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ATTACHMENT A
METHODS OF INSTRUCTION: PROBLEM SOLVING

General. The most important goal of any instruction is to prepare the student to meet and solve the problems which confront him. This is referred to frequently as "teaching how to think" or "how to reason." However it may be defined, preparing the individual to organize and utilize all of his capacities in any situation is the final objective of instruction.

If the solution of problems constitutes one of the important aspects of human existence, then it may be profitable to review what psychologists believe is the "reasoning" or "thinking" process applied to these problems. This examination will show why it is necessary to give a large place in any instructional program to a method of teaching that will enable the individual to increase his ability to solve his problems.

The "reasoning" or "thinking" process.

- a. Psychologists agree that thinking starts with a problem or "felt difficulty." Whatever it is, it is a "problem," because the habitual ways of reacting to that situation have been unsatisfactory.
- b. The next requirement is that the existence of the problem be recognized, its nature defined clearly and concisely. Many people are only vaguely aware that a perplexity exists. They bring no frontal attack upon it, because they fail to see and define it clearly.
- c. Once the problem is defined, a possible solution or hypothesis must be formulated. This hypothesis is usually a mixture of what is known (experience and training) and those new meanings suggested by the imagination.
- d. Once a hypothesis is proposed, all of its factors are examined critically to appraise or assess their significance to that hypothesis. All possible consequences of the hypothesis are "thought over." A proposed solution found wanting must be cast aside and new ones formulated and examined until one is found that offers reasonable promise of success.
- e. Finally, we act on the proposed solution and the reasoned-out relationships. The results of the first experience in applying the solution may develop new problems or phases of this problem, heretofore unknown, which again, will require the application of the reasoning process.

The problem solving method. Problem solving is a teaching method which guides the trainee through the reasoning process necessary to the solution of a training problem. The training problems so used are of the most value when they create "real" or "live" problems similar to those likely to confront the trainee.

The general outlines of the method are the same as the five steps described in the "reasoning" or "thinking" process. The instructor, from the teaching standpoint, must realize his responsibility to the student in each of these

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steps to gain the greatest value from this instructional method.

- a. Stating the problem. The instructor's responsibility here is to create problems built on anticipated "felt needs" or real difficulties of the students. The problem must be defined clearly for the student, or he must be assisted in localizing it so that he will acquire the technique of analyzing problems which confront him.
- b. Suggestions for possible solution. In this step, the student or student groups, independently, or under the direction of the instructor, construct hypotheses. If the problem is constructed properly, these proposed solutions will arise from the subject matter, skills, and techniques which were taught previously. Here the instructor guides the student's thinking and activity principally by suggestion.
- c. Testing the hypothesis. In this phase the activity of the student is observed by the instructor for evidence that the student is finding and examining all of the factors and their relationships which influence the hypothesis. Here, too, the instructor must keep the student from getting too far afield in order that the desired learning will take place.
- d. Evaluating the conclusion. The completion of the problem affords the instructor the opportunity to review with his students both the success of their solution, and the effectiveness of the problem-solving technique they applied.

Considerations required in the preparation of a problem.

- a. Establishing the objectives or goals. Problem solving is an excellent tool of teaching for integrating techniques and other instruction which has been presented in an unrelated fashion. This applies especially to instruction involving coordinated individual or group actions, such as tactical exercises and plans. In initiating the planning of such problems, the instructor must be very precise in establishing the objectives of the problem and in defining them clearly. For example, such an objective might be to teach a small unit how to plan and ambush a motor convoy or to show the student the importance of establishing emergency communications. (All objectives must be stated with relation to the general aims of the course.) It should follow that the problem presented is real, that is, it is likely to be encountered by the student in his future assignment. The entire framework and detail of the problem must relate only to these objectives and not involve extraneous techniques, knowledge, or skills unknown to the student.
- b. Selecting the elements of the problem. Having established the objectives of the problem to be presented to the students, the instructor must set down in detail all the factors and requirements of that problem which would likely be present in a real situation. Once these factors have been examined they should be arranged in the order and relationship they

are most likely to have with each other. The instructor must re-determine that the problem leads to a solution or solutions consistent with the objective of the problem. All elements of the problem situation should produce actions on the part of the student or students which are directed toward that objective.

analyzing the problem situation. Training conditions in a problem situation cannot always duplicate those to be expected in a real situation. In fact, it may be desirable not to attempt to duplicate all of the elements of the real situation. Some of them will require the student to accomplish tasks not yet mastered or not relating directly to the principle skills or techniques to be taught by the problem. The instructor must study the problem carefully and extract those items so that he may conserve the student's time by relieving the student of responsibility for them or for using them as additional control factors. In most instances, this can be done in establishing the setting or situation for the student or the group. The student must understand clearly what the situation is and where he, his group, or team is to start. These conditions must be the same for all individuals or groups. At this point those real factors which cannot be duplicated in the training situation must be isolated from the problem-situation. Also such incidentals as will encumber the student, or lend little to the teaching of the techniques required by the objective, should be set aside. These aspects of the problem situation are prepared for the student by the instructor. These factors, in general, are the assumptions of the planning of the problem which start the student or group toward

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d. Controlling the progress of the problem. The control of the problem as

it progresses is maintained by the carefully designed initial staging and by the framework of the problem as it develops. The instructor must anticipate all the situations to be met by the students, the materials, activities, skills, and understandings demanded, and all the possible alternatives that might be chosen by the student. Here again the instructor must review possible influences and actions with relation to the objective of the lesson. As these situations unfold, some clearly mark themselves as appropriate checkpoints for the instructor on the student. These control points may be used to guide or redirect the student if he is proceeding incorrectly. New elements may be introduced into the situation at the points to which the student must continue to apply the problem-solving technique. The instructor may find it necessary to provide the student or group with an acceptable solution of the problem through that phase so that the trainee may analyze his errors or poor judgments. In this manner the trainee will get the value of the instruction he did not complete successfully and will also be prepared to meet later phases of the problem.

Testing and evaluating the student and his performance. Problem solving is, perhaps, the best instructional method for evaluating students and their performance, as it requires more from the student than proficiencies in specific subject-matter and skills. It demands the integration of all special abilities, the exercise of reasoning and judgment by the trainee and the display by the student of some intangible personal factors, such as leadership, initiative, and imagination. The instructional problem must indicate clearly what is to be evaluated during and at the conclusion of the problem. The instructor must set up evaluative criteria for each phase of the problem as well as for the whole problem. These should be stated clearly to the trainees in terms of what is to be done and how well it is to be done.

Critique of the problem. The critique of a problem is a valuable instructional tool. Here the original framework and stage setting must be recalled and the why and how of student performance analyzed and explained against the possible solutions of the problems and the level of achievement required by the instructor. All possible solutions of the problem, or any of its phases, should be covered and evaluated. The problem must always be subject to modification after valid criticism. The instructor must be a student of his problem—showing a readiness to learn the deficiencies in his instruction and to adopt suggested techniques to insure a higher degree of instruction and reality.

8. Mechanical and physical aspects of planning the problem. Ill-planned problems, of course, will result from a lack of thorough study and realization of the potentialities of available time, equipment and terrain. These are always considered in planning instruction.

Additional comments on instructor guidance in problem solving and suggested rules. Although the instructor may not appear to occupy the center of attention in some aspects of the problem method, he is an important cog in the machinery of this method. The tendency is to individualism in problem solution. Whatever the direct approach, the degree to which the instructor himself is a master of problem solving will bear a direct relation to the effectiveness of his direction of others in the process. An instructor who

has the ability to see problems clearly, the power to analyze with discernment, and the faculty to synthesize and draw conclusions with accuracy will be a rare help to the students in their mastery of the difficult technique of problem attack. Guidance in problem solving is, in reality, training in how to study, and, it might be added, in how to think.

The following is a suggested list of rules which every instructor should study carefully as a guide in this task. It is well for the instructor to remember, however, that the order of rules will vary with the procedure used.

- a. Get the students to define the problem at issue and keep it clearly in mind.
- b. Get the students to recall as many related ideas as possible by encouraging them:
 - (1) To analyze the situation.
 - (2) To formulate definite hypotheses and to recall general rules or principles that may apply.

Get the students to evaluate carefully each suggestion by encouraging them to maintain an attitude of unbiased, suspended judgment or conclusions.

Get the students to organize their material so as to aid in the process of thinking by encouraging them:

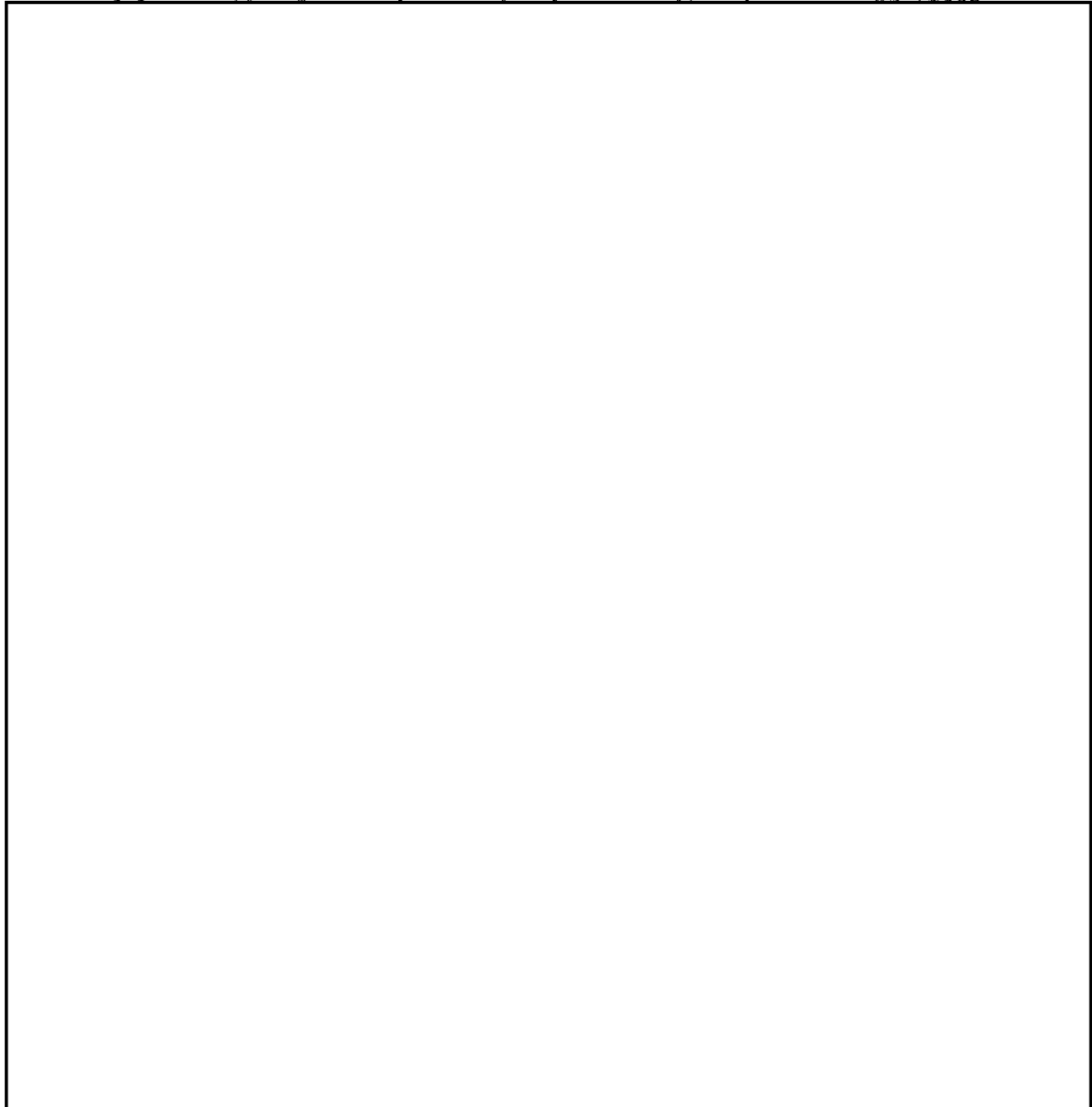
- (1) To take stock from time to time.
- (2) To use methods of tabulation and graphic expression.
- (3) To express concisely tentative conclusions reached from time to time during the inquiry.

Kinds of problems used. The kinds of problems (or problem-situations) used in the problem-solving method of instruction are as varied as there are training situations. Although the term problem solving may be applied to a single one-technique or single skill, usually it pertains to those problems which require the students to integrate knowledge, skills, and techniques into action which will bring a solution to the problem. Several of these problem-solving methods have proven of particular value for the kinds of training situations which will likely confront instructors of this organization. They are the case study, the live problem, the field problem, and the planning or "paper" problem.

- a. The case study. The case study problem is based on the student's

analysis of an operational history especially prepared for instructional purposes. The case study must contain the essential factors in agreement with the objectives of the instructor. It may be treated in a positive or negative way, that is, in a way as to emphasize the suc-

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4. The live problem. The live problem is so constructed as to confront the student with a situation which requires the exercise of the mental and emotional processes of an actual operation. In such a problem the instructors and students assume the various characterizations required by the situation. It is particularly valuable as it may be used to evaluate the student as a person. Inasmuch as it should be an active exer-

side of other instruction, it provides an opportunity for the student to practice operational principles.

Construction. The principles of problem construction must be applied carefully during the preparation of a live problem. The instructor must determine what is to be taught in the problem, its elements should be those presented in the course or subject and evaluated as to their significance. As a matter of principle, the problem is a carefully constructed experiment in which all the factors are controlled except those to be taught and, of course, the student. Those factors which limit the activities of the student reduce the value of the problem. In restricting his freedom, these limiting factors channel his actions and thereby decrease the value of the assessment of the trainee.

(2) **Presentation.** The principles applying to the preparation of the student and the instructor for the problem are of great importance. The student's briefing must contain a clear, concise statement of the situation with a definite assignment for the student. No student will be able to proceed successfully until he understands both. The instructor's briefing sheet must contain all possibilities of action in the problem as well as the complete information used. Instructions must be clear to the instructors as to the reactions to be presented the student in response to various approaches. During the progress of the problem, the instructor must utilize the checkpoints established on the student. Realism is instilled by the instructor by adopting the attitudes and levels of conversation assigned to the characterization he is assuming.

Critique. To unfold the critical steps of the problem point by point in the critique is an effective means of initiating the discussion of the problem. This provides an opportunity to review the possible action at those points and to analyze the factors of judgment supporting various actions. During the problem and at the critique some mechanical recording of the student's performance is helpful for the instructor's evaluation of the student. If recordings can not be made of the full discussions, the use of a check list is helpful. Again the problem critique is an opportunity to continue the motivation of the student for his work and to provide a source of suggestion for the improvement of the problem.



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(b) The type of problem set was too advanced.

The instructor must provide opportunities within the problem for the students to use their imagination, ingenuity, and initiative in solving the problem. Vague, uncertain, or ambiguous situations must be avoided in such problems. The training given within the exercise should be specific, and any unusual conditions arising that require techniques beyond the skill of the trainees will destroy the value of the remainder of the problem.

(3) Critique. The instructor conducting the field problem should be thoroughly familiar with the tactical or technical principles of the applicatory exercise as well as how to conduct a critique. A critique is a method of instruction. The instructor must plan his critique as carefully as his problem. It will be necessary,

during the performance, for the instructor to watch for specific examples of good and poor performances, to make brief notes on the techniques and procedures used and how they could be improved to meet the standard he has established. The critique must be held as soon as possible following the completion of the problem and in the same location or on the same terrain over which the problem was conducted.

(4) Cautions in the use of field problems.

(a) Use competition.

(1a) Desirable as a motivating factor.

(2a) Should not be allowed to develop ill feeling among the men.

(b) Keep to objectives when setting up field problem.

(c) Avoid problems requiring the application of too many newly presented principles and procedures.

(d) Plan problem in terms of the entire training situation.

(1a) Condition of the men.

(2a) Their other assignments.

(e) Plan for adequate amount of time.

(1a) Field problems consume more time than any other method of instruction.

(2a) Field problems should be scheduled at the place in the training program where it will be most effective.