantages using your decision-making criteria.

Ninth: Decision-making effectiveness depends upon the effectiveness with which you have analyzed a situation and have formulated alternative solutions.

Tenth: Even though we would all like to think that we will now start using these principles, steps, and practices more conscientiously, we will not always do so when we should. However, if we use the analytic approach on a more regular basis, its use will tend to become a habit. When people around us use and talk about the approach, this reinforces our use of it. We suggest, therefore, that you ask those around you at home, at school, or at work to familiarize themselves with the analytic approach so that you can all reinforce each others' use of it.

Relationships Among Methods

Table 4.4 illustrates these relationships. Goal setting, planning, and problem solving are all closely interrelated and interdependent in several ways.

First, byformulating short-, intermediate-, and long-term personal (and organizational) goals and plans, we "program our minds" to become more aware of problem situations and to stop and think about what we are doing and how to do it well. Goal setting also increases our motivation to concentrate and sustain attention and effort during a problem-solving or decision-making process. Furthermore, it increases our motivation to learn, and make a habit of using, the principles, steps, and practices that improve thinkwork effectiveness.

Second, asalso shown in ***Table 4.4***, problem-solving principles and practices are involved in effective personal motivation (goal setting and planning). They improve how

well we analyze of ourselves. They increase how well we formulate goals and plans. And they improve how well we choose among the possible roads we contemplate taking. In effect, we use much of the analytic approach to figure out how to attain the goals we have set for ourselves.

Third, reaching goalscan also involve learningthat is, acquiring additional knowledge and experience, further developing skills, and adjusting our attitudes and behavior. However, before we begin to learn and adjust, we must identify what we need to learn, further develop, or adjust. This requires analyzing who we are now, who and where we want to be, and what it will take to get there. How to go about acquiring the necessary inputs constitutes another problem-solving and decision-making situation. The solutions should incorporate principles of learning, since their implementation will involve learning.

Problem-solving activities result in learning. We are learning when we define what occurred that was unintended or unexpected, when we identify and relate variables, and when we collect and review facts. We are also learning as we diagram alternative solutions, anticipate possible outcomes of acts, or assess and write down probabilities of events. So if we wish to get the most out of a problem-solving situation, we should maximize the effectiveness and efficiency with which we record new information or insights in memory. This means applying learning principles and practices—such as using diagrams to etch information into memory. In short, **a problem-solving situation is also a learning situation**. Therefore, principles, steps, and practices for learning should be used at appropriate points in planning, problem-solving, and decision-making processes. Chapter 5 on learning is next.