Problem Solving in Extension

Habits and sets bred by mechanical learning of procedures cripple the agent who must solve problems arising from changing times

HELEN P. QUARRICK
and
EUGENE A. QUARRICK

THE EXTENSION worker today is likely to find himself caught up in a confusing swirl of change, which means that old standard ways of doing things either do not work or do not work well. Therefore, the worker must begin to look at things in new ways, devise new approaches—in short, more and more he is going to be faced with problem-solving situations.

Problem solving is an extremely complex process, and as yet our knowledge about it is incomplete. Problem solving cannot be taught as directly as one might teach a person the multiplication table or how to drive a car. At this time the most that psychologists can tell us is what good problem solvers seem to do or not to do when they attack a problem and what some of the obstacles to good problem solving are.[1]

A problem arises when a person has a goal but does not know how this goal is to be reached. Whenever he cannot go from a given situation to a desired situation simply by action, there has to be recourse to thinking—i.e., problem solving. Problem solving is to be distinguished from the mere performance of *tasks* (the routine use of habits and skills in reaching a goal or objective).[2] A familiar sit-

[1] Ernest R. Hilgard, "Can We Train Better Problem-Solvers?" in E. L. Hartley and R. E. Hartley (eds.), *Outside Readings in Psychology* (New York: Thomas Crowell Company, 1959), p. 303.

[2] Bernard Berelson and Gary A. Steiner, *Human Behavior: An Inventory of Scientific Findings* (New York: Harcourt, Brace and World, Inc., 1964), p. 201.

HELEN P. QUARRICK *is State Extension Program Leader—Home Demonstration* and EUGENE A. QUARRICK *is Assistant Professor of Psychology, West Virginia University, Morgantown, West Virginia.*

uation is dealt with by habitual methods, i.e., methods that worked in the past. A problem exists when these habits and skills are no longer effective in reaching the objective.

The process of problem solving has generally been divided into a number of steps: (1) define the problem; (2) formulate the criteria or goals by which the solution will be evaluated; (3) formulate a hypothetical situation; (4) collect and analyze the data; (5) test the proposed solution against criteria.

Somebody once said that in chess—which is probably pure problem solving—one can only teach the opening moves. In this article only the "opening" steps of problem solving will be discussed—i.e., defining the problem, keeping the goals in mind, and analyzing the data.

Extension Problems

In an attempt to apply these principles to "real-life situations," a state-wide survey was made of the problems of county Extension agents. Agents were asked to list their most important problems in carrying out the county Extension program. Most agents responded with three or four problems.

The first three problems of each agent are summarized in Table 1. Percentages are based on a total of 126 problems from 42 agents. Replies were received from agents in 38 counties, representing about 40 per cent of the agent sample. However, some of the responses were from individuals and others reflected feelings of the county staff, so it is difficult to determine the exact extent of the sample.

Define the Problem

When a person defines a problem, he is already on the way to solving it or not solving it. The ease with which a problem can be solved depends on how it is stated. The way the problem is posed is so important that it may be virtually impossible if stated one way and easy if stated in another way. For example, *"how* to build a house with an all Southern exposure is a difficult question, but *where* to build one is easy—at the North Pole."[3] While this example may seem trivial, the point is an important one.

Sometimes, just by redefining a question, it comes into sharper focus and may be more amenable to solution. "How to reach your

[3] John Dollard and Neal E. Miller, *Personality and Psychotherapy: An Analysis in Terms of Learning, Thinking and Culture* (New York: McGraw-Hill Book Company, Inc., 1950), p. 113.

homemakers" might make more sense when re-phrased as "how to get free time for young homemakers to attend meetings." Since young children are the biggest obstacle here, a logical solution might be a baby-sitting service. No less a problem-solver than Einstein recognized the value of this general principle when he said, "The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill."[4]

Table 1. Problems of county Extension agents by per cent of frequency mentioned.

General description of problem	Percentage of times listed
Motivating leaders	18
Motivating the general public to support and participate in Extension programs	16
Adapting to changing roles and dealing with resistance to change	11
Lacking knowledge, e.g., what resources are available at local and university level; how to deal with motivation and leadership problems, etc.	11
Establishing contacts with new groups, e.g., the disadvantaged, young homemakers, etc.	10
Conflicting interests with civic, governmental, church, and similar agencies	9
Determining priorities, i.e., what aspects of the overall program to emphasize	6
Not having enough time	6
Lacking sufficient budget for equipment, physical facilities, secretarial help, etc.	6
Attempting to maintain good public relations and image for 4-H and Extension	4
Meeting the expectations of state supervisors and getting them to appreciate local situations	3

If at all possible the problem should be defined in terms, objects, or operations over which the person has some control and which he can change. Six per cent of the problems of Extension agents (Table 1) were defined in terms of "not having enough time." While this may be true in a certain sense, it is a poor way of stating a problem one wants to do something about. *Time* is a limited commodity; there are only 24 hours in a day. If one doesn't have enough time, there is not much that can be done about getting more. On the other hand, if the problem were stated in terms of material that

[4] Albert Einstein and Leopold Infeld, *The Evolution of Physics* (New York: Simon and Schuster, 1938), p. 95.

could be changed, then at least the way is left open for some solution. If the problem were posed as "I have too many projects going" or "I am not getting the help I should," then some action and change is possible. While this seems like saying the same thing in other words, it is these very words and labels that determine our sets and attitudes and our hopes or pessimism about solving the problem.

Problems defined as "too many projects" or "not enough help" easily lead to some form of action, e.g., substitution, rearrangement. One might substitute a new approach to a club that is lagging, substitute a new leader for one who is unsatisfactory, rearrange the staff work loads to distribute the time better, etc. While any of these steps might mean a sacrifice in one area, they might bring the agent the more desirable goal of more time.

Keep the Goal in Mind

A problem consists of two elements—a current undesirable situation and a future desirable situation (the goal). When a man defines a problem, he is saying what is needed in the current situation that will lead him to the future goal situation. But he can do this effectively only if he keeps the *goal in mind.*[5]

It is impossible to evaluate what one is doing without using the goal as a standard. An analogy might be made to the problem that faced the captain of an old sailing ship. If he did not know to what port he was steering, no wind or ocean current would be favorable. In fact, without a knowledge of the destination, nothing else counted—neither the captain's sailing skill nor the hard work of the crew.[6] The importance of keeping the goal in mind has always been recognized in folk wisdom as seen in these two proverbs: "Think on the end before you begin" and "A wise man begins at the end, a fool ends in the beginning."[7]

With the goal in mind, one begins to reason about the problem. As paradoxical as it may sound, problem-solving thinking often seems to proceed best in reverse direction; after an initial definition of the problem, good problem solvers concentrate on the desired goal and work backwards. Ideally, the person tries to visualize the final position in which he would like to be.[8] He then asks himself, "What do I have to do to get there?"

An application of this principle to a problem that plagues every

[5] The Royal Bank of Canada, "Analyzing a Problem," *The Royal Bank of Canada Monthly Letter,* XXXVII (March, 1956), 2.

[6] *Ibid.*

[7] G. Polya, *How to Solve It* (Princeton: Princeton University Press, 1945), p. 195.

[8] *Ibid.*

body is illustrated in Figure 1. In this highway scene, the driver of the black car wants to make a left turn at the intersection; however, the traffic jam in front of him is over a fourth of a mile long. He can see the intersection in the distance and notices that cars coming from the opposite direction can make the right turn easily on the road he wants to take. He thinks to himself, "If I were only going the other way." Here he is visualizing the goal situation. This stimulates him to think *how* he could be going the other way. He pulls out into the right lane, and follows the path indicated by the arrow in Figure 1. He drives past the intersection, turns around, comes back the other way, and then turns on to the desired highway.

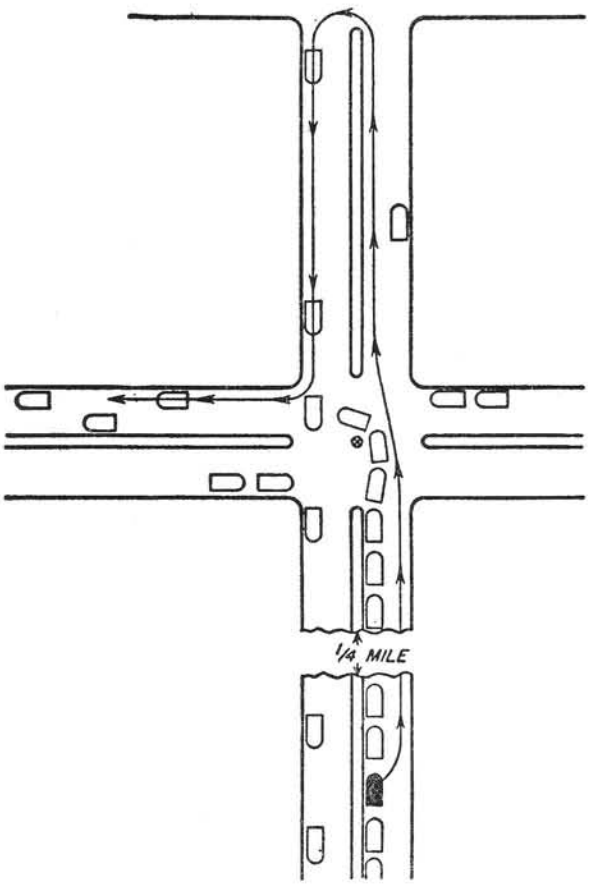

Figure 1. Example of problem solving in a traffic situation.

(From *Personality and Psychotherapy* by Dollard and Miller, Copyright© 1950 by McGraw-Hill Book Co., Inc. Used by permission of McGraw-Hill Book Company.)

In this illustration it will be noted that the driver not only reasoned backwards from the goal, but in order to reach it he had to go away from the goal at first. It is often true that what seems to be the most direct path to a goal is not always the best long-run solution to a problem. For example, to be more efficient on the job a person might *at first* have to institute certain practices which make him even less efficient than he now is. If he were very anxious or pressured to be more efficient this would be hard to do; it goes against the grain—there is a psychological resistance to it because one feels he is doing the very opposite of what is desired.

Some animal experiments illustrate that "going away from" the direction of the goal is hard to do psychologically. If an animal is partially enclosed by a length of wire screen and food is placed on the other side of the screen, it may be hard for the animal to "get the idea" that simply by turning around, going around the screen, he can quickly get to the food. Instead, he may try to get to the food directly by climbing the screen, pawing the ground, running back and forth along the screen, etc. People sometimes behave like this when they try to solve problems by direct attack, muddling through, and trying old unworkable responses again and again.[9] If they succeed, it is purely by chance; and not only have they been very inefficient in terms of time and effort, they have learned very little about solving future problems.

Analyzing Facts

The heart of problem solving lies in knowing how to work with available facts. Problem solving does not mean discovering new facts, but new ways of thinking about those that are available. It does not mean creating something out of nothing; it means *uncovering, selecting, reshuffling, combining,* and *synthesizing* already existing facts. Very often this new combination of facts occurs by paying attention to facts that previously were ignored, seemed irrelevant, or were taken for granted. Tools for analyzing and thinking about facts are called *concepts* and *principles*. The more developed these tools are, the easier the problem solving.

What kinds of problem-solving tools does the Extension agent have? It depends on what kinds of problems he has to work with. If his orientation is primarily agricultural, then his tools are probably more refined than those of the agent whose problems are primarily social-psychological. In agriculture, as a result of years of research, there is a definite technology—a system of well-developed concepts

[9] *Ibid.*, p. 203.

and principles which guide one in resolving problems. If crops do not grow well, the agent immediately has several hypotheses and, like a good trouble shooter, he proceeds to test these out, eliminating the unworkable ones. In other words, his concepts and principles about the crops and soil requirements immediately tell him what facts are pertinent to solving the problem and how to go about collecting the facts.

Contrast this with the situation of the typical Extension agent in our survey (Table 1). There was a good deal of agreement among these agents that their principle problems are *people-problems*—the leader who does not measure up in some way, people who are apathetic and unresponsive to Extension programs, the uncooperative people in other agencies. About 40 per cent (nearly half) of the problems were people-problems.

People-Problems

How does one solve problems with people? What are the relevant facts? How does one organize and think about these facts? Although psychology and sociology do not have the kind of advanced technology found in agriculture, these disciplines do make available to us concepts and principles helpful in solving people-problems. The relevant facts for solving problems with people have to do with needs, attitudes, morale, social pressure, etc. Unless the agent continually sees people and social situations in these terms he will not have *facts* when it comes to solving people-problems.

A bit of self-examination may be in order:

1. If you were asked right now, could you say why each of your leaders is in Extension work? Could you say how they are different in what moves them? Could you say why that particular middle-aged bachelor volunteered his free time to be a leader? And is this man getting out of his work what he expected to?
2. What hypotheses come to mind when you have to deal with a cranky leader? Are you capable of seeing him in terms of some unfulfilled needs rather than just automatically reacting to him on a personal basis?
3. Do you understand the concept of social class and how important this is to your doing effective work with people not of your middle-class orientation? Do you realize that low-income families may live in a psychological world much different from the middle-class world? Do you know how such a person thinks, what he thinks about, what he values, what codes he tries to live by?

This is not the place to discuss social-psychological concepts (attempts are made to familiarize agents with this knowledge through periodic conferences and graduate programs). We only want to point up how invaluable these concepts are in solving people-problems—*they tell what the important facts are.* We recognize that these concepts and facts are often hard to grasp and work with. For one thing they are not as precise and systematic as, for example, an agricultural or subject-matter technology. For another thing social-psychological facts are not as tangible and as readily apparent as agricultural things. It is relatively easy to treat and work with the soil; but how does one "handle" an attitude? In view of this, it is easy to understand the exclusive attention sometimes given to subject-matter areas such as agriculture and home economics.

By analyzing the facts, the problem can be broken into parts that can be tackled individually. Vague difficulties must be translated into specific form. The idea is to search for the point of the problem by sorting facts into rational and easy-to-understand divisions. The easiest way to break a problem down is to ask questions.

If the fuel behind problem solving is factual infomation, then it is *questions* which ignite this fuel: "What is the unknown? What is needed? Can the problem be restated? Is there a familiar problem that has the same or similar unknowns? Is there a related problem that has been solved before? Am I considering all the data? The good problem solver will also ask else-questions, like what-else, where-else, when-else, who-else, and why-else.[10]

Another useful device in analyzing facts and getting new perspectives on them is to reason by analogy. This means that the person compares his situation with another situation that is different in some ways but similar in others. For example, it is said that Newton got his great scientific insight into the concept of gravity when he saw that in some respects the moon behaved like an apple. To have this device work, a person must have a knack for seeing hidden similarities.

In our survey, a good many Extension agents listed "reaching the disadvantaged" as a problem. To reason by analogy about this problem one might consider the methods of other professionals who have to arouse, motivate, or "reach" people—the advertiser, the politician, the clergyman, etc. One might also look into some of the famous cases wherein people have sought to help out-groups that were initially unresponsive or hostile. Albert Schweitzer, Tom Dooley, Father Damien, the "hoodlum priest," to mention a few, are

[10] The Royal Bank of Canada, *op. cit.*, p. 3.

doubt had to solve problems similar to those faced by the Extension agent who is trying to reach an impoverished Appalachian community. A problem that is new to us is probably not new to this world. And it is good to remember that our libraries are storehouses of solutions arrived at by others.

Defining the Problem

In the first section of this article, we stated that definitions are important and that how a problem is defined may or may not put us on the path to its solution. A comment may be in order on the most frequently reported problem in the survey—the poor motivation of leaders. This problem was so persistent and the complaints about the leaders generally so vague that one wonders if this is the best way to formulate the problem—i.e., that the problem is *in* the leaders. Is this really a problem that arises directly from the leaders? Does it not seem odd that people who volunteer their services should turn out to be "uncooperative," "not interested," "not conscientious," etc., as they were described in the survey?

We are not questioning the agent who reports that he has a problem with leaders. However, we think that it is important to point out that such problem behavior is not likely to be an inherent personality characteristic of *volunteer* workers, but that such behavior may be a function of the situation they are in. In other words, we may have a morale problem, not a personality problem. Insofar as the agent has to deal with morale problems, or incentive problems, or problems with subordinates, he is like a superintendent in industry. And to that extent he may be able to profit from some of the solutions that have already been arrived at through industrial research. There is indeed a voluminous body of literature and research which bear examination by the problem-solving agent.

Obstacles to Problem Solving

If problem solving is anything, it is the ability to cope with *newness*. It requires alertness to new possibilities, the capacity of doing things differently from the ways they were done before, and sometimes the knack for putting things together that do not normally go together. Since this is so, the principal danger for the good problem solver is an over-reliance on old habits and old ways of looking at things. Over-learned habits may so firmly fix routine ways of doing things that they interfere when the person has to think about and deal with a new situation.[11]

[11] Hilgard, *op. cit.*, p. 306.

Psychologists use the term *mental set* to describe the effect of old habits and perceptions. Being of a certain frame of mind, a person can be blinded to facts that do not correspond to his mental set. He can get so involved in one way of doing things that he fails to consider other possibilities. Here are some examples of *set,* taken from an introductory psychology text:

> Think of a four-letter word ending in "any." The words "many" and "zany" come to mind. Now think of a four-letter word ending in "eny." If the reader will contend with this problem for a while before he looks up the answer on the bottom of the next page, he will perhaps see intimately the phenomenon of mental set.*
>
> Many brain teasers take such a form that our customary sets lead us astray. For example: "A farmer has 20 cows. All but 13 of them die. How many does he have left?" Anyone who answers 7 has been captured by a set. Or the problem: "There are two coins, one of which is not a nickel, totaling 30 cents. What are the coins?" Or another: "Two men play five games of tennis. Each man wins five times. Explain." The set for the latter problem here activates the concept of a game between the two men. Until such a set is overcome the solution is impossible.[12]

Set interferes with our ability to cope with new situations. While past learning often makes it easier to learn something new, most of us at one time or another find that old habits interfere with developing new ones (as when we move from driving a car with a conventional gear shift to one with an automatic shift). This principle holds true even when it comes to using the same tool or object in a new way.

In fact, it has been well established by psychological research that the more recently an object has been used in its usual way, the greater the tendency to overlook its use in a new way. For example, in a now classic study, subjects were required to solve a series of problems using a certain formula. When new problems were presented, requiring a new approach, many of the subjects continued to apply the mal-adapted formula. Easier solutions were available but were not seen. In drawing some educational implications of this research, the author stated:

> Exercise and even drill have their values. Mechanized responses have a place in one's behavior. They possess the advantages of releasing one from the bother of finding anew responses to recurring everyday situations; they equip one with precise, ready, and speedy responses to certain aspects of his environment; and they free the mind so that it can

[12] Fillmore H. Sanford, *Psychology: A Scientific Study of Man* (San Francisco: Wadsworth Publishing Company, Inc., 1961), p. 370.

more adequately deal with complicated tasks. What the study has shown is that in mechanization there are certain dangers. When the individual does not adequately deal with problems but views them merely from the frame of reference of a habit; when he applies a certain habituated behavior to situations which have a better solution or which, in fact, are not even solvable by the just working habit; . . . when, in a word, instead of the individual mastering the habit, the habit masters the individual—then mechanization is indeed a dangerous thing.[13]

Instead of drill and mechanical procedures, psychologists have found that it is much better to teach by use of general principles.[14] A principle that is well understood is more easily modified to fit new situations than a formula learned by rote memory. There seems little doubt that we in Extension make excessive use of mechanical, "cook book type instruction" which says "when this happens, do the following in one, two, three order," or "just do it this way, never mind why." How many of us have heard this remark from Extension agents: "I don't have time to go into the detail of it, just tell me what I should do." Training that is only mechanical breeds habit and "set minds." Old habits and old sets, like old shoes, are comfortable—but they ill-equip the agent for coping with changing times.

SUMMARY

This paper attempts to identify some guidelines for problem solving. Problems should be defined in terms of things or material over which one has some control. Reasoning in problem solving generally starts with the goal and works backwards. Various kinds of questions must be asked in order to collect all of the relevant data; one must have a knowledge of concepts by which to organize the data; analogies are very helpful devices by which to apply old solutions to new problems. Finally, habits and sets which are bred by mechanical learning of procedures cripple the Extension agent who has to solve problems arising from changing times. Throughout the paper an attempt is made to apply these principles to some concrete Extension problems, the most common of which seems to be the motivation of people.

[13] Abraham S. Luchins, "Mechanization in Problem Solving," *Psychological Monographs*, LIV (No. 248, 1942), 93.
[14] Berelson and Steiner, *op. cit.*, p. 206.
[15] Answer to the question on the previous page is DENY.

CREATIVE THINKING is today's most prized, profit-producing possession for an individual, corporation or country. It has the capacity to change you, your business and the world.

—ROBERT P. CRAWFORD.