

# CREATIVE PROBLEM SOLVING



**COMPETENCY**

**CATEGORY:** Life Survival

**COMPETENCY**

**NUMBER:** G.55

**COMPETENCY:** Apply the problem solving process to complex problems.

**OBJECTIVE:** Upon completion of this module, students will be able to apply the problem solving process to complex problems.



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## INTRODUCTION

- State module topic and review module objective.
- Make the following statements to your students:
  1. From 1750 to 1900 (150 years), the knowledge base of man doubled.
  2. From 1900 to 1950 (50 years), the knowledge base of man doubled.
  3. From 1950 to 1960 (10 years), the knowledge base of man, doubled.
  4. From 1960 to 1965 (5 years), the knowledge base of man doubled.
  5. Now with computers, knowledge is doubling just about every year.
  6. By the year 2010, it is estimated that the knowledge base of man will double every 73 days!
- People will need creative problem solving skills to help them make decisions and plan a course of action.

## Administer Pre-Assessment

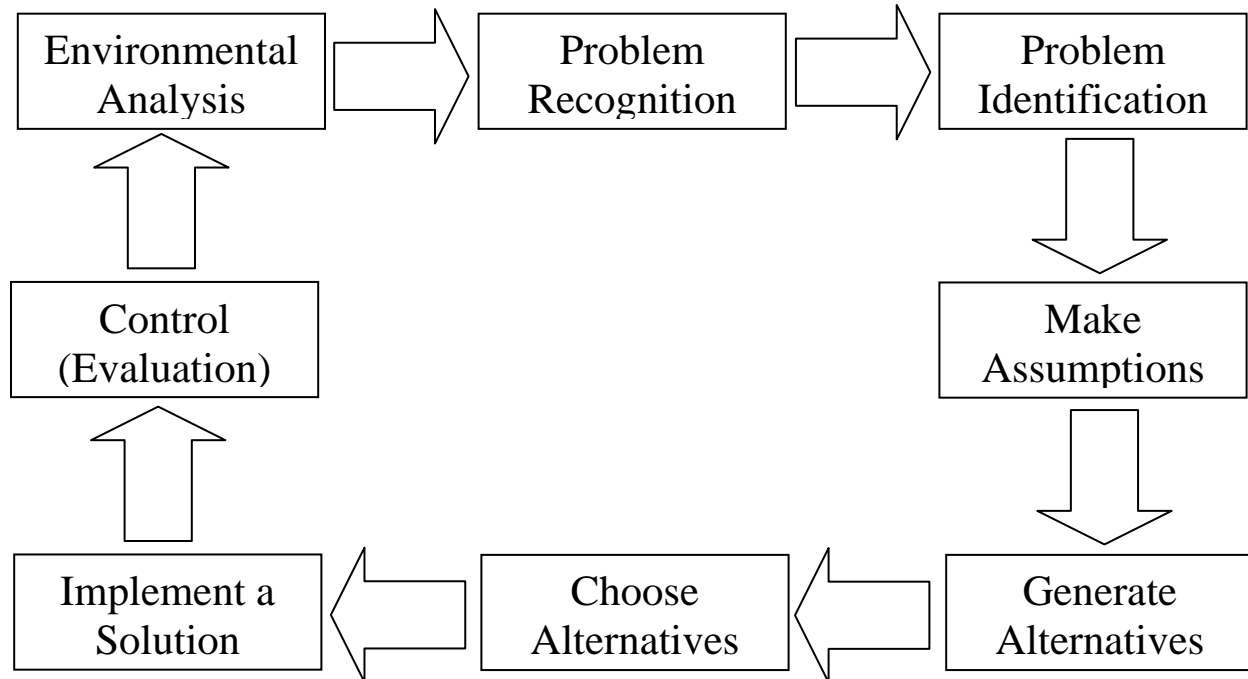
**Note to Specialist: Be sure that you have practiced the various creative problem solving techniques addressed in this module.**

## OUTLINE

- A. Creative problem solving

1. As scientists and management researchers tried to improve the problem solving process, they focused on analysis and quantitative factors.
2. In recent years, they came to realize that a strictly rational approach misses the whole point of problem solving.
3. Creativity is vital to successful problem solving.
4. The problem solving process therefore has come to be referred to as the creative problem solving process or CPS.
5. There are eight basic stages in the creative problem solving process:
  - a. Analyzing the environment
  - b. Recognizing the problem
  - c. Identifying the problem
  - d. Making assumptions
  - e. Generating alternatives
  - f. Choosing among alternatives
  - g. Implementing the chosen solution, and
  - h. Control

## The Creative Problem solving (CPS) Process



**Note to Specialist: The Creative Problem solving model presented and discussed below was developed by James M. Higgins, 101 Creative Problem solving Techniques.**

### 6. Analyzing the environment

- a. If you're not constantly searching for problems (which, as defined here, include opportunities), how will you know if they exist?
- b. How can you solve problems or taken advantage of opportunities if you don't know they exist?
- c. Being able to recognize problems and opportunities as soon as they occur, or even before they occur, is vital to success.
- d. In this stage of the process, you are gathering information. Information gained during the control stage of CPS is vital to this stage of the process.

- e. **Example:** Royal Dutch Shell Oil Company spends millions of dollars annually tracking its competition and the economy, and learning about its customers, for just one type of information system – the strategic information system. It also trains all levels of management to look for weak signals of environmental change. It spends thousands of man-hours creating forecasts/scenarios of possible futures, all to enable it to solve strategic and operational problems better.

7. Recognizing the problem

- a. You need to be aware that problem or opportunity exists before you can solve it or take advantage of it.
- b. It is from the information gathered in analyzing the environment that you will learn that a problem or opportunity exists.
- c. **Example:** When Mikio Kitano, Toyota’s production guru, began analyzing the firm’s manufacturing cost information in the early 1990s, he intuitively sensed that something was wrong. The firm simply wasn’t saving as much money as it should from all the automation and robotization that it had just completed. He believed it was because robots were being used when human beings could do the job just as well, at less cost. Other top managers doubted him, but in the end he proved that he was right, saving Toyota millions of dollars in unnecessary investment.

8. Identifying the problem

- a. The problem identification stage involves making sure the organization’s efforts will be directed toward solving the real problem rather than merely eliminating symptoms.

- b. This stage also involves establishing the objectives of the problem solving process and determining what will constitute evidence that the problem has been solved.
- c. The outcome of this stage is a set of decision criteria for evaluating various options.
- d. Key questions asked include the following:
  - 1. What happened or will happen?
  - 2. Who does it or will it affect?
  - 3. Where did it or will it have an impact?
  - 4. When did it or will it happen?
  - 5. How did it or will it occur?
  - 6. Why did it or will it occur?
  - 7. What could we do to be more successful?
- e. Example: Frank Prince, formerly the director of CPS for Frito-Lay, offered this example of how CPS worked at Frito-Lay. Members of the planning group were meeting to discuss how to improve business. This group consisted of plant managers, logistics managers, and sales managers from plants or territories. Breakage became a hot issue at one point. Typically, each manager had defended his own turf on the issue. Plant managers blamed logistics for breakage; logistics blamed the plant for poor quality containers and packaging. Sales, which included retail unit servicers, were blamed by both for the rough treatment of items at point of display. By working together and using CPS, this group discovered ways they could help solve this problem. For example, they made changes in the way that products were stacked in the delivery trucks, and in the way products were stacked within containers. These potato chips are known today under the brand name – Pringles!

## 9. Making assumptions



- a. It is necessary to make assumptions about the condition of future factors in the problem situation.
- b. For example, how will your manager react to a suggestion?
- c. Remember that assumptions may be a major constraint on the potential success of solutions, or may cause you to overestimate the potential of a particular alternative to solve the problem effectively.

10. Generating alternatives

- a. Generating alternatives involves cataloging the known options and generating additional options.
- b. To the extent that you can clearly identify and formulate useful options, you can maximize the chances that a problem will be solved satisfactorily.
- c. The purpose of generating alternatives is to ensure that you reach the selection stage of CPS with enough potential solutions
- d. Creative techniques for generating alternatives can help you develop many more possible solutions than you might come up with otherwise.
- e. For most people, creativity reaches its highest levels in this stage of CPS.

11. Choosing among alternatives

- a. Decision-making should be based on a systematic evaluation of the alternatives against the criteria established earlier.

- b. A key, very rational part of this process involves determining the possible outcomes of the various alternatives.
- c. This information is vital in making a decision.
- d. The better the job done in generating alternatives, the greater the chance that an effective choice will be made.
- e. The choice process is mostly rational, but very skilled decision-makers rely on intuition as well, especially for complex problems.
- f. **Examples:** When Honda engineers pioneered the development of an engine that would get 55 miles per gallon, they had several alternatives to choose from. Important to their decision of the technology they chose, were the impacts of the new technology on the costs of production, compatibility with existing transmissions, and so on. Each possible technology had to be evaluated for its impact on these factors.

When McDonalds Corporation considers new menu items for its fast food restaurants, each potential menu items has to be evaluated against important criteria such as freezability (all McDonalds' ready-made foods are frozen), compatibility with other menu items, taste, customer demand, and cost/price relationships.

## 12. Implementing a solution

- a. Once you have a clear idea of what you want to do and a plan for accomplishing it, you can take action.
- b. Implementation requires persistent attention. This means accounting for details and anticipating and overcoming obstacles.

- c. Set specific goals and reasonable deadlines, and gain the support of others for your solution.
- d. Example: When General Mills Restaurants, a subsidiary of General Mills, Inc., began a total quality management program for its Olive Garden chain, it paved the way for adaptation at all sites by providing a lengthy training and development program. In addition, success stories were chronicled and distributed on videotape to all restaurants.

13. Control (Evaluation)

- a. Evaluating results is the final, and often overlooked, stage in the creative problem solving process.
- b. The purpose of the evaluation is to determine the extent to which the actions you took have solved the problem.
- c. This stage feeds directly into the environmental analysis stage, which begins a new cycle of creative problem solving.
- d. It is important at this stage to be able to recognize deficiencies in your own solutions if necessary.

14. **Example:**

**Note to Specialist: Work out the following example with your class using the Creative Problem solving Process.**

Deon always goes to his grandmother's house for Thanksgiving. His whole family gathers, and he really enjoys it. It means a lot to his grandmother, too. But this year his girlfriend, Anna, has invited him to spend Thanksgiving with her family. Deon really likes Anna, and he knows she wants him to meet all her relatives. But on the other hand, he hates to miss his own family gathering. Use the creative problem solving process to make a decision for Deon.

15. **Example:**

Pam finally landed the part-time job she'd been hoping for. It's a job in a day-care center three mornings a week. The school will permit her to do this as long as it doesn't keep her from going to any required classes. She's checked it out with the guidance counselor, and it's OK. Now she finds out that the special word processing course she's been wanting to take is going to be offered this term in the mornings. Since Pam will be graduating, this is her last chance to take the course. It isn't required, but she was told it would really help her in getting a job. Now she doesn't know what to do – take the course or the part-time job. Use the Creative Problem solving Process to make a decision for Pam.

B. Building creativity into problem solving

1. Experience with problem solving has produced some discouraging findings. Among them are the following:
  - a. Creativity is not a major part of the problem solving process for most organizations or individuals.
  - b. People are not usually encouraged to be creative, either as individuals or as members of organizations. This means that creativity is discouraged in most organizations including families, schools and companies.
  - c. Few people really know the creative techniques that can be applied in the problem solving process.
  - d. Few individuals develop their personal creative problem solving skills, but that is changing.
2. It is evident that most people, as well as most organizations, can improve their CPS skills.

C. Advantages of creative problem solving

1. Individuals trained in creative problem solving skills have a higher degree of:
  - a. Improved confidence
  - b. Ability to define or redefine problems quickly
  - c. Ability to ensure maximum results for efforts
  - d. Improved creativity
  - e. Arrive at final conclusion correctly
  - f. Independent judgements

D. Individual techniques for creative problem solving

1. People tend to think that having really good ideas is possible for only a few, and that the rest of us, who don't have special "intuitive" talents, cannot be creative.
2. Nothing could be further from the truth. This module presents a large number of creative techniques for generating alternatives.
3. Some may be utilized by individuals, others by work groups, many by both.
4. These techniques will produce results quickly and easily for virtually anyone who is willing to take the time to learn them and use them.

E. Individual technique—Analogies

1. An analogy is a comparison of two things that are essentially dissimilar but have been shown through the analogy to have some similarity.
2. Analogies are often used to solve problems.

**Example:** A product development team from a mining-equipment company based in Golden, Colorado, used analogies to develop a machine that would both dig ore and load it onto a conveyor belt. One of the members of the problem solving team was an entomologist. He suggested the praying mantis as an example. As it eats, it clutches food between its forelegs and thrusts it into its mouth. The result of this analogy was the ROC 302, a large tractor with shovels on each side (like forelegs) that load ore onto a conveyor belt running through the middle of the machine.

3. As this example demonstrates, while in its simplest form an analogy is a comparison of dissimilar entities, in many instances analogies are fully developed comparisons.

<p style="text-align: center;"><b>COMPLETE LEARNING ACTIVITY G.55-1</b> <b>“INDIVIDUAL TECHNIQUES FOR CREATIVE PROBLEM SOLVING”</b></p>
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F. Individual technique—Metaphors

1. A metaphor is a figure of speech in which two different schools of thought are linked by some point of similarity.
2. Typically, metaphors treat one thing as if it were something else so that a resemblance that would not ordinarily be perceived is pointed out.
3. Examples include **the idea drought, frozen wages, the corporate battleground, liquid assets**. Also: The sergeant **barks** an order, the cold wind **cuts** to the bone, the road was a **ribbon** of moonlight.
4. Metaphors have many uses in creative endeavors.
5. Comparisons that are obvious are not metaphors.
6. Example: To say that the noise of firecrackers on the Fourth of July sounds like gunfire, for example, is not a metaphor.

7. Metaphors occur when a surprisingly imaginative connection is made between two different ideas or images that are normally perceived as dissimilar.

8. **Example:** Think of five metaphors that describe the meaning of life, such as “life is a maze.”

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

9. **Example:** Now think of a problem. Write five metaphors that describe your problem.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

10. For each of the metaphors you have listed, ask yourself what insights it provides into how to solve your problem. What solutions do your metaphors suggest?

**COMPLETE LEARNING ACTIVITY G.55-1**  
**“INDIVIDUAL TECHNIQUES FOR CREATIVE PROBLEM SOLVING”**

G. Individual technique—Association

1. Association involves making a mental connection between two objects or ideas.
2. It works through three primary laws: contiguity, similarity, and contrast.
3. **Contiguity** means nearness – for example, when you see a chalkboard you are reminded of school.
4. **Similarity** means that one object or thought will remind you of a similar object or thought. For example, when you see a Firebird you might think of a Camaro.
5. **Contrast** refers to dissimilarities that are nearly opposites – black/white, man/woman, child/adult.
6. Thus, association involves thinking of something near, similar to, or in contrast to the object or idea in question.
7. Free association
  - a. In free association, you say whatever comes into your mind relative to a word you just wrote or relative to a one- or two-word definition of a problem.
  - b. A trail of thoughts is pursued in this way.
  - c. The purpose is simply to get thoughts onto a sheet of paper that will trigger new thoughts about the problem.
  - d. You don't expect to find solutions per se; rather, you are looking for thoughts that might lead to solutions.
  - e. For example, on one occasion a group of bank managers started free-associating on the word "fast." "Fox" and "jet plane" were among the associations that resulted; so was "Federal Express".



f. **Example:** At Campbell Soup Company, product developers began by selecting the word “handle”. Through free association the word “utensil” was suggested. That led to “fork.” One participant joked about a soup that could be eaten with a fork. The group reasoned that you couldn’t eat soup with a fork unless it was thick with vegetables and meat...and Campbell’s Chunky Soups.

g. **Example:**

**Note to Specialist: Work out the following example on the writing board**

Let’s try free-associating, starting with a one-word summary of your problem on line 1. On line 2, write down the first word that comes to mind after looking at line 1. One line 3, write down the first word that comes to mind after looking at line 2. Continue until you have ten words.

1. _____	1a. _____
2. _____	2a. _____
3. _____	3a. _____
4. _____	4a. _____
5. _____	5a. _____
6. _____	6a. _____
7. _____	7a. _____
8. _____	8a. _____
9. _____	9a. _____
10. _____	10a. _____

8. Regular association

- a. The difference between free association and regular association is that in regular association, the associated word must somehow be related to the word before it.
- b. Thus, “airplane” could lead to “pilot” but not to “tree.”

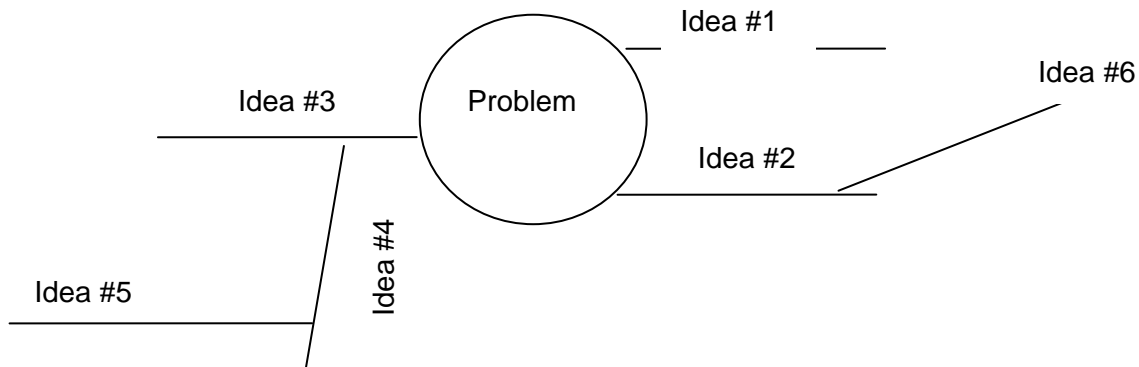
- c. In free association, in contrast, any word, the first word that pops into your mind, can be used.

**COMPLETE LEARNING ACTIVITY G.55-1**  
**“INDIVIDUAL TECHNIQUES FOR CREATIVE PROBLEM SOLVING”**

H. Individual technique—Mind Mapping

1. This technique is based on research findings showing that the brain works primarily with key concepts in an interrelated and integrated manner.
2. Mind mapping involves “working out” from a core that suite the brain’s thinking patterns better.
3. Mind mapping is an individual brainstorming process. (In brainstorming, you are interested in generating as many ideas as possible, even wild and crazy ones. Just write or otherwise record whatever comes into your head as it occurs. Quantity, not quality, is what you are after. No criticism is allowed during the brainstorming itself. Later you can go back and critique your inputs)
4. With mind mapping you can generate new ideas by looking at what you have already written—that is, “piggyback” on what has already been done.
5. To begin a mind mapping session, write the name or description of the object or problem in the center of a piece of paper and draw a circle around it.
6. Then brainstorm each major facet of that object or problem, drawing lines outward from the circle like roads leaving a city.
7. You can draw branches from those “roads” as you brainstorm them in more detail.

8. You can brainstorm all the main lines at once and then the branches for each, or brainstorm a line and its branches.
9. Example:



10. Mind mapping is an excellent technique not only for generating new ideas but also for developing one's intuitive capacity.
11. It is especially useful for identifying all the issues and subissues related to a problem, as well as the solutions to a problem and their pros and cons.

**COMPLETE LEARNING ACTIVITY G.55-1**  
**“INDIVIDUAL TECHNIQUES FOR CREATIVE PROBLEM SOLVING”**

- I. Group techniques for creative problem solving
  1. Since much work is performed in groups, many of the approaches to management that are currently favored focus on work groups such as autonomous work teams and self-management programs.
  2. In recent years, groups have been the focus of attempts to improve quality and productivity.
  3. Research and experience indicate that groups usually provide better solutions than individuals.
- J. Advantages and disadvantages of group problem solving

1. Groups offer six advantages over individual problem solving.
  - a. The group can provide a better solution to that of an individual. Collectively the members of a group have more knowledge than an individual. Interactive groups not only combine this knowledge but also create a knowledge base greater than the sum of its parts as individuals build on each other's inputs.
  - b. Those who will be affected by a decision or must implement it accept it more readily if they have a say in making it.
  - c. Group participation leads to a better understanding of the decision.
  - d. Groups help ensure a broader search effort for solutions.
  - e. The propensity to take risks is balanced. Individuals who are highly likely to take risks often fail. Groups moderate this tendency. Conversely, groups encourage the risk avoider to take more risks.
  - f. There is usually a better collective judgment.
2. On the other hand, there are some liabilities to employing group problem solving.
  - a. In interactive groups there is pressure to conform. Sometimes these groups become susceptible to what is known as “group think,” in which people begin to think alike and not tolerate new ideas or ideas contrary to those of the group.
  - b. One individual may dominate the interactive groups so that his or her opinions prevail over those of the group.

- c. Groups typically require more time to come to decisions than individuals do.
- d. Although groups usually make better decisions than the average individual, they seldom make better ones than the superior individual.
- e. Spending an excessive amount of time arriving at a consensus may negate the advantages of a good decision.
- f. Groups sometimes make riskier decisions than they should. This propensity of groups is known as the risky shift.

K. Group technique–Brainstorming

1. Brainstorming is a method for developing **creative** solutions to problems.
2. It works by focusing on a problem, and then deliberately coming up with as many deliberately unusual solutions as possible and by pushing the ideas as far as possible.
3. During the brainstorming sessions there is not criticism of ideas – the idea is to open as many possibilities as possible, and break down preconceptions about the limits of the problem.
4. Once this has been done the results of the brainstorming sessions can be analyzed and the best solutions can be explored either using further brainstorming or more conventional solutions.
5. The following rules are important to brainstorming successfully:
  - a. A leader should take control of the session, initially defining the problem to be solved with any criteria that must be met, and then keeping the session on course.

- b. He or she should encourage an enthusiastic, uncritical attitude among participants and encourage participation by all members of the team.
  - c. The session should be announced as lasting a fixed length of time, and the leader should ensure that no train of thought is followed for too long.
  - d. The leader should try to keep the brainstorming on subject, and should try to steer it towards the development of some practical solutions.
  - e. Participants in the brainstorming process should come from as wide a range of experience as possible. This brings many more creative ideas to the session.
  - f. Participants should be encouraged to have fun brainstorming, coming up with as many ideas as possible, from solidly practical ones to wildly impractical ones in an environment where creativity is welcomed.
  - g. Ideas must **not** be criticized or evaluated **during** the brainstorming session. Criticism introduces an element of risk for a group member in putting forward an idea. This stifles creativity and cripples the free running nature of a good brainstorming session.
  - h. Participants should not only come up with new ideas in a brainstorming session, but also should also 'spark off' from associations with other people's ideas and develop other peoples' ideas.
  - i. A record should be kept of the session either as notes or on a flipchart.
6. Brainstorming can either be carried out by individuals, groups or both.

7. Individual brainstorming tends to produce a wider range of ideas than group brainstorming, but tends not to develop the ideas as effectively, perhaps as individuals on their own run up against problems they cannot solve.
8. Individuals are free to explore ideas in their own time without any fear of criticism, and without being dominated by other group members.
9. Group brainstorming develops ideas more deeply and effectively, as when difficulties in the development of an idea by one person are reached, another person's creativity and experience can be used to break them down.
10. Group brainstorming tends to produce fewer ideas (as time is spent developing ideas in depth) and can lead to the suppression of creative but quiet people by loud and uncreative ones.
11. Individual and group brainstorming can be mixed, perhaps by defining a problem, and then letting team members initially come up with a wide range of possibly shallow solutions. These solutions could then be enhanced and developed by group brainstorming.

(Source: **Serious Creativity**)

<b>COMPLETE LEARNING ACTIVITY G.55-2</b> <b>"BRAINSTORMING"</b>
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- L. Group Technique-Creative Circles (Quality Circles)
1. Creative (Quality Circles) circles are small groups of workers who meet to solve quality problems related to their specific work areas.
  2. First developed in Japan, quality circles have helped Japanese firms achieve superior quality compared to their competitors.

3. Recently the concept has been expanded under the banner of "creativity circles" to include all types of problems, not just quality problems.
4. With creative circles groups of individuals work together to solve problems.
5. The group functions as a creative problem solving team.

<b>COMPLETE LEARNING ACTIVITY G.55-3</b> <b>“CREATIVE CIRCLES”</b>
---

M. Group Technique-Crawford Slip Method

1. The Crawford slip method (CSM) is a type of brainstorming.
2. The name is derived from the use of slips of paper, about the size of note cards, on which participants write their ideas.
3. A CSM group may consist of any number of people, but larger groups are desirable since the time allotted for generating ideas is short-normally about ten minutes.
4. About 400 ideas can be produced by a group of 20 people in a thirty- to forty-minute period.
5. The process consists of four key steps.
  - a. Step 1 - The facilitator creates target or focus statements.
    1. These are statements that help draw responses from participants.
    2. Most idea generation methods simply state a problem. In CSM, a problem area related to an issue is identified and an overall problem is stated.
    3. Then additional statements are made that further define the problem.



- b. Step 2 - Participants then write their replies on slips of paper, using one slip for each idea.
1. The slips are small (4 1/4 by 2 3/4 inches) to ensure that answers are concise and clearly written or notecards will suffice.
  2. In writing their responses, participants follow specific rules:
    - Write across the long edge, not across the end of the slip.
    - Write on the very top edge of the slip.
    - Write only one sentence per slip.
    - Use a new slip for explanations.
    - Avoid words like "it" or "this."
    - Write short sentences using simple words.
    - Write until time is called.
  3. Participants are then thanked for their inputs and usually dismissed. In most cases participants do not take part in the data reduction process.
- c. Step 3 - The facilitator reduces the comments by:
1. Sorting the slips into many general categories.
  2. Consolidating these into a few major categories.
  3. Refining these categories and develop an outline for the written report.
  4. Compiling into chapters, divisions, sections, and paragraphs and editing the written report.
- d. Step 4 - In writing the final report, all of the related comments on slips are itemized under the relevant subcategory headings. Duplications should be eliminated.

**COMPLETE LEARNING ACTIVITY G.55-4**  
**“CRAWFORD SLIP METHOD”**

N. Group Technique-Nominal Group

1. The nominal group technique (NGT) is a structured small-group process for generating ideas.
2. It can be used to diminish the impact of a dominant person on the outcome of the group's idea generation process, whether the source of the dominance is formal authority or individual personality.
3. The nominal group technique accomplishes this objective through a process that limits an individual's inputs to brief explanations and uses a secret ballot to choose among brainstormed ideas.
4. For this technique to be effective, the participants must agree that the group's decision is binding.
5. The process of decision making using the nominal group technique consists of four distinct steps.
  - a. Step 1: Generation of ideas
    1. The leader phrases the problem, stimulus question or other focal issue for the participants, and writes this on the writing board or flip chart.
    2. Group members are given a specified period, usually five to ten minutes, to write their suggested solutions on notecards.
    3. This reflective period helps avoid some of the pressure for conformity to a particular person's ideas. Yet there is still a sense of belonging and responsibility.
  - b. Step 2: Recording of ideas
    1. In the second step the ideas are generated in step 1 are recorded, in round-robin fashion, on the board.
    2. The leader asks each person in turn for the first ideas on his or her list that has not yet been presented by someone else.

3. The process continues until every participant has exhausted his or her list of items and all items have been recorded on the board.
4. When a person's list is exhausted, he or she passes when called upon for solutions.
5. The round robin continues until everyone passes.
6. This process emphasizes the equality of ideas and serves to build enthusiasm.
7. It also depersonalizes the ideas presented and helps prevent prejudging, and it helps ensure that no ideas are lost.

c. Step 3: Clarification of ideas

1. Each idea on the list from step 2 is discussed in the order in which it was written down.
2. Typically, the leader points to each item, asking if everyone clearly understands that item. If there are no questions, then the leader moves on to the next item.
3. When a participant seeks clarification of an item, the presenter of the idea is given a brief period of time, normally thirty seconds to one minute, to respond.
4. More time may be given if necessary, but the leader must make certain that these discussions are brief and that they are not used to sell the idea to the other participants.
5. This process continues until all ideas are understood. The purpose of this step is not to reach agreement on the best choices but simply to achieve understanding of what the choices actually call for.

d. Step 4: Voting on ideas

1. A nominal group will often list from 20 to 100 or more ideas. This list must be somehow narrowed

down to the "best" choice as determined by the group.

2. There are several ways to proceed at this point, all based on the principle of the secret ballot.
3. The most common voting procedure is for the leader to have each participant write the five ideas he or she considers best on a 3 X 5 card, which is then passed to the leader for tabulation and announcement of scores.
4. Normally, the five to ten "best" choices as determined by secret ballot are then voted on to determine the one, two, or three best choices.
5. In both rounds of the voting process, participants rank their five choices (first iteration) and two or three choices (second iteration).
6. In tabulating scores, the most important item should receive the highest score, the least important the lowest. You may choose to use a scale of 1 to 5, 1 to 3, or something similar. Total votes and total scores should be documented for purposes of comparison.

**COMPLETE LEARNING ACTIVITY G.55-5**  
**“NOMINAL GROUP”**

O. Group Techniques-Storyboarding

1. Storyboarding is a structured exercise based on brainstorming. It assists in all stages of the problem solving process but especially in generating and deciding on alternatives.
2. In contrast to brainstorming, which is best used with a narrowly defined problem, storyboarding is especially useful for solving complex problems.
3. It can be used not only to provide solutions but also to help define the various aspects of a complex problem. A specific format for describing the problem and a specific process for solving it are provided.

4. Walt Disney and his staff devised a forerunner of the storyboard technique in 1928. Disney wanted to achieve full animation in cartoon features, something no one had been able to accomplish previously.
5. To do so, he produced an enormous number of drawings-thousands more than the then current state of the art required.
6. Before long, however, piles of drawings were stacked up in the small studio. It was nearly impossible to keep tabs on what had been completed and what still needed to be done.
7. Finally, Disney decided to have his artists pin their drawings on the walls of the studio in sequence. Thereafter anyone could know at a glance how far along any given project was.
8. The story was told on a wall covered with a special kind of board; hence the term **storyboard**.
9. Storyboarding is, as its name implies, creating a story on boards. You take your thoughts and those of others and spread them out on a wall as you work on a project or attempt to solve a problem.
10. When you put ideas on storyboards, you begin to see interconnections - you see how one idea relates to another, how all the pieces fit together.
11. Storyboarding follows the basic processes of brainstorming-it uses a leader, a secretary, and a group of people working openly and following the four rules of brainstorming.
12. A storyboard is organized in columns underneath major elements known as headers.
  - a. The Topic Header - The first step in storyboarding: identifying the topic. At the top of the storyboard, the topic to be defined or the problem to be solved is identified.

This is referred to as the **topic header**. Here the topic header is storyboarding.

- b. The Purpose Header - The second step in the process, establishing the purpose header and brainstorming the purposes for pursuing the topic, which are then listed beneath the purpose header. These purposes must be identified before any other headers are created. Each item placed under a header is known as a subber.
  - c. The Miscellaneous Header - The column beneath this header contains all the items that don't seem to fit in any of the other columns. Items are placed under the miscellaneous header as the rest of the columns are brainstormed. Later they may be placed under another header or may become headers themselves if enough similar items appear in the miscellaneous column.
  - d. The Other Headers - The third step in the storyboarding process: identification of the other headers-that is, the major issues and/or solutions to the problem, other than the purpose and miscellaneous headers.
13. Most storyboards are created on a wall surface with cards (4X6) or writing board with chalk or markers.

**COMPLETE LEARNING ACTIVITY G.55-6**  
**"STORYBOARDING"**

**COMPLETE LEARNING ACTIVITY G.55-7**  
**"JOURNAL WRITING"**

**COMPLETE LEARNING ACTIVITY G.55-8**  
**"SERVICE LEARNING"**

**COMPLETE READING ACTIVITY G.55**  
**"HARD TO CHOOSE"**

**COMPLETE MATH ACTIVITY G.55**  
**"A LITTLE HELP FROM MATH"**

**Administer Post-Assessment**

**LEARNING ACTIVITY G.55-1**  
**“INDIVIDUAL TECHNIQUES FOR CREATIVE PROBLEM SOLVING”**

**OBJECTIVE:** To practice various individual techniques for creative problem solving

**RESOURCES:** • Resources will vary depending on technique(s) selected

**SUGGESTED TIME:** 30 minutes to 1 hour per technique

**DIRECTIONS:**

**Note to Specialist: You may select a wide variety of individual techniques for creative problem solving. Select the technique(s) that best fit your particular students. Review the steps for each technique(s) in the module outline. Your choices are as follows:**

- 1. Analogies**
- 2. Metaphors**
- 3. Association (free and regular)**
- 4. Mind mapping**

1. Assign students to teams of two.
2. Since these are **individual** techniques for creative problem solving, the "partner" is only to assist the individual in better understanding the rules or steps involved in each technique.

**Note to Specialist: You may need to assist students with the identification of an individual "problem" to be solved creatively.**

3. The Specialist should oversee each activity and ask students for comments and feedback.
4. At the appropriate time, have each partner switch so that all students can practice their individual techniques for creative problem solving.
5. Have each student share his or her ideas (solutions) with the class.



**LEARNING ACTIVITY G.55-2**  
**"BRAINSTORMING"**

**OBJECTIVE:** To practice the group technique - Brainstorming, for creative problem solving

**RESOURCES:**

- Writing board or flip chart
- Flip chart paper
- Markers

**SUGGESTED TIME:** 30 minutes to 2 hours

**DIRECTIONS:**

**Note to Specialist: Review the steps for this technique in the module outline before you or one of your students serves as the leader.**

1. Select a problem that will serve as the example for this technique. A problem currently facing one of your students or the Career Association would be a good place to start.
2. Review the steps or rules for this technique with your class.
3. Select a leader from the group. If other "roles" are needed, make those assignments.

**Note to Specialist: It might be necessary to lead the first example for the class. Remember that the objective is for your students to practice this group technique for creative problem solving.**

4. Engage the class in a discussion of the technique as well as a discussion to the problem addressed.

**LEARNING ACTIVITY G.55-3**  
**“CREATIVE CIRCLES”**

**OBJECTIVE:** To practice the Group Technique - Creative Circles, for creative problem solving

**RESOURCES:**

- Flip chart, flip chart paper and markers for each group

**SUGGESTED TIME:** 30 minutes to 2 hours

**DIRECTIONS:**

**Note to Specialist: Review the steps for this technique in the module outline before you or one of your students serves as the leader.**

1. Select a problem that will serve as the example for this technique. A problem currently facing one of your students or the Career Association would be a good place to start.
2. Review the steps or rules for this technique with your class.
3. Select a leader and form groups of 5-6. If other "roles" are needed, make those assignments.

**Note to Specialist: It might be necessary to lead the first example for the class. Remember that the objective is for your students to practice this group technique for creative problem solving.**

4. Engage the class in a discussion of the technique as well as a discussion to the problem addressed.

**LEARNING ACTIVITY G.55-4  
"CRAWFORD SLIP METHOD"**

**OBJECTIVE:** To practice the group technique-Crawford Slip Method, for creative problem solving

**RESOURCES:** • Slips of paper or 5X8 note cards

**SUGGESTED TIME:** 30 minutes to 2 hours

**DIRECTIONS:**

**Note to Specialist: Review the steps for this technique in the module outline before you or one of your students serves as the leader.**

1. Select a problem that will serve as the example for this technique. A problem currently facing one of your students or the Career Association would be a good place to start.
2. Review the steps or rules for this technique with your class.
3. Select a leader from the group, if other "roles" are needed, make those assignments.

**Note to Specialist: It might be necessary to lead the first example for the class. Remember that the objective is for your students to practice this group technique for creative problem solving.**

4. Engage the class in a discussion of the technique as well as a discussion to the problem addressed.

**LEARNING ACTIVITY G.55-5**  
**“NOMINAL GROUP”**

**OBJECTIVE:** To practice the group technique-Nominal Group, for creative problem solving

**RESOURCES:**

- Writing board
- 5X8 Note cards

**SUGGESTED TIME:** 30 minutes to 2 hours

**DIRECTIONS:**

**Note to Specialist: Review the steps for this technique in the module outline before you or one of your students serves as the leader.**

1. Select a problem that will serve as the example for this technique. A problem currently facing one of your students or the Career Association would be a good place to start.
2. Review the steps or rules for this technique with your class.
3. Select a leader from the group, if other "roles" are needed, make those assignments.

**Note to Specialist: It might be necessary to lead the first example for the class. Remember that the objective is for your students to practice this group technique for creative problem solving.**

4. Engage the class in a discussion of the technique as well as a discussion to the problem addressed.

**LEARNING ACTIVITY G.55-6**  
**"STORYBOARDING"**

**OBJECTIVE:** To practice the group technique-Storyboarding, for creative problem solving

**RESOURCES:**

- Writing board or large open wall space
- 4X6 note cards and masking tape

**SUGGESTED TIME:** 30 minutes to 2 hours

**DIRECTIONS:**

**Note to Specialist: Review the steps for this technique in the module outline before you or one of your students serves as the leader.**

1. Select a problem that will serve as the example for this technique. A problem currently facing one of your students or the Career Association would be a good place to start.
2. Review the steps or rules for this technique with your class.
3. Select a leader from the group, if other "roles" are needed, make those assignments.

**Note to Specialist: It might be necessary to lead the first example for the class. Remember that the objective is for your students to practice this group technique for creative problem solving.**

4. Engage the class in a discussion of the technique as well as a discussion to the problem addressed.

**LEARNING ACTIVITY G.55-7**  
**“JOURNAL WRITING”**

**OBJECTIVE:** Student will demonstrate writing skills by creating a journal entry centered on a topic assigned by the Specialist

**RESOURCES:** None

**SUGGESTED TIME:** 1 hour

**DIRECTIONS:**

1. Provide students with the topic they are to use for this journal writing activity. The topic should relate to this module.
2. Assign the page range for the journal writing assignment.

This range could vary depending on the timeframe provided for the assignment, the writing skills of the entire group, a small group of students, or individual students. This assignment can be individualized by the Specialist by placing the page length in the blank space on the work sheet.

**LEARNING ACTIVITY G.55-7**  
**“JOURNAL WRITING”**  
**WORK SHEET**

**NAME:**

**DATE:**

**TOPIC:**

**DATE DUE:**

**PAGE LENGTH:**

**LEARNING ACTIVITY G.55-8**  
**"SERVICE LEARNING"**

**OBJECTIVE:** Students will participate in a service learning activity assigned by the Specialist

**RESOURCES:** Learning Activity G.55-8

**SUGGESTED TIME:** 1 hour

**DIRECTIONS:**

1. Identify the type of support linkage which could be used to reinforce the key concept(s) in this module with students (See "Types of Support Linkages").
2. With your students, identify the school and/or community resources which could be contacted to create a Service Learning Activity for this module (See "Community Resources").
3. With students, brainstorm, organize, implement and evaluate the effectiveness of the Service Learning Activity using the "Service Activity Action Plan."



<b>TYPES OF SUPPORT LINKAGES</b>		
<b>Direct Services to Students</b>	<b>Consultative and Technical Assistance</b>	<b>Information and Referral</b>
Community agencies	Professional organizations	Career counseling centers
Parents and personal advocates	Service organizations	Work experience and job placement services
Local education agency support/auxiliary staff	Parent organizations	School and private psychologists
Volunteer and service organizations	Advisory groups	Tutors
Placement services	State education agency personnel	Recreational programs
Postsecondary programs and personnel	Business/industry personnel and programs	Employers
Transitional services	Other vocational support service teams	Employment Services
Other school-based personnel	Local colleges and universities	Community agencies for counseling or health services
	Vocational education research and development resource center(s)	New schools (transfer students)
		Division of Vocational Rehabilitation
		Job Training Partnership Program

Source: HANDBOOK FOR VOCATIONAL SUPPORT SERVICE TEAMS IN MARYLAND

## COMMUNITY RESOURCES

Federal and State Agencies provide services to their local and regional offices. Such services include financial support, job training and placement programs, housing, health, youth programs, consumer information, and legal aid. Examples include:

- legal services
- armed services
- state employment services
- state agency or school for the visually impaired
- State Department of Welfare
- mental health agency
- Department of Immigration
- Veterans Administration
- Social Security Administration
- Job Training Partnership Act (JTPA)
- Community Action Program
- law enforcement agency
- legal and judicial agencies
- Bureau of Indian Affairs
- public health service
- social services
- adult continuing education programs
- Office of Economic Opportunity
- civil service programs
- Rehabilitation Services Administration
- employment services
- Parks Department
- public health programs
- Adult Basic Education programs
- migrant programs
- military service representatives
- Planned Parenthood
- correctional facilities
- Governor's/Mayor's Committee for Employment of the Disabled

Community agencies and organizations provide such services as youth recreation, counseling and tutoring, employment and job training, foster care placement, and leadership development. Examples include:

- Chamber of Commerce
- YMCA/YWCA
- drug and alcohol abuse centers
- Red Cross
- child abuse/women's centers
- urban league
- adult continuing education programs
- student financial aid programs
- League of Women Voters
- mental health clinics
- probation and parole services
- children and youth services
- foster homes
- halfway houses
- community action programs
- migrant programs
- bilingual programs
- dropout prevention programs
- parent-teacher organizations
- American Legion
- Veterans of Foreign Wars
- Salvation Army
- JAYCEES
- Optimists
- Goodwill Industries

Citizen and special interest groups typically offer scholarship programs, legal aid, daycare, and transportation. Examples include:

- Lions Club
- canes
- Rotary
- churches
- women's and men's clubs in the community
- crisis intervention centers
- hospitals
- Girl Scouts
- Campfire Girls
- Big Brothers and Sisters
- Boy Scouts
- Indian guides
- Knights of Columbus
- Sertoma
- Elks
- retired citizens
- Volunteer tutor groups

Business, industry, and labor organizations are good sources of field trips, guest speakers, job opportunities, and occupational and product information. Examples include:

- Trade and labor unions
- Advisory committee members
- Employers
- Personnel offices
- industrial supervisors

Source: Sarkees-Wircenski, M. & Scott, J. VOCATIONAL SPECIAL NEEDS

## SERVICE ACTIVITY ACTION PLAN

IMPLEMENTATION ACTIVITY/IDEA	
IMPLEMENTATION STEPS	RESOURCES NEEDED

<b>PERSONNEL/AGENCIES/ COMMUNITY</b>	<b>REPRESENTATIVE INVOLVED RESPONSIBILITIES</b>
<b>POSSIBLE BARRIERS</b>	<b>CREATIVE SOLUTIONS</b>
<b>TIMEFRAME</b>	

**READING ACTIVITY G.55**  
**“HARD TO CHOOSE”**

**OBJECTIVE:** To read with comprehension

**RESOURCES:** Reading Activity G.55

**SUGGESTED TIME:** 1 hour

**DIRECTIONS:**

1. Make copies of Reading Activity G.55 and distribute to each student.
2. Have students read “Hard to Choose.”
3. Have students complete the “Reading Recall” and check their answers for accuracy.
4. Discuss the story with your students.

## "HARD TO CHOOSE"

Terry Winters thought that life sure was funny. For the past two months he had been looking for a summer job. Every place he went the people said they were sorry. They already had more than enough guys for summer jobs. They wanted people with experience. Terry just had no luck.

Now, all of a sudden, he had two job offers. One of them was with the telephone company. They would train him, and he would learn things about putting phones in people's homes. The pay was good, too. Terry thought that maybe if he liked the job and the telephone company liked him, they would hire him full-time in the fall.

The other job was completely different. It was a job as a worker at an orchard. His friend Jeff's father owned the orchard. He was hiring some guys to help him during the summer. Jeff and three more of Terry's friends were going to work there. It would probably be the last time they were all together. At the end of the summer Ron was going into the army and Jeff was going to college. Terry knew the pay at the orchard wouldn't be nearly as much as he would get with the phone company. Plus there was no chance of getting a full-time job at the orchard. In the fall, Terry would have to start looking all over again.

"It's times like these," Terry said to no one in particular, "when I wish someone would just tell me what to do."

His stepfather looked at him for a moment. "All right, Terry, I'll tell you what to do. Go to work for the phone company."

"But I wanted to work at the orchard with the rest of the gang!" Terry whined.

"Ok, then," his stepfather said, "Go work at the orchard."

Terry shook his head. "The pay is lousy, and in the fall I'll have to look for a job again."

"You see?" his stepfather asked. "I can't decide for you. Let's say I tell you what job to take. You take it and then you're unhappy with it. You can't

blame me. Instead, you have to make your own decision and take the responsibility for the outcome."

"Yeah, I guess you're right," Terry said. "The trouble is I want to do both things."

Terry's stepfather smiled, "I don't think that's possible. Why don't you try this. Make a list for the phone company and for the orchard. Write down all the good and bad things about each. Then, after looking at your list, decide which is more important to you. Make your decision and stick with it. Don't spend all summer wishing you'd taken the other job."

Terry nodded. His stepfather was right. Now for the hard job of making a decision.

What would you do?

## READING RECALL

**DIRECTIONS:** Fill in the blanks to complete the paragraphs below.

Terry was having trouble finding a summer job. Then \_\_\_\_\_ of a sudden he was \_\_\_\_\_ two jobs. One job \_\_\_\_\_ with the phone company. \_\_\_\_\_ would learn to put \_\_\_\_\_ in people's homes. The \_\_\_\_\_ company would train him. \_\_\_\_\_ would also make \_\_\_\_\_ of money. If Terry \_\_\_\_\_ a good job, the \_\_\_\_\_ company might hire him \_\_\_\_\_ in the fall.

The \_\_\_\_\_ job was working for \_\_\_\_\_ father at an orchard. \_\_\_\_\_ whole gang would be \_\_\_\_\_. It was the last \_\_\_\_\_ they would all be \_\_\_\_\_ for a while. Terry thought \_\_\_\_\_ would be a lot of \_\_\_\_\_.

He couldn't decide which \_\_\_\_\_ to take. His stepfather \_\_\_\_\_ him to make a \_\_\_\_\_ for each job. He \_\_\_\_\_ Terry to write down \_\_\_\_\_ the good and bad \_\_\_\_\_ about each job. This would help Terry to make a decision.



**MATH ACTIVITY G.55**  
**"A LITTLE HELP FROM MATH"**

**OBJECTIVE:** To perform addition, subtraction and multiplication calculations

**RESOURCES:**

- Work Sheet—Math Activity G.55
- Pencil

**SUGGESTED TIME:** 1 hour

**DIRECTIONS:**

1. Make copies of the work sheet for Math Activity G.55 and distribute to each student.
2. Read through the explanation for "Multiplying by 9" explaining and giving examples.
3. When you get to the student activity part, let the students complete that part of the activity with a partner.
4. Have the students report on how they did.
5. Use the same procedure of 2 through 4 above to work through "Making Change with the Smallest Number of Coins," "Leaving a Tip," and "Measuring Volume of Objects."
6. Using the key, check the results of the student's work for accuracy.

**DISCUSSION QUESTIONS:**

1. Are there easier ways to complete the activities included in the work sheet?

2. What other tasks in life can be made easier with some math "tricks?"

**MATH ACTIVITY G.55**  
**"A LITTLE HELP FROM MATH"**  
**WORK SHEET**

**DIRECTIONS:** Every day we are faced with making decisions or solving problems. Often, knowing some "tricks" from math makes life a little easier or at least saves time. The following are some examples.

1. Multiplying by 9

Believe it or not, opportunity to use this does come up quite a bit. This works for  $9 \times 2$  through  $9 \times 9$ . A quick way to make these calculations in your head is to:

- a. Look at the number that you are multiplying by 9
- b. Reduce that number by 1
- c. This is the "first number" or number in the tens column

Example:

$$9 \times 3 = 27$$

$3 - 1 = 2$  → Note that the two is the first number or the number in the "tens" column

- d. Ask yourself, "What number can I add to this number (In our example, that number would be "2.") that would give a sum of 9?" (In our example, the number added to make 9 would be 7.)
- e. The number added (7 in our example) becomes the 2<sup>nd</sup> number, or the number in the "ones" column.

Notice that when solving each of the problems ( $9 \times 2$  through  $9 \times 9$ ) following the above steps will result in the correct answer. You can do this in your head!

9	9	9	9	9	9	9	9
<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
18	27	36	45	54	63	72	81

Pick a partner and verbally check each other's ability to multiply by 9 in your head by calling out the following numbers. Your partner will multiply that number by 9 in their head and give you the answer. After going through the number, trade places and have your partner call out the numbers to you.

9,4,2,6,8,5,7,3,5,4,8,2,9,6,7,3,5,4,8,9,5,3,7,2,6

2. Making change with the smallest number of coins

*This is often considered a courtesy in the business world.*  
 Count back the change starting with the largest coin available. (Usually this is a quarter.) Keep adding quarters until adding another quarter would take the total over the amount of the change due. When quarters are too large to add, see if the next largest (a dime) will fit. Do the same with dimes until they are too large, then go to nickels and then pennies.

For example:

A person gives a one dollar bill for an item costing \$.33. What is the least number of coins you would give when counting back change?

Change = \$.67

1 quarter + 1 quarter + 1 dime + 1 nickel + 2 pennies = \$.67  
 \$.25 + \$.25 + \$.10 + \$.05 + \$.02 = \$.67

Total coins = 6

Working with your partner and using the smallest number of coins, verbally count back change for the following amounts: *(Write down how many coins were used for each)*

- a. \$.13      b. \$.60      c. \$.38      d. \$.57      e. \$.29

f. \$.43      g. \$.91      h. \$.24      i. \$.88      j. \$.76

3. Leaving a tip

15% is considered to be an appropriate tip. It is also customary for many customers to round the amount up or down to a more "even" amount. For states whose sales tax is approximately 7 1/2 %, an easy way to do this is to simply look at the bill, find the sales tax and double it to get 15%. Even if the tax is close to 7 1/2%, this will get you close enough for rounding up or down to an appropriate tip amount.

Doing the necessary work in your head, calculate an appropriate tip amount for the following:

- a. Meals = \$14.95; Sales tax (7 1/2%) = \$1.12; Tip = \_\_\_\_\_
- b. Meals = \$7.50; Sales tax (7 1/2%) = \$.56; Tip = \_\_\_\_\_
- c. Meals = \$10.00; Sales tax (8 1/4%) = \$.83; Tip = \_\_\_\_\_
- d. Meals = \$21.70; Sales tax (7 1/4%) = \$1.57; Tip = \_\_\_\_\_
- e. Meals = \$34.80; Sales tax (7 3/4%) = \$2.70; Tip = \_\_\_\_\_

Now, calculate a. through e. by multiplying the cost of the meals by 15% and write your answers below:

a. \_\_\_\_\_ b. \_\_\_\_\_ c. \_\_\_\_\_ d. \_\_\_\_\_ e. \_\_\_\_\_

How do the amounts of the two tips vary? Could they be rounded up or down to the same amounts?

4. Measuring volume of objects

It is often necessary to measure the volume of certain items to get an idea of their mass, weight, amount, etc. All items, however, are not in geometric shapes that allow you to measure their volume. The ancient Greeks found a solution to this problem by submerging an item into a container of water that was geometrically suitable for measurement (cylinder, cube, etc.) They found they could mark where the water level was before and after the submersion and the difference represented the volume of the item submerged.

For example:

If an item is submerged into a 4 ft. cube half filled with water and it raised the water level by 2 inches, what is the volume of the item?

Answer: 4608 cu.in. or 2 2/3 cu. ft. (4608/1728 - a cubic foot is 12"X12"X12")

48"X48"X2"

Calculate the volume for the following:

- a. A statue is submerged into a rectangle tank that measures 2' length width X 4' depth. The statue raises the water line by 1'.

- b. A dinosaur bone raises the water line in a rectangle tank by 6" (1/2 ft.). The tank is 5' wide and 6' long.

**PRE-ASSESSMENT**     **POST-ASSESSMENT**

**DIRECTIONS:**    Answer the following questions to the best of your ability.  
A listing of points as opposed to sentences is suggested.

1.    Outline the steps or draw a model of the Creative Problem solving (CPS) Process.

2.    List 6 advantages of creative problem solving.

3.    List 4 individual techniques for creative problem solving.

4.    What are the 5 advantages of group problem solving?

5. List 4 group techniques for creative problem solving.

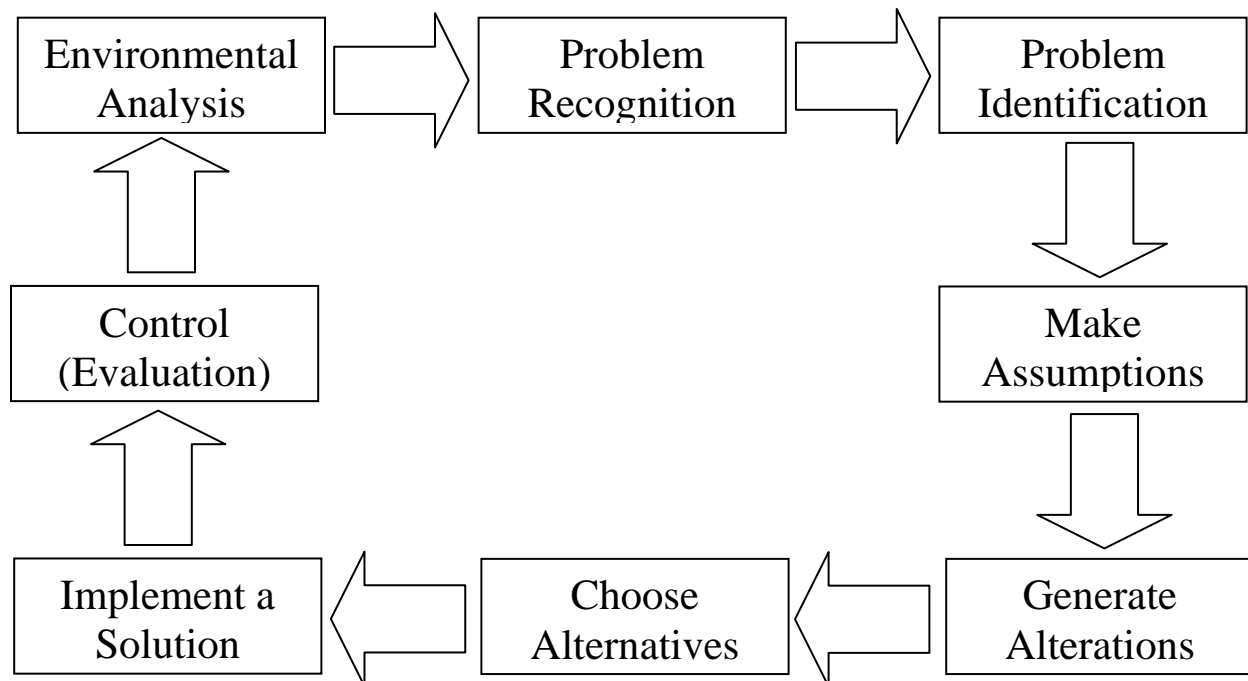


### ANSWER KEY

PRE-ASSESSMENT     POST-ASSESSMENT

1. Outline the steps or draw a model of the Creative Problem solving (CPS) Process.

## The Creative Problem solving (CPS) Process



2. List 6 advantages of creative problem solving.

- Improved confidence
- Ability to quickly define problem
- Ability to ensure maximum results
- Improved creativity
- Arrive at conclusions correctly
- Independent judgements

3. List 4 individual techniques for creative problem solving.

- Analogies
- Metaphors
- Association (Free and Regular)
- Mind mapping

4. What are the 6 advantages of group problem solving?

- Better solutions
- Better acceptance of final decision
- Better understanding of final decision
- Ensures a broader search effort for solutions
- Risks are balanced
- Better collect judgements

5. List 4 group techniques for creative problem solving.

- Brainstorming
- Creative Circles
- Crawford Slip Method
- Nominal Group
- Storyboarding

**ANSWER KEY**  
**READING ACTIVITY**

Terry was having trouble finding a summer job. Then all of a sudden he was offered two jobs. One job was with the phone company. He would learn to put phones in people's homes. The telephone company would train him. He would also make lots of money. If Terry did a good job, the telephone company might hire him full-time in the fall.

The other job was working for Jeff's father at an orchard. The whole gang would be there. It was the last time they would all be together for a while. Terry thought it would be a lot of fun.

He couldn't decide which job to take. His stepfather told him to make a list for each job. He told Terry to write down all the good and bad things about each job. This would help Terry to make a decision.

**ANSWER KEY**  
**MATH ACTIVITY**

1. 81, 36, 18, 54, 72, 45, 63, 27, 45, 36, 72, 18, 81, 54, 63, 27, 45, 36, 72, 81, 45, 27, 63, 18, 54
  
2.
  - a. 4
  - b. 3
  - c. 5
  - d. 5
  - e. 5
  - f. 6
  - g. 6
  - h. 6
  - i. 7
  - j. 4
  
3. (Calculate in your head)
  - a. \$2.24
  - b. \$1.12
  - c. \$1.66
  - d. \$3.14
  - e. \$5.40

(Direct multiplication by 15%)

  - a. \$2.24
  - b. \$1.13
  - c. \$1.50
  - d. \$3.26
  - e. \$5.22
  
4.
  - a. 6 cu. ft.
  - b. 15 cu. ft. or 25,920 cu. in