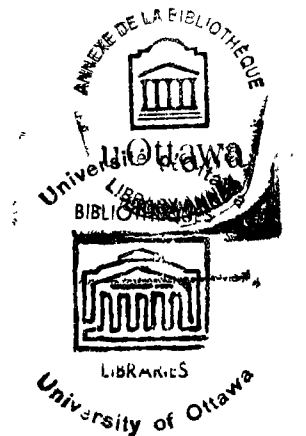


THE EFFECT OF PROCEDURAL PLANNING  
AND BRAINSTORMING TECHNIQUES ON GROUP  
PERFORMANCE USING A CURRICULUM TASK

by Bonnie L. Viney

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## CURRICULUM STUDIORUM

Bonnie L. Viney was born August 27, 1950, in Toronto, Ontario. She received the Bachelor of Arts degree in French and English from the University of Toronto in 1972.

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## INTRODUCTION

Teacher responsibility in the area of curriculum development has been officially sanctioned by the Ontario Ministry of Education as a means of ensuring an educational system capable of responding to both widely varying individual needs and the constantly changing demands of society. Teachers are therefore intended to work together to develop sound, coherent programs which, while consistent with general provincial guidelines, provide for the particular needs of every child in the school:

In planning sessions attended by the entire teaching staff of a school, teachers can share ideas and reach consensus on the objectives for each division and on the ways in which they contribute to the overall aims of the school. They can gain a unified sense of direction and a better understanding of the levels of expectations for children of various age groups. In so doing, they will be able to develop a more consistent program with concomitant opportunities for each child to advance at his own rate.<sup>1</sup>

Nevertheless, although many admonitions such as these, urging teachers to develop curriculum, have appeared, and although numerous arguments demonstrating the merits of such teacher

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<sup>1</sup> Ministry of Education of Ontario, The Formative Years, Toronto, Ministry of Education, 1975, p. 3.

curriculum development have been advanced,<sup>2-6</sup> basic guidelines as to how this planning should be approached are rare. To date, few empirical investigations of curriculum deliberation are available.<sup>7</sup> The need for such guidance, however, is strong. If teachers are to be continually urged to develop curriculum, they should also be given some direction as to effective methods of proceeding in this sort of endeavor. It is the inadequacy of the empirical basis for such direction that the present study addresses.

Although little research on curriculum deliberation itself is available, the closely related literature

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2 George A. Beauchamp, "A Study of the Effects of the Installation of a Curriculum Engineering System," paper presented at the American Educational Research Association Annual Meeting, New Orleans, 1973, p. 6-7.

3 -----, "Longitudinal Study in Curriculum Engineering," paper presented at the American Educational Research Association Annual Meeting, Chicago, 1974, p. 9.

4 John I. Goodlad, "Educational Change: A Strategy for Study and Action," in National Elementary Principal, Vol. 48, No. 3, 1969, p. 6-13.

5 -----, "Staff Development: The League Model," in Theory into Practice, Vol. 11, No. 4, 1972, p. 207-214.

6 Schools Council, Curriculum Development: Teachers' Groups and Centres, London, Her Majesty's Stationery Office, 1967, p. 2.

7 Douglas A. Roberts and F. Michael Connelly, "The 'Conceptualization/Practice Interface'," paper presented at the Canadian Association for Curriculum Studies Annual Meeting, Edmonton, 1975, p. 5.

on group problem solving is of some assistance. It is possible, from an examination of this literature, to find certain theoretical bases for group processes in complex problem-solving situations similar to teacher curriculum deliberations. The results of empirical studies based on these theories lend credibility to predictions in the area of curriculum development itself.

The first portion of this report consists of a review of the literature examining group effectiveness in terms of certain phase theories which explain the interaction processes intervening between group input variables and group performance outputs. A conceptualization of such interaction processes as consisting of the three phases of orientation to the problem, alternative generation, and alternative criticism and choice, as well as a summary of the derivative experimental interventions therefore useful in increasing group effectiveness, is presented. The following prediction, based on the above conceptualization and the demonstration of manipulations derived from it in empirical studies in the literature, is then formulated and explained: that groups using procedural planning and brainstorming techniques are more efficient in solving a complex curriculum problem than groups not employing these procedures. The

generation of this hypothesis is followed by a description of the experiment used to test it.

The results obtained in this analysis of group problem solving are thereupon presented and discussed, with special attention being paid to the characteristics of the sample and, thus, the generalizations which can be accurately drawn from the study.

The implications for subsequent research are indicated, and, in an appendix, the directions for the various group procedures and evaluations are given.

It is believed that this area of research is of considerable value in education today.

## CHAPTER I

### REVIEW OF THE LITERATURE

Although many attempts have been made to study group functions through the manipulation of such variables as group size, member composition, or task characteristics, it has become increasingly apparent in the literature that the crucial differences in the operation of highly effective groups dealing with complex tasks are to be found not in these input factors but in the group interaction processes which convert them into some form of output. In other words, regardless of the type of complex task it faces, certain phases of interaction which must be worked through by every group's members have the capability of limiting or increasing its performance effectiveness. There is considerable agreement in the literature on the nature of these phases of interaction, which might be broadly classified in three areas as an orientation to the problem, a generation of alternatives, and a critical examination of these alternatives resulting in a final choice of solution.

In this review of the literature, certain theories of group interaction processes which isolate and define these crucial phases, linking them conceptually to group performance effectiveness both in general problem solving

and in curriculum deliberations, are examined. The empirical studies focusing on the same phases are then reviewed to demonstrate what the effects of manipulating certain elements of interaction, specifically the orientation and alternative generation stages, have been. Finally, a research problem based on the theories and studies reviewed is formulated, combining two separate classes of experimental intervention which have been individually manipulated in the past, the formulation of procedural strategies and the use of brainstorming techniques. A procedure is thus established which is capable of maximizing group effectiveness in all three phases of curriculum problem solving simultaneously.

#### 1. Some Theories of Group Interaction Processes

Every group, as Maier has pointed out,<sup>1</sup> has certain characteristics which may in combination work to its advantage or disadvantage. A sum of individual knowledge and information, for example, a number of possible approaches to the problem, an increased acceptance by members of the problem solution due to their participation in its formulation, and a better comprehension of the

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<sup>1</sup> Norman R. F. Maier, "Assets and Liabilities in Group Problem-solving: The Need for an Integrative Function," in Psychological Review, Vol. 74, No. 4, 1967, p. 239-249.

final decision reached are all potential assets to any group. On the other hand, a social pressure for member conformity, a tendency to adopt the first solution reaching a minimum level of satisfaction, problems of individual domination and conflicting secondary goals are potential liabilities equally present in any group. What is it, then, that accounts for the ability of some groups to maximize their assets and minimize their liabilities? How is it that some groups are more capable of accomplishing a complex task than others? The explanation lies in the interaction processes through which groups mobilize their potentials to reach their goals.

Hackman and Morris have pointed out that "the key to understanding the 'group effectiveness problem' is to be found in the on-going interaction process which takes place among group members while they are working on a task."<sup>2</sup> It is, therefore, through these phases of interaction that group characteristics are converted to liabilities or assets for task performance. (See Figure 1.) Input factors such as individual member skills, attitudes,

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2 J. Richard Hackman and Charles G. Morris, "Group Tasks, Group Interaction Process, and Group Performance Effectiveness: A Review and Proposed Integration," in Advances in Experimental Social Psychology, Vol. 8, Leonard Berkowitz, editor, New York, Academic Press, 1975, p. 46.

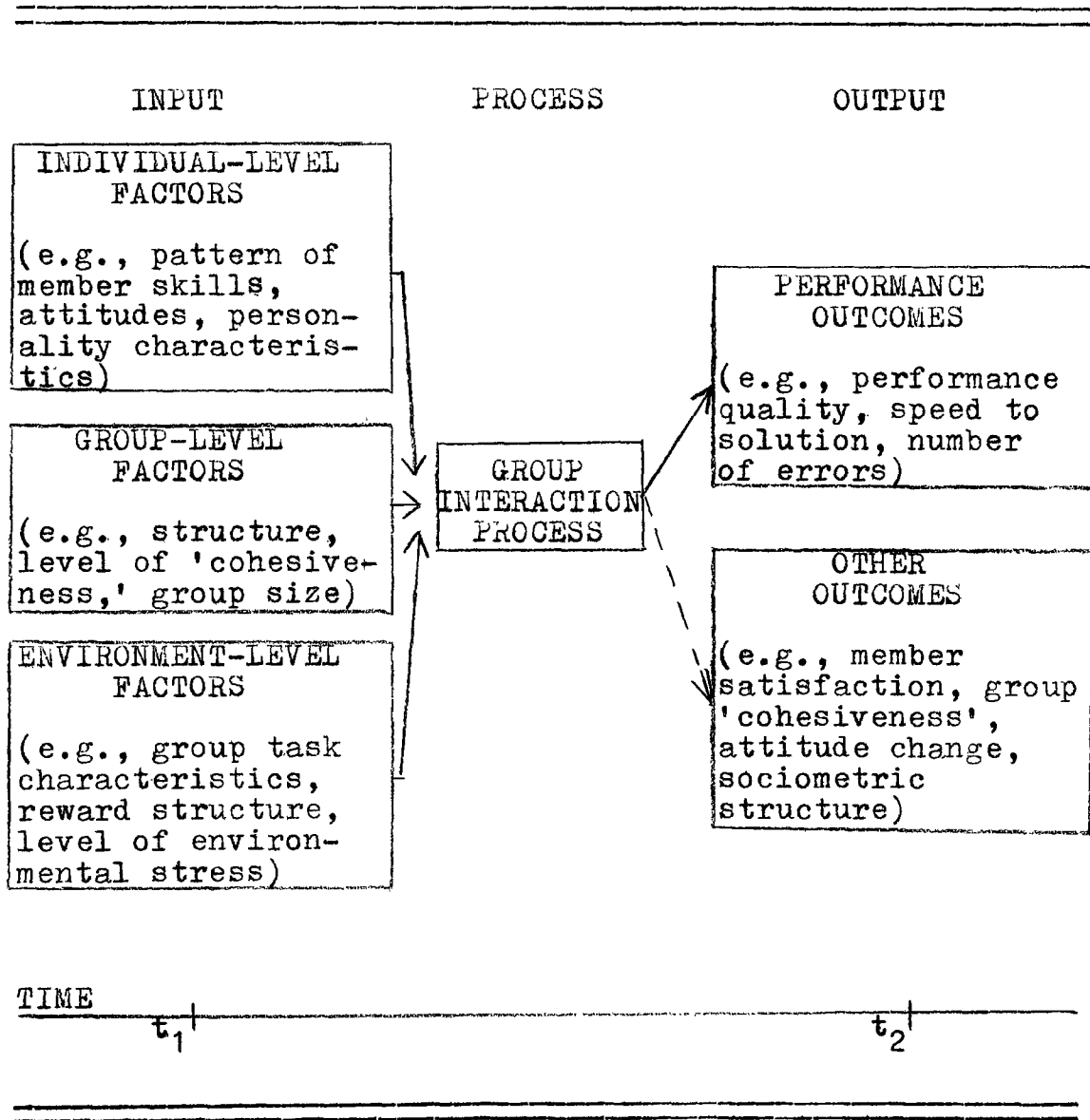


Figure 1.

Group Interaction as a Mediator of Performance Outcomes.<sup>3</sup>

<sup>3</sup> J. Richard Hackman and Charles G. Morris, op. cit., p. 50.

and personality characteristics, group structure, level of cohesiveness and size, and group task characteristics, reward structure and level of environmental stress are, thus, combined through the group interaction process resulting, over time, in such output factors as performance quality, speed to solution and number of errors, as well as member satisfaction, group cohesiveness, attitude change and sociometric structure.

According to Hackman and Morris,<sup>4</sup> then, it is the combination of input factors through the group interaction process which results in an increased or decreased level of group performance output. The individual efforts brought to bear on the task by group members, for example, may be enhanced or lessened as they are well or poorly coordinated through group interaction. Similarly, member knowledge and skills useful to the group for task performance may also be increased or diminished through interaction as they are well or poorly weighted and applied. Finally, the performance strategies suggested by individual members for task completion may be well or poorly implemented, or new, even more task-appropriate strategies may be developed through the

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<sup>4</sup> J. Richard Hackman and Charles G. Morris, op. cit., p. 72.

interaction process. Thus, this process of group interaction has been used to explain why groups with similar potentials perform with greatly different effectiveness on similar tasks.

What, then, is the nature of the group interaction process so crucial to task performance effectiveness? Although many theoretical descriptions have been presented in the literature, certain similar elements have appeared again and again within them.

Hoffman,<sup>5</sup> for example, has described a movement in group interaction from concerns of problem identification, to idea generation, to solution evaluation and selection. These stages closely parallel Dewey's five phases of reflective thought in the individual,<sup>6</sup> which have been reworded by Adams to apply specifically to groups as follows:

1. Location and definition of a problem, difficulty or situation which merits consideration by a group.
2. Collection of data, evidence or information which relates to the defined situation, problem or difficulty.

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5 L. Richard Hoffman, "Group Problem Solving," in Advances in Experimental Social Psychology, Vol. 2, Leonard Berkowitz, editor, New York, Academic Press, 1965, p. 114-117.

6 John Dewey, How We Think, Boston, D. C. Heath and Company, 1933, p. 107.

3. Recommendation of possible conclusions, alternatives, or solutions arrived at through examination of the data, evidence or information collected.

4. Selection of solution(s), conclusion(s), or alternative(s) which will eliminate the problem, difficulty or situation which has caused initial anxiety.

5. Implementation of the solution(s), conclusion(s) or alternative(s) selected, in the most efficient and effective way.<sup>7</sup>

For groups which are assigned an already clearly defined problem and which are required to formulate but not implement an effective solution to that problem, therefore, the crucial phases of interaction are the collection of information related to the defined difficulty, the recommendation of possible alternatives for dealing with that difficulty, and the final selection of a solution to it.

These stages are similar to those identified by Bales and Strodtbeck<sup>8</sup> as problems of orientation, evaluation and control. Wood<sup>9</sup> and Cooper and Wood<sup>10</sup> have

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7 Terrence D. Adams, Problem-Solving Discussion, Berkeley, McCutchan Publishing Corporation, 1970, p. 35.

8 Robert F. Bales and Fred L. Strodtbeck, "Phases in Group Problem-Solving," in Journal of Abnormal and Social Psychology, Vol. 46, No. 4, 1951, p. 485.

9 Michael T. Wood, "Power Relationships and Group Decision Making in Organizations," in Psychological Bulletin, Vol. 79, No. 5, 1973, p. 284.

10 Michael R. Cooper and Michael T. Wood, "Effects of Member Participation and Commitment in Group Decision Making on Influence, Satisfaction, and Decision Riskiness," in Journal of Applied Psychology, Vol. 59, No. 2, 1974, p. 127.

used slightly different terminology, identifying the three decision-making phases occurring in groups as a generation of alternatives, an evaluation of the strengths and weaknesses of these alternatives, and a choice of recommendation or of what is to be put into effect.

The stages of group problem solving have been described by Maier<sup>11</sup> in a similar fashion, as being comprised of idea getting, idea evaluation and selection. Although he has used different terms, Taylor<sup>12</sup> also has given support to this conceptualization of group functioning. His panel consensus technique includes phases of ideation, screening, selection, refinement and decision.

Borman has clearly described three periods of group interaction, which are also comprised of these basic elements, as follows:

During the orientation phase, the discussants discover those statements of fact that describe the problem and find an explanation for these facts. In the evaluation phase, the severity and importance of the problem are decided and it is compared with other problems that demand

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11 Norman R. F. Maier, Problem Solving and Creativity, Belmont, Brooks/Cole Publishing Co., 1970, p. 182.

12 Charles W. Taylor, "Panel Consensus Technique: A New Approach to Decision Making," in Journal of Creative Behavior, Vol. 6, No. 3, 1972, p. 191.

attention. Various representative solutions are examined and evaluated. The final phase is the one in which a decision is made.<sup>13</sup>

March and Simon<sup>14</sup> have referred to this process as a sequence of broad phases such as problem formulation, search for alternatives and evaluation of alternatives, Likert<sup>15</sup> has described a process for arriving at a common solution which includes an analysis and interpretation of facts in the discussion process resulting in a wide variety of possible decisions which are subsequently examined and narrowed to one solution.

It is apparent that all of these descriptions of group processes have quite similar components. Groups faced with a problem to solve are postulated by all of these authors to first define that problem, to then seek alternatives for dealing with it, and finally to critically examine the suggested alternatives, eventually arriving at a solution.

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<sup>13</sup> Ernest G. Bormann, Discussion and Group Methods, New York, Harper and Row, 1975, p. 135.

<sup>14</sup> J. G. March and H. A. Simon, Organizations, New York, Wiley, 1958, p. 178-179.

<sup>15</sup> Rensis Likert, New Patterns of Management, New York, McGraw-Hill, 1961, p. 217.

Roby and Lanzetta<sup>16</sup> have extended the above categories to include an initial factfinding and a final implementation phase suggestive of Dewey's experimental trying out, along with alternative generation, evaluation and choice. Tuckman<sup>17</sup> has further emphasized that before any group performing can take place, the important orientation processes of forming, storming and norming must be worked through. In other words, group members must not only define the problem in their early stages of interaction, but also become personally acquainted on a polite basis, undergo conflict in attempts to determine status within the group, and finally establish certain forms of individual behavior acceptable to the group before problem solving can be accomplished. Thus, the orientation phase involves personal as well as task-directed definitions.

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16 Thornton B. Roby and John T. Lanzetta, "Considerations in the Analysis of Group Tasks," in Psychological Bulletin, vol. 55, No. 2, 1958, p. 96.

17 Bruce W. Tuckman, "Developmental Sequence in Small Groups," in Psychological Bulletin, Vol. 63, No. 6, 1965, p. 396.

Referring specifically to groups working on curriculum development tasks, Walker<sup>18</sup> has similarly identified a three-phase deliberative pattern of the statement of a problem, followed by proposals related to this problem and brief arguments for and against these proposals. Fox,<sup>19</sup> also in relation to curriculum problems, has further clarified the conception of an initial orientation stage expanded by Roby and Lanzetta<sup>20</sup> and Tuckman,<sup>21</sup> recognizing that in the early phases of group problem solving the location of the problem may shift several times before it is clearly defined. Schwab<sup>22</sup> again described this preliminary phase of problem examination in practical curriculum deliberations as being necessary before the alternative solutions or "curriculum bits"<sup>23</sup> could be evaluated and some finally chosen. His orientation phase

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18 Decker F. Walker, "A Study of Deliberation in Three Curriculum Projects," in Elements of Curriculum Development, F. Michael Connelly, editor, Toronto, The Ontario Institute for Studies in Education, 1971, p. 125.

19 Seymour Fox, "A Practical Image of 'The Practical'," in Curriculum Theory Network, No. 10, 1972, p. 47.

20 Thornton B. Roby and John T. Lanzetta, op.cit., p. 96.

21 Bruce W. Tuckman, op.cit., p. 596.

22 Joseph J. Schwab, "The Practical 3: Translation into Curriculum," in The School Review, vol. 81, No. 4, 1973, p. 518-520.

23 Ibid., p. 520.

included a comparison of the ideal and the real results of the current curriculum. Connelly and Dienes<sup>24</sup> similarly identified the stages of practical deliberation in curriculum planning groups as a diagnosis of the problem situation, an examination of theoretically preferred choices, an evaluation of these choices in view of reality to determine "practically preferred choices"<sup>25</sup> and a formulation and implementation of the curriculum plan. Bank<sup>26</sup> has further described the elements of problem solving in elementary classroom planning as problem identification and diagnosis, alternative development, alternative evaluation and implementation. In this way, all of these writers have suggested that curriculum development groups follow problem-solving processes essentially similar to the phases envisaged by others as occurring in groups performing complex tasks in general.

Thus, if the initial choice of a problem and the final implementation of a solution are not regarded as part of the problem-solving process proper, the group processes

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24 F. Michael Connelly and Barbara Dienes, "The Teacher as Choice Maker in Curriculum Development," Toronto, The Ontario Institute for Studies in Education, 1973, p. 10.

25 Ibid.

26 Adrienne Bank, "The Product as Change Agent," paper presented at the American Educational Research Association Annual Meeting, Chicago, 1972, p. 4.

determining the effectiveness of a group's task performance, although defined in various terms in the literature, have been consistently identified in three phases: the group's orientation to itself and to the problem, the generation of alternatives, and the critical examination of alternatives resulting in a solution choice. According to the literature, therefore, it is the functioning of these three stages in a group's operation that determines how that group's potential assets and liabilities are combined in the performance of its task.

Such an explanation leads to certain implications which are open to experimental investigation. Potential experimental manipulations logically include specific, forced changes in performance strategies calculated to improve either a group's orientation to the problem, or its generation or evaluation of alternatives as a means of increasing its task effectiveness, for a group maximizing its effectiveness at each stage of the problem-solving process could be predicted, according to this conceptualization of group interaction, to thereby capitalize on the assets while limiting the liabilities present in its input characteristics, and so to increase its level of task performance output.

Some studies have been reported in the literature testing precisely this sort of manipulation, although

generally only one stage of the problem solving process has been examined at a time.

## 2. The Orientation Phase

The orientation phase is that stage of a group's problem solving in which the members come together, define the problem, and decide upon their method of attacking it. It is in the orientation phase that goals, values, and obstacles must be clearly differentiated before the actual seeking of a solution begins, in order to avoid later difficulties with evaluation based on widely varying assumptions by group members.<sup>27</sup> This phase has been studied both with and without specific manipulation.

Bales and Strodtbeck<sup>28</sup> observed groups without experimental intervention and found that the frequency of orientation acts was in fact highest in the first third of interaction, confirming the theoretical postulations of the existence of such a phase. Morris<sup>29</sup> also

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<sup>27</sup> Norman R. F. Maier, Problem Solving and Creativity, Belmont, Brooks/Cole, 1970, p. 186.

<sup>28</sup> Robert F. Bales and Fred L. Strodtbeck, "Phases in Group Problem-Solving," in Journal of Abnormal and Social Psychology, Vol. 46, No. 4, 1951, p. 491.

<sup>29</sup> Charles G. Morris, "Changes in Group Interaction during Problem Solving," in Journal of Social Psychology, Vol. 81, No. 2, 1970, p. 163.

measured the occurrence of problem-solving phases, similarly reporting that preparation, analysis, diagnosis and orientation activities reached their maximum rates in the early stages.

The prediction that a less-than-optimum functioning of this preliminary phase would result in less effective task performance has been given some support by Ghiselli and Lodahl,<sup>30</sup> who found the number of organizational and methods changes undergone by a group to be negatively related to its productivity. Thus, a group which did not clearly define the problem and select an adequate method of attacking it in the orientation phase, and which consequently was forced to change strategies in the middle of problem solving, was less effective in its task accomplishment. Shelly and Gilchrist<sup>31</sup> also reported a less-than-optimum effectiveness in groups which failed to establish, in the early stages of problem solving, adequate methods of proceeding. In this study, groups having to handle a good deal of information were handicapped

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30 Edwin E. Ghiselli and Thomas M. Lodahl, "Patterns of Managerial Traits and Group Effectiveness," in Journal of Abnormal and Social Psychology, Vol. 57, 1958, p. 65.

31 M. W. Shelly and J. C. Ghilchrist, "Some Effects of Communication Requirements in Group Structures," in Journal of Social Psychology, Vol. 48, 1958, p. 43.

by an inability to organize their information distribution processes: far more messages than necessary were sent as individuals would forget or duplicate items. Thus, much time was wasted in information seeking. Guetzkow and Dill<sup>32</sup> further found that organized groups, i.e., groups that had developed a hierarchy, were much more efficient than unorganized groups. The communication network pattern of a group was found to affect its efficiency only by indirectly governing this ability of its members to organize themselves for efficient task performance. Mulder<sup>33</sup> further found that different groups within one network which chose a more centralized decision structure or group organization required less time and fewer messages to complete a task than groups which employed a less appropriate structure, a difficulty directly related to the degree of effectiveness of the orientation phase. Lanzetta and Roby<sup>34,35</sup> reported additional evidence of efficient

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32 Harold Guetzkow and William R. Dill, "Factors in the Organizational Development of Task-Oriented Groups," in Sociometry, Vol. 20, 1957, p. 175-204.

33 Mauk Mulder, "Communication Structure, Decision Structure and Group Performance," in Sociometry, Vol. 23, 1960, p. 1-14.

34 J. T. Lanzetta and T. B. Roby, "Group Learning and Communication as a Function of Task and Structure 'Demands'," in Journal of Abnormal and Social Psychology, Vol. 55, 1957, p. 121-131.

35 -----, "The Relationship between Certain Group Process Variables and Group Problem Solving Efficiency," in Journal of Social Psychology, Vol. 52, 1960, p. 135-148.

orientation to the problem having an effect on task performance. In these studies, a tactic of volunteering unsolicited information, a procedure established in the orientation phase, resulted in few messages being sent and less time being spent in talking, subsequently leading to increased group effectiveness.

Further indications that the performance effectiveness of a group can be affected strongly by the strategies its members use in working on a task has been reported by Maier,<sup>36</sup> Shiflett,<sup>37</sup> Shure et al.<sup>38</sup> and Stone.<sup>39</sup> Guetzkow<sup>40,41</sup> demonstrated that very specific strategy planning, as opposed to more general organizing, was crucial to effective task performance. Another insight into the importance

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36 Norman R. F. Maier, Problem Solving Discussions and Conferences, New York, McGraw-Hill, 1963, p. 240.

37 S. G. Shiflett, "Group Performance as a Function of Task Difficulty and Organizational Interdependence," in Organizational Behavior and Human Performance, Vol. 7, 1972, p. 442-456.

38 G. H. Shure, M. S. Rogers, Ida M. Larsen and J. Tassone, "Group Planning and Task Effectiveness," in Sociometry, Vol. 25, 1962, p. 263-282.

39 T. H. Stone, "Effects of Mode of Organization and Feedback Level on Creative Task Groups," in Journal of Applied Psychology, Vol. 55, 1971, p. 324-330.

40 Harold Guetzkow, "Organizational Leadership in Task-Oriented Groups," in Leadership and Interpersonal Behavior, Luigo Petrullo and Bernard M. Bass, editors, New York, Holt, Rinehart and Winston, 1961, p. 192.

41 -----, "Differentiation of Roles in Task-Oriented Groups," in Group Dynamics, Dorwin Cartwright and Alvin Zander, editors, New York, Harper and Row, 1968, p. 523.

of specific planning in the orientation phase has been offered by Maier,<sup>42</sup> who pointed out that the direction initially taken in problem solving, if erroneous, may in fact prevent the finding of any solution at all.

No single performance strategy chosen in the orientation phase could be productive for every task. Shiflett<sup>43</sup> has suggested that the only universally effective procedure for a group attempting to become oriented to its problem may be an ability and a willingness to switch strategies as the need arises. The number of strategy comments has, in fact, been positively correlated with group solution creativity by Hackman and Morris.<sup>44</sup> Nevertheless, such an ability and willingness may be difficult for a group to achieve. As Weicke<sup>45</sup> has pointed out, a pervasive norm not to address performance strategy matters explicitly exists in most groups. Shure et al.<sup>46</sup> found

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42 Norman R. F. Maier, "Reasoning in Humans," in Journal of Comparative Psychology, Vol. 10, 1930, p. 143.

43 S. C. Shiflett, op.cit., p. 454-455.

44 J. Richard Hackman and Charles G. Morris, op.cit., p. 67-68.

45 K. E. Weick, The Social Psychology of Organizing, Reading, Addison-Wesley, 1969, p. 11-12.

46 G. H. Shure et al., op.cit., p. 263-282.

planning activities to be lower in priority for task groups than actual task performance, even when group members were aware that it was to their advantage to plan, and even when it was possible for them to do so without difficulty. Maier<sup>47</sup> and Varela<sup>48</sup> have further demonstrated this tendency for group members to begin immediately to generate and evaluate solutions when presented with a task, rather than to take time to study and analyze the task itself. Morris<sup>49</sup> and Hackman and Morris<sup>50</sup> also found a low frequency at all times during group interaction of procedural comments.

Hackman<sup>51</sup> has reported that in such cases, when adequate procedural planning does not occur, pre-existing strategies automatically take over without discussion. Similar, pre-existing strategies were found to be

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47 Norman R. F. Maier, op. cit., 1963, p. 242-243.

48 J. A. Varela, Psychological Solutions to Social Problems, New York, Academic, 1971, p. 160-161.

49 Charles G. Morris, op. cit., p. 157-165.

50 J. Richard Hackman and Charles G. Morris, op. cit., p. 66.

51 J. Richard Hackman, "Effects of Task Characteristics on Group Products," in Journal of Experimental Social Psychology, Vol. 4, 1968, p. 162-187.

continued by a group even when different procedures were possible and helpful in studies by Cohen<sup>52,53</sup> and Cohen and Bennis.<sup>54</sup> As Janis<sup>55</sup> has observed, a reconsideration of strategic norms in task-oriented groups rarely occurs spontaneously, even when there is clear evidence available to members that the group may be failing at the task.

Thus, without specific procedural planning, and such planning has rarely been found to occur, a group tends to adopt pre-existing norms, which may be based upon the broad type of task<sup>56</sup> or the previous experiences of group members,<sup>57</sup> but not upon a rational examination of the particular requirements of the immediate problem. Leaving the procedural organization of a group to be

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52 Arthur M. Cohen, "Changing Small Group Communication Networks," in Journal of Communication, Vol. 11, 1961, p. 116-124, 128.

53 -----, "Changing Small Group Communication Networks," in Administrative Science Quarterly, Vol. 6, No. 4, 1962, p. 443-462.

54 Arthur M. Cohen and W. G. Bennis, "Predicting Organization in Changed Communication Networks," in Journal of Psychology, Vol. 54, 1962, p. 397-416.

55 I. L. Janis, Victims of Groupthink, Boston, Houghton, 1972, p. 8-9.

56 J. Richard Hackman, op. cit., p. 162-187.

57 H. J. Leavitt, "Task Ordering and Organizational Development in the Common Target Game," in Behavioral Science, Vol. 5, 1960, p. 233-239.

spontaneously developed in the orientation phase, therefore, does not appear to ensure that effective procedures will in fact evolve.

Thus, since the procedural organization of a group has been related to its efficiency, and since it has been demonstrated that groups do not consider procedural strategies before attacking a task but rather base their organization on certain pre-accepted norms of behavior, it would be logical to attempt to increase group effectiveness by intervening in the orientation phase to force groups to consider the strategies they will use. Hackman and Morris<sup>58</sup> have suggested that one function of such forced strategy discussion is to unfreeze individuals from traditional, well-learned approaches to the task, and thereby open the possibility of discovering a more task-effective way of proceeding.

Maier and Solem<sup>59</sup> noted that the pressure to reach a solution probably inhibits the discussion of the problem and of how to attack it, thus preventing the group from systematically reviewing the problem requirements or their approach to it. They therefore forced groups to implement

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<sup>58</sup> J. Richard Hackman and Charles G. Morris, op. cit., p. 68.

<sup>59</sup> Norman R. F. Maier and A. R. Solem, "Improving Solutions by Turning Choice Situations into Problems," in Personnel Psychology, Vol. 15, 1962, p. 151-157.

an abnormal, three-step procedure involving the airing of everyone's view, the listing of important factors in the problem, and the use of this list as a basis for the final solution. The implementation of this procedure resulted in significantly more creative solutions.

A developmental discussion technique involving a division of the task into sub-problems, intended to separate the influence of feelings and facts and to ensure the systematic attention of the group to several facets of the problem, similarly resulted in improved solutions.<sup>60,61</sup> A simple requiring of groups to come up with two solutions to the problem also resulted in better performance, with the second solution being inventive three and one-half to five times as often as the first solution.<sup>62</sup>

Without imposing any specific procedural strategies such as these on the group, several experimenters have

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60 Norman R. F. Maier and Richard A. Maier, "An Experimental Test of the Effects of 'Developmental' vs. 'Free' Discussions on the Quality of Group Decisions," in Journal of Applied Psychology, Vol. 41, No. 5, 1957, p. 320-323.

61 Norman R. F. Maier and L. R. Hoffman, "Using Trained 'Developmental' Discussion Leaders to Improve Further the Quality of Group Decisions," in Journal of Applied Psychology, Vol. 44, 1960, p. 247-251.

62 -----, "Quality of First and Second Solutions in Group Problem Solving," in Journal of Applied Psychology, Vol. 44, 1960, p. 278-283.

successfully manipulated group effectiveness by forcing the group, in the orientation phase, to spend time on procedural planning. The pervasive norm of not wasting time on such planning was overcome by capitalizing on the tendency of groups to follow rather slavishly the demands of the task they see as legitimate,<sup>62,63</sup> through the inclusion in the task of an initial problem involving strategy selection. It has been demonstrated that groups given an initial task such as this have, indeed, discussed strategy in the orientation phase, whereas without the initial task they have not.<sup>64</sup>

What effect does such forced procedural planning in the initial phase have on group task effectiveness? Shure et al.<sup>65</sup> found that groups given separate planning periods were far more successful in evolving an efficient organization for information transmission and were significantly faster in problem solving by the last trial. Contemporaneous planning groups, on the other hand, appeared to have great difficulty in organizing themselves; the pressures

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62 J. G. March and H. A. Simon, Organizations, New York, Wiley, 1958, p. 185.

63 G. H. Shure et al., op. cit., p. 263-282.

64 J. Richard Hackman and Charles G. Morris, op. cit., p. 86.

65 G. H. Shure et al., op. cit., p. 263-282.

of the immediate task were irresistible and so prevented group planning. Thus, this experiment suggested that groups tend not to use the opportunity to organize for effective problem solving unless such organization is part of the task itself.

A study reported by Hackman and Morris<sup>66</sup> compared the problem-solving effectiveness of three groups. Some were asked to spend the first five minutes of a thirty-five minute performance period on a preliminary task explicitly discussing their goals and how they might optimally work together to maximize their proficiency. Others were asked not to waste their time in discussions of procedure or given no special instructions whatsoever. The results showed that virtually no procedural discussion occurred in either those groups asked not to waste their time or those given no special instructions. On a task requiring coordination and sharing among members, the procedural planning groups were more effective. These groups also exhibited more conflict and more interpersonal problems, but a higher flexibility in their approach to the task and a considerable ability to change procedures in midstream when the group was doing poorly.

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<sup>66</sup> J. Richard Hackman and Charles G. Morris, op. cit., p. 84-87.

Moreover, all of the procedural planning group members tended to see themselves as high on personal leadership and influence, whereas members of the other two groups viewed themselves as not having much influence on the group. Thus, it has been demonstrated that it is possible to create a new, nontraditional norm in a problem-solving group by intervening in its orientation phase, and to identify the beneficial effects of such intervention on the group's task performance.

In summary, the literature on procedural planning in the orientation phase of problem-solving groups has demonstrated that such groups are generally obsessed with the immediate task demands and are strongly influenced by the norm of non-deviation from such demands, to the extent of refusing to spend time planning the procedures to be used by the group in attacking the task, even if it has been demonstrated to the group that such planning is valuable and even if sufficient time is available to plan.

The pre-task consideration of group strategy has been correlated with group effectiveness in several studies implementing specific strategies, and in two studies implementing a preliminary task simply forcing the discussion and conscious choice of any defensible strategy to take place.

It has thus been shown that one method of maximizing a group's effectiveness in the initial orientation stage of problem solving is the forcing of that group either to follow a predetermined, effective strategy or to discuss, choose and follow any defensible form of procedure. The latter alternative, although resulting in more conflict, has been related to the additional advantage of member satisfaction with personal influence and leadership.

By derivation, the technique of strategy discussion could also result in an increased group effectiveness in the third and final stage of complex problem solving, that of alternative criticism and choice. If well chosen strategies are implemented, criteria for the final selection of a solution will be clearly defined in light of the values inherent in the problem itself. The preferred method of reaching a final group decision will also have been discussed ahead of time, so that strong personalities will be less likely to dominate the final phase. Thus, initial procedural planning would not only maximize group effectiveness in the orientation phase of problem solving but also in the final phase of criticism and choice, leading to superior task performance.

### 3. The Alternative Generation Phase

The alternative generation phase is that stage of a group's problem solving in which the members suggest various possible solutions to the problem. The theoretical postulations of its existence as a middle phase have been confirmed by Morris,<sup>67</sup> Bales and Strodtbeck,<sup>68</sup> and Walker.<sup>69</sup> Its manipulation has been studied by several authors who have concluded that an effective method of maximizing idea generation is the use of brainstorming techniques.

Osborn<sup>70</sup> has described brainstorming as an attempt to circumvent pressures to uniformity in group problem solving and thus to elicit a wide range of ideas by withholding the criticism and evaluation of ideas until after they have all been generated. According to Osborn, brainstorming has four main characteristics:

- (1) Criticism is ruled out. Adverse judgement of ideas must be withheld until later.
- (2) 'Free-wheeling' is welcomed. The wilder the idea the better; it is easier to tame down than to think up.

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67 Charles G. Morris, op. cit., p. 157-165.

68 Robert F. Bales and Fred L. Strodtbeck, op. cit., p. 491.

69 Decker F. Walker, op. cit., p. 125.

70 Alex F. Osborn, Applied Imagination, New York, Charles Scribner's Sons, 1963, p. 152.

(3) Quantity is wanted. The greater the number of ideas, the more the likelihood of useful ideas.  
(4) Combination and improvement are sought. In addition to contributing ideas of their own, participants should suggest how ideas of others can be turned into better ideas; or how two or more ideas can be joined into still another idea.<sup>71</sup>

Such a procedure, Osborn has maintained, produces far more good ideas than a conventional conference for several reasons: a chain reaction may be generated as several people follow up one line of thought; a social atmosphere is created which tends to facilitate free association; rivalry is stimulated; and contributions are reinforced.<sup>72</sup> In this way, if the generation of ideas is clearly separated from their evaluation, many more ideas will be generated to choose from. As Robins<sup>73</sup> has pointed out, brainstorming can, thus, provide a quick and effective means of obtaining the permissive atmosphere required for a free flow of ideas.

Osborn's concept has received some support in the literature. Hoffman and Maier,<sup>74</sup> for example, confirmed

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71 Alex F. Osborn, op. cit., p. 156.

72 Ibid., p. 154-155.

73 R. S. Robins, "Brainstorming Re-Evaluated," in Journal of Communication, Vol. 10, No. 3, Sept. 1960, p. 151.

74 L. R. Hoffman and N. R. F. Maier, "Valence in the Adoption of Solutions by Problem-Solving Groups," in Journal of Abnormal and Social Psychology, Vol. 69, 1964, p. 264-271.

quantitatively that one of the most effective barriers to diversity of opinion is the tendency for group members to evaluate suggested solutions as they appear. Such premature evaluation, they have concluded, may promote a mediocre solution, kill off a good solution early, or cause certain suggestions to be forgotten. By delaying evaluation, on the other hand, and by systematically recording each idea generated, brainstorming avoids such tendencies from directing group problem solving. Parnes and Meadow<sup>75</sup> have also demonstrated the usefulness of brainstorming by comparing trained and untrained subjects, and have further found a correlation between the quantity and quality of ideas generated. In other words, not only has this technique resulted in the generation of more alternatives, but also in an increased total quality of alternatives generated. Both Osborn<sup>76</sup> and Bayless<sup>77</sup> have reported similar increases in both the number of ideas and the number of good ideas produced under brainstorming conditions.

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75 Sidney J. Parnes and Arnold Meadow, "Effects of 'Brainstorming' Instructions on Creative Problem Solving by Trained and Untrained Subjects," in Journal of Educational Psychology, Vol. 50, No. 4, 1959, p. 171-176.

76 Alex F. Osborn, op. cit., p. 183-189.

77 Ovid L. Bayless, "An Alternate Pattern for Problem Solving Discussion," in Journal of Communication, Vol. 17, No. 3, 1967, p. 188-197.

In addition, a study by Weisskopf-Joelson and Eliseo<sup>78</sup> showed that brainstorming groups produced significantly more possible solutions with a greater total quality of solutions than critical problem-solving groups. Although student judges in this study found no difference in the number of good ideas or the average quality of ideas generated, such results might be attributed to the conservative tastes of the judges, and their lack of appreciation for highly original suggestions.

Lamm and Trommsdorff<sup>79</sup> and Stein<sup>80</sup> concluded from their reviews of the literature on both individual and group performance on tasks requiring idea generation that a greater ideational proficiency resulted in groups given brainstorming directions as compared to those given critical directions. This proficiency was attributed by Lamm and Trommsdorff<sup>81</sup> to a lessened social inhibition experienced by individuals in the brainstorming groups.

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78 Edith Weisskopf-Joelson and T. Eliseo, "An Experimental Study of the Effectiveness of Brainstorming," in Journal of Applied Psychology, Vol. 45, 1961, p. 45-49.

79 Helmut Lamm and Gisela Trommsdorff, "Group versus Individual Performance on Tasks Requiring Ideational Proficiency (Brainstorming)," in European Journal of Social Psychology, Vol. 3, No. 4, 1973, p. 361-388.

80 Morris I. Stein, Stimulating Creativity, New York, Academic, 1975, p. 135.

81 Helmut Lamm and Gisela Trommsdorff, op.cit., p. 382.

Moreover, Brillhart and Jochem<sup>82</sup> found that brainstorming groups generating ideas before determining their evaluation criteria produced not only more ideas but more good ideas than groups guided by pre-established criteria in their idea generation or groups instructed to consider the relative merits of each idea as it was suggested. Furthermore, their post-experimental questionnaire showed that subjects preferred the brainstorming pattern which placed the generation of ideas before the development of criteria for their evaluation.

Parloff and Handlon<sup>83</sup> have shown group brainstorming to be superior to traditional group problem solving in written responses.

Bouchard,<sup>84,85</sup> in addition to finding group brainstorming to be superior to group critical problem solving for idea generation, found that a group sequencing procedure with as few status distinctions as possible among

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82 J. K. Brillhart and L. N. Jochem, "Effects of Different Patterns on Outcomes of Problem-Solving Discussions," in Journal of Applied Psychology, Vol. 48, 1964, p. 175-179.

83 M. B. Parloff and J. H. Handlon, "The Influence of Criticalness on Creative Problem-Solving in Dyads," in Psychiatry, Vol. 27, 1964, p. 17-27.

84 T. J. Bouchard, Jr., "Personality, Problem-Solving Procedure, and Performance in Small Groups," in Journal of Applied Psychology, Vol. 53, No. 1, Pt. 2, 1969, p. 1-29.

85 Thomas J. Bouchard, "Whatever Happened to Brainstorming," in Journal of Creative Behavior, Vol. 5, No. 3, 1971, p. 182-189.

members had a profound effect in increasing still further the value of such brainstorming.

Although Osborn's technique of idea generation has, thus, been found to be superior to more critical methods, it has also been found to be rather difficult to implement when group members have a genuine concern about the task at hand.<sup>86,87</sup> It would therefore appear that pre-established norms of critically examining each idea as it is presented must be consciously altered by the group members themselves, especially in deliberation on a topic important to them. A decision to alter norms in this way could be effectively taken during specific procedural planning in the orientation phase.

A further problem to be overcome in implementing brainstorming procedures has been noted by Bouchard and Hare<sup>88</sup> who have explained the often cited ability of

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86 Oren Harari and William K. Graham, "Tasks and Task Consequences as Factors in Individual and Group Brainstorming," in Journal of Social Psychology, Vol. 95, No. 1, 1975, p. 61-65.

87 Peter C. Dillon, William K. Graham and Andrea L. Aidells, "Brainstorming on a 'Hot' Problem," in Journal of Applied Psychology, Vol. 56, No. 6, 1972, p. 487-490.

88 T. J. Bouchard Jr. and M. Hare, "Size, Performance and Potential in Brainstorming Groups," in Journal of Applied Psychology, Vol. 54, No. 1, Pt. 1, 1970, p. 51-55.

nominal groups to generate more and a higher quality of ideas under brainstorming procedures than real groups as a result of the lack of effective time management in real groups<sup>89</sup>-- a problem, it would appear, that could also be overcome by specific procedural planning in the orientation phase of problem solving.

In summary, research has demonstrated that idea generation in problem-solving groups can be significantly improved through the use of brainstorming techniques. By separating the critical from the creative phase in this way, more and better ideas can be generated. Thus, it would appear that the effectiveness of the second phase of group problem solving, the generation of alternatives, could be maximized through the use of these brainstorming procedures.

In addition, by derivation the third and final phase of problem solving, the critical examination and choice of alternatives, could also be made more effective through brainstorming, for with a greater range of better ideas to critically compare and to choose from, a group logically would be less likely to select the first solution

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89 T. J. Bouchard Jr. and M. Hare, op. cit., p. 54.

reaching minimum standards, and would have a higher chance of choosing a good quality solution. Thus, just as increasing the effectiveness of the first phase, orientation to the problem, by implementing a specific procedural planning session would lead to an increased effectiveness in the final phase, so also would the improvement of the second, idea generation stage of problem solving have a direct and positive effect on that final phase.

#### 4. Summary and General Hypothesis

The phase theory of complex problem solving by small groups, although presented in many different terminologies in the literature both on small groups in general and on curriculum deliberations in particular, basically postulates that groups solve complex problems through three interaction processes: orientation to the task, generation of alternatives, and alternative criticism resulting in the choice of a final solution. Such a theory implies that the difference in effectiveness between groups with similar potential assets and liabilities is due to a difference in the functioning of these three processes. Interventions into a group's interaction to maximize its effectiveness in each of these phases could be predicted to enable that group to capitalize on its assets while

minimizing its liabilities, thus increasing the effectiveness of its task performance.

The research on the first, or orientation phase of problem solving has revealed that such orientation is greatly improved through a forced implementation of strategy planning, and that task performance can thus be made more effective. The research on the second, or alternative generation phase of problem solving has shown that brainstorming techniques can offer significantly increased effectiveness in this area. The third, or critical choice phase, it has been proposed, could be rendered more effective through the use of both of these techniques. Moreover, the use of procedural planning in the orientation phase would further improve the effectiveness of brainstorming in the second phase both by enabling group members to consciously choose to delay criticism during idea generation regardless of their genuine concern for the task at hand, and by permitting the group to more effectively manage its time through pre-planning. Therefore, the combined implementation of forced procedural planning along with brainstorming techniques could be predicted, using the phase theory of group problem solving, to even more significantly increase group effectiveness on a complex, curriculum task than the use of either of these two methods alone.

The present study thus examines the problem of the procedures used in effective group deliberations on a curriculum task. Specifically, it tests the hypothesis that groups which preplan their problem-solving strategies, which use brainstorming techniques, or which use a combination of these two procedures are indeed more effective in their curriculum deliberations than groups which do not use any of these procedures. It is further predicted that the greatest difference in effectiveness will occur between groups using a combination of procedural planning and brainstorming techniques and groups not using either of these two procedures.

## CHAPTER II

### EXPERIMENTAL DESIGN

The experimental design used to test the hypothesis presented in the preceding chapter is described in the following manner. Section One presents a definition of the terms used in the study, while Section Two specifies the experimental variables. The treatment groups and the sample are described in Sections Three and Four, with Section Five containing the experimental procedure. Section Six outlines the data collection. Finally, the rating methodology and the reliability of the ratings in Sections Seven and Eight are followed by the data analysis procedures in Section Nine.

#### 1. Definition of Terms.

The definitions assigned to the principal terms of this study are as follows.

Small group problem solving is a process in which two to five individuals move in face to face interaction from initiation of study to resolution of a question involving group decision.

A complex problem is a question for which there is no simple response, no single correct answer, but for which

there are rather several alternative solutions, some better than others.

A curriculum problem for the purposes of this study is a question concerning the development of a unit of an educational program to be implemented in a school.

A problem-solving phase is a qualitatively different sub-period of a complete session of group interaction, serving primarily a particular segment of problem solution not addressed to the same extent in any other sub-period. Three main problem-solving phases have been identified: orientation, alternative generation, and critical choice.

Procedural planning is the determination by a group, in its orientation phase of interaction, of which specific strategies will be followed by its members in their problem solving process. Strategies selected may range from the employment of one person as a recorder or chairman to the division of the problem into subsections for discussion purposes, the delaying of criticism until the end of the planning session, or the use of a majority rule for final decision making. Regardless of which strategies are selected, procedural planning implies that group members will discuss and choose some specific procedures before beginning to solve the problem itself.

Brainstorming is a technique for the generation of ideas which separates criticism from idea creation.

Every solution suggested is accepted and recorded, no matter how wild; previous solutions are added to, combined and altered to generate new solutions. No criticism whatsoever of ideas is permitted until all possible ideas have been generated.

An effective solution is defined as an answer to a problem which has a high probability of enabling the accomplishment of all the goals implied in that problem without creating new difficulties not easily overcome.

## 2. Experimental Variables.

The dependent variable in this study was each group's score on its solution to a complex curriculum problem requiring the formulation of a mathematics unit in graphing at the junior level, taking into consideration both the content and the process elements specified in a quotation from the Ministry of Education guidelines.

(See Appendix 1, page 66.)

The independent variables of the study were the four treatments given, involving exposure to specific directions as to how to proceed in the planning of the unit. (See Appendices 2-4, pages 68-74.)

### 3. Treatment Groups

Four different treatments were assigned randomly to the thirty-six groups in the study: a control condition, instructions to employ procedural planning, instructions to brainstorm, and instructions to combine both procedural planning and brainstorming techniques.

The control groups were simply presented with the curriculum problem and asked to solve it to the best of their ability. (See Appendix 1, page 66.)

In addition to being presented with the curriculum problem and similar admonitions to solve it to the best of their ability, the other three treatment groups were given the following special directions.

The procedural planning groups were presented with directions to spend the first five minutes planning how they would organize themselves as a group for problem solving. (See Appendix 2, page 68.)

The brainstorming groups were asked to follow a simplified version of Osborn's<sup>1</sup> procedures for idea generation at any point in their deliberations where they were seeking ideas. (See Appendix 3, page 70.)

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<sup>1</sup> Alex F. Osborn, Applied Imagination, New York, Charles Scribner's Sons, 1963, p. 156.

In the combination condition, groups were asked to both preplan their problem solving strategy and use brainstorming techniques for idea generation. (See Appendix 4, page 72.)

All groups were permitted to freely question any aspect of the directions unclear to them before problem solving began. Once the groups were working on the task, however, no questions were accepted.

No group received training in any problem solving technique used other than the written and oral explanations given by the experimenter.

#### 4. The Sample

The sample selected consisted of thirty-six groups of two to five teachers each, one hundred and thirty-three subjects in all, from thirty-five elementary schools in three school boards of the Ottawa-Carleton region: the Carleton Public School Board, the Carleton Roman Catholic School Board, and the Ottawa Roman Catholic Separate School Board.

Subjects were all practising teachers volunteering to plan one unit with several of their coworkers in their own school at the end of a regular school day.

Although the study was dependent upon volunteers, a wide range of subjects participated in it, with

experience in all grade levels from Kindergarten to Grade Eight, including specialist teachers of library skills, French, remedial reading and music as well as classroom teachers, with backgrounds of teaching experience ranging from less than one year to more than twenty years.

All groups consisted of coworkers who already knew each other and had planned together at least on a staff level on previous occasions.

Each group did its planning in the usual planning environment for that staff, whether in the staff room, resource center, team planning area, or one teacher's classroom. Distractions were few, but precisely the sort of interruption that would normally disturb teacher planning: telephone calls, loudspeaker announcements, custodial care, messages from other teachers, or student emergencies.

In this way, the groups of teachers involved, the time for planning, the physical setting and the interruptions occurring were precisely the same as they would be for teachers normally planning in each participating school, with the only exceptions being the experimenter's presence and the assigned problem itself.

### 5. Experimental Procedure

Schools were approached for the study on a random basis through the school boards. Teacher groups volunteering to participate in the experiment were then randomly assigned to one of four treatment conditions. The experimenter was the same for all thirty-six groups, thus ensuring that the directions given and the procedures followed were held constant.

The experimenter met with each group of teachers after classes were dismissed in an area of the school chosen by the teachers themselves. Directions were given in both a written and an oral format, and all procedural questions were answered. The actual planning periods were taped, and a maximum time of forty-five minutes was allowed for each one.

After all group sessions had been completed, two impartial judges, both graduate students in curriculum with teaching backgrounds, were hired and trained in the use of the rating scale. (See Appendix 5, page 75.) All of the groups' plans were then rated, the scores were analyzed, and conclusions were drawn.

### 6. Data Collection

Group sessions were run over a period of ten months. The data consisted of the written unit plans composed by

the thirty-six groups, the judges' ratings of these plans, and the incidental observations made by the experimenter in regards to the difficulties encountered in each problem solving session.

### 7. Rating Methodology

The unit plans were evaluated according to a rating scale derived directly from the problem itself. (See Appendix 5, page 75.) The quotations from the Ministerial guidelines (see Appendix 1, page 66) were simply broken down into their component parts, and a checklist was formulated to indicate the extent to which each of these components had been taken into consideration in any group's solution. A continuum of four levels of inclusion was employed rather than a yes/no checklist to increase the precision of the ratings. Total scores were calculated by summing the ratings from zero to three on all of the scale items.

The content validity of the instrument was evaluated by expert opinion: twenty educators and curriculum experts were invited to criticize the various items included in it in relation to their logical derivation from the problem itself. Revisions were made accordingly.

The instrument's reliability was tested through its repeated application to identical unit plans.

### 8. Reliability of the Ratings

Interjudge reliability was determined using Winer's<sup>2</sup> interrater reliability coefficient, the results of which are presented in Table I. The interjudge reliability was calculated to be 0.91.

### 9. Data Analysis Procedures

The data were analyzed using a one-way analysis of variance F test at the 0.05 level of significance. A Scheffé post hoc test was then employed.

From the results of these tests it was possible to determine for which treatment groups the performance scores were significantly higher, and therefore to draw conclusions concerning the usefulness of the experimental interventions made in improving group effectiveness.

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<sup>2</sup> B. J. Winer, Statistical Principles in Experimental Design, New York, McGraw-Hill Book Co., 1962, p. 127-130.

Table I.  
Analysis of Variance and Reliability Coefficient of  
Ratings.

Source	SS	df	MS	r
Between groups	2045.49	35	58.44	0.91
Within groups	191.35	36	5.31	

## CHAPTER III

### PRESENTATION AND DISCUSSION OF RESULTS

The results of the analysis of the data are presented and discussed in the following manner. Section One describes the results of the testing of the hypothesis. The major findings are summarized in Section Two. Section Three consists of a discussion of these findings, while Sections Four and Five present implications for educational practice and future research. The summary and conclusions of the study follow.

#### 1. Results of Testing the Hypothesis

The results of the one-way analysis of variance are shown in Table II. The value of  $F$  was found to be 8.775, significant as predicted at the 0.05 level. Thus, an important difference in mean scores was found among the treatment groups.

The results of the Scheffé test used for post hoc analysis of variance are presented in Table III. Here, significant differences were found between the control group and each of the treatment groups, with the greatest difference being between the control group and the combination condition. No significant differences were found among the treatment groups themselves.

Table II.

Analysis of Variance for the Four Treatment Groups.

Source	SS	df	MS	F
Among groups	461.604	3	153.867	.
Within groups	561.127	32	17.535	8.775*
Total	1022.731	35		

\* significant as predicted at the 0.05 level

Table III.

Post Hoc Analysis of Variance for the Four  
Treatment Groups.

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Scheffé Simultaneous Confidence Intervals	
Mean 1 - Mean 2	-6.333 $\pm$ 5.822*
Mean 1 - Mean 3	-7.690 $\pm$ 5.822*
Mean 1 - Mean 4	-9.518 $\pm$ 5.822*
Mean 2 - Mean 3	-1.357 $\pm$ 5.822 n.s.
Mean 2 - Mean 4	-3.184 $\pm$ 5.822 n.s.
Mean 3 - Mean 4	-1.823 $\pm$ 5.822 n.s.

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\* significant at the 0.05 level.

## 2. Major Findings

The prediction that groups which were instructed to both preplan their problem-solving strategies and to use brainstorming techniques would be more effective in their curriculum deliberations than groups which were not instructed to follow either of these procedures or groups which were instructed to follow only one of these procedures was confirmed. In addition, groups which were instructed to use either preplanning of problem-solving strategies or brainstorming techniques alone were found to be more effective in their curriculum deliberations than the control groups, which received no procedural instructions.

In this way, the experimental interventions based on the phase theories of group interaction and designed to increase overall group task effectiveness by increasing effectiveness in the orientation or the alternative generation stages did in fact result in improved group performance, with the greatest improvement occurring when both phases were manipulated simultaneously.

## 3. Discussion of Results

All groups were observed to follow the planning directions to a noticeable degree, confirming Shure's

contention<sup>1</sup> and the findings of Hackman and Morris.<sup>2</sup> Thus, without exception, groups asked to preplan their problem-solving strategies did so, as did groups instructed to brainstorm or to use both of these techniques. Simple oral and written instructions with no other training were therefore sufficient to guarantee the implementation of these planning methods.

The increased group task performance effectiveness in the procedural planning condition occurred, as predicted in the literature,<sup>3,4</sup> in spite of the fact that these groups had five minutes less actual planning time. The reason for this increased efficiency appeared to be that the remaining time could be totally devoted to productive unit planning. Control groups, which consistently began immediately to write up the unit, as Maier and Solem predicted,<sup>5</sup> often

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1 G. H. Shure, M. S. Rogers, Ida M. Larsen and J. Tassone, "Group Planning and Task Effectiveness," in Sociometry, Vol. 25, 1962, p. 263-282.

2 J. Richard Hackman and Charles G. Morris, "Group Tasks, Group Interaction Process, and Group Performance Effectiveness: A Review and Proposed Integration," in Advances in Experimental Social Psychology, Vol. 8, Leonard Berkowitz, editor, New York, Academic Press, 1975, p. 86.

3 Ibid., p. 84-87.

4 G. H. Shure et al., op. cit., p. 263-282.

5 Norman R. F. Maier and A. R. Solem, "Improving Solutions by Turning Choice Situations into Problems," in Personnel Psychology, Vol. 15, 1962, p. 151-157.

found themselves floundering half way into their planning time, arguing over the previously undiscussed problem requirements and frequently changing direction completely. Much time was also wasted in member conflicts, as the prevailing, unconsciously accepted norm of consensus was adhered to religiously, confirming Hackman's findings,<sup>6</sup> and individual dissident members held up planning indefinitely. Procedural planning groups, on the other hand, frequently invoked a democratic vote after only a minute or two of disagreement. Since all group members had agreed on this procedure initially, it did not appear to be viewed as a personal attack by the disagreeing individuals.

In this way, the procedural planning groups, in contrast to the control groups, maximized their effectiveness in the orientation phase of problem solving. Members were able to come together, clearly define the problem, and decide upon their method of attacking it before moving on to the idea generation phase. Thus goals, values and obstacles were in fact clearly differentiated before the actual seeking of a solution began. As Maier<sup>7</sup> suggested,

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6 J. Richard Hackman, "Effects of Task Characteristics on Group Products," in Journal of Experimental Social Psychology, Vol. 4, 1968, p. 162-187.

7 Norman R. F. Maier, Problem Solving and Creativity, Belmont, Brooks/Cole, 1970, p. 186.

the successful completion of these orientation activities enabled these groups to avoid later difficulties with evaluation based on widely varying assumptions by members. An increased effectiveness in the orientation phase, therefore, actually did contribute to an increased overall task effectiveness, as was predicted in the phase theories of group interaction.

The lesser quality of control group plans could also be attributed to a lack of established criteria as to the acceptability of decisions made. Frequently the first notion reaching a minimum level of satisfaction was accepted and alternative, perhaps superior, ideas were never examined. Brainstorming groups, as predicted by Osborn,<sup>8</sup> had a distinct advantage in the range of ideas they had available to choose from. Groups members appeared to become caught up in the competitive nature of idea generation,<sup>9</sup> and many creative ideas were put forward. Having thus greatly increased their effectiveness in the alternative generation phase of interaction, these groups could afford to be very selective in the final choice phase, so that even without a predetermined set of criteria for such choices, superior selections were made.

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8 Alex F. Osborn, Applied Imagination, New York, Charles Scribner's Sons, 1963, p. 152.

9 Ibid., p. 154-155.

Overall task performance effectiveness was improved, in this way, through increased group effectiveness in the alternative generation phase.

The combination condition groups did not appear to suffer from the length of the instructions they received. All groups did in fact both preplan their problem-solving strategies and brainstorm, and the individual benefits noted above for each of these procedures individually were again apparent in the combination condition. The use of procedural planning further enabled the accurate implementation of brainstorming techniques, as group members, having initially discussed their procedures together in some detail, freely reminded each other of the decisions made earlier if any deviations occurred. The difficulty encountered in brainstorming by groups having a genuine concern about the task at hand, a problem discussed by Harari and Graham<sup>10</sup> and Dillon et al.,<sup>11</sup> was thus overcome through an increased effectiveness in the orientation phase. The idea generation occurring in the combination condition, therefore, was superior to that occurring in brainstorming groups, since the brainstorming rules were more closely followed.

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10 Oren Harari and William K. Graham, "Tasks and Task Consequences as Factors in Individual and Group Brainstorming," in Journal of Social Psychology, Vol. 95, No. 1, 1975, p. 61-65.

11 Peter C. Dillon, William K. Graham and Andrea L. Aidells, "Brainstorming on a 'Hot' Problem," in Journal of Applied Psychology, Vol. 56, No. 6, 1972, p. 487-490.

A combination of time planning,<sup>12</sup> role specification, problem subdivision and choice of criteria for judging the final solution reached, all organized in the groups' pre-planning of problem-solving strategy, with the wide range of ideas resulting from brief brainstorming sessions led to very organized and yet creative planning sessions. Members of these groups generally expressed pride and confidence in the final unit plan submitted, frequently insisting that a copy be returned to them for subsequent implementation.

As was predicted in the phase theories of interaction, therefore, groups with similar input characteristics produced significantly different levels of output<sup>13</sup> when their performance in each of the stages of interaction was varied. Groups which, through procedural planning or brainstorming techniques, maximized their effectiveness in the orientation or alternative generation phases significantly increased their overall task performance effectiveness in comparison to the control condition.

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12 T. J. Bouchard Jr. and M. Hare, "Size, Performance and Potential in Brainstorming Groups," in Journal of Applied Psychology, Vol. 54, No. 1, Pt. 1, 1970, p. 51-55.

13 J. Richard Hackman and Charles G. Morris, op. cit., p. 50.

Groups implementing both of these techniques at once, and therefore maximizing their effectiveness in all three phases of interaction, produced output superior not only to that of the control condition but also to that of all other groups. Thus, although manipulations which improved group performance in one or two phases of interaction were effective, those which improved group performance in all three phases simultaneously produced significantly superior results.

The disturbances occurring in all planning sessions, such as student emergencies, custodial care, telephone calls or public address system announcements, did not upset the planning. Teachers appeared to be so accustomed to these interruptions that they could deal with them without disrupting the train of thought in the planning session.

The use of the posttest-only control group design for this experiment facilitated the control of several potential sources of internal invalidity. Through the inclusion of control groups and random assignment to treatments, problems of history, maturation, testing, instrumentation, regression, selection and mortality were limited.

Possible sources of external invalidity were also a consideration in the design of the study. The

possibility of an interaction of selection with treatment, however, remained, since control for the effects of using only volunteers in the experiment was impossible due to local school board regulations. The results cannot, therefore, be generalized to forced planning situations.

In order to determine the effects of other extraneous variables, certain exploratory analyses of the data in addition to the original analysis of variance were carried out. The exact numbers of group members, the presence or absence of an administrator in the group, and the particular school board to which the school belonged were all examined in relation to group task performance. No significant effects were found, confirming the contention by Hackman and Morris<sup>14</sup> that the crucial elements to be examined in group experimentation are indeed the interaction processes, rather than the input characteristics.

Because of the design of the study, enabling a variety in the composition of planning groups used and realistic settings in which the planning could take place, the results may be generalized to the everyday voluntary planning situations of most elementary teachers in public or separate school systems similar to those in the Ottawa area.

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<sup>14</sup> J. Richard Hackman and Charles G. Morris, op. cit., p. 51.

#### 4. Implications for Educational Practice

As was implied by the phase theories of group interaction, group performance on a curriculum task was significantly improved through the use of procedural planning and brainstorming techniques in the orientation and idea generation phases of deliberation. Since no training was given to any of the treatment groups other than the oral and written instructions presented by the experimenter, these methods are directly applicable to many teacher planning situations.

This study suggests that teachers voluntarily developing curriculum in small groups in a school setting could significantly increase their effectiveness by resisting the impulse to begin immediately to plan units. Instead, the first five minutes of deliberation should be spent discussing and choosing specific procedures for the group to follow in its planning. Certain member roles, such as chairman or secretary, should be determined, as well as a method for dealing with conflict, a procedure for attacking the unit, and criteria for judging the final solution reached. In addition, throughout their deliberations, whenever ideas on a topic are being sought, teachers should implement a brainstorming technique, deferring all criticism until as many ideas as possible have been generated.

These two procedures are simple to implement and require no special equipment or extra time. Moreover, the results of this study suggest that their use will lead to significantly improved curriculum planning.

#### 5. Implications for Future Research

Replications of the present experiment in a variety of geographical locations are necessary to confirm its findings. Moreover, the following variations of the study would further clarify its results.

The influence of the school administrator's philosophy and of the school climate appeared to have a considerable effect on the way teachers related to each other in their planning sessions. A comparison of the planning effectiveness of groups following any or all of this experiment's planning procedures in varying administrative climates would be useful.

In order to be more applicable to all teacher planning situations, the study should be replicated using non-volunteers as well as volunteers to determine if reactive arrangements exist, since there are some teacher deliberations which are in fact forced.

It would also be interesting to verify whether training in brainstorming and strategy-planning techniques would increase group task performance even more.

The type of procedures used in this study in the area of curriculum development might be further examined in the context of school planning in other areas, such as budgeting, scheduling, or programming.

From the results of the present experiment it is apparent that research into all of these areas would be extremely useful.

## SUMMARY AND CONCLUSIONS

Derived from a concern over the lack of empirically-based guidelines accompanying the recent push in Ontario for teacher curriculum development in all areas, this study has examined three methods of improving teacher planning.

Due to the scarcity of empirical research specifically dealing with curriculum deliberations, the psychological literature on group problem solving in general was reviewed to establish a theory base for predictions about curriculum problem solving in particular. Extensive writings on certain phase theories of group interaction were found to imply that techniques designed to maximize group effectiveness in the orientation, idea generation, and alternative criticism and choice stages of problem solving would also maximize overall group task effectiveness.

Many empirical studies dealing with various procedures intended to assist groups to become oriented to themselves and to the problem, or to generate ideas pertaining to the solution of that problem, were available in the literature on group problem solving in general. From these studies, the two techniques of conscious procedural planning and brainstorming were selected as being particularly consistent with the phase theories of group interaction, and the present experiment tested the prediction that these two

tactics used in combination would significantly increase group effectiveness on a curriculum task.

Analysis of the data revealed considerable improvements in group effectiveness through the use of procedural planning or brainstorming techniques, with the greatest increase in scores resulting in the combination condition.

These results indicate that voluntary teacher curriculum deliberations at the school level could be significantly improved by the implementation of strategy planning in combination with non-critical idea generation.

If teacher curriculum development is indeed the key to responsive schools, capable of adapting to both a wide range of individual needs and frequently changing societal concerns, then the training of teachers in techniques such as these, designed to increase planning effectiveness, must receive a high priority.

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A comprehensive review and discussion of existing research on five techniques which have been used to facilitate idea generation. A prime source for work on group creativity.

Walker, Decker, "A Study of Deliberation in Three Curriculum Projects," in Elements of Curriculum Development, F. Michael Connelly, editor, Toronto, The Ontario Institute for Studies in Education, 1971, p. 118-134.

An explication of the procedures by which groups formulate curriculum plans and materials, based on the implementation of an original system for analyzing curriculum deliberations. A worthwhile reference, particularly helpful in the distinguishing of patterns in long and varied sessions of group interaction.

APPENDIX 1

PROBLEM

## APPENDIX 1

### PROBLEM

One part of the Ontario curriculum policy for primary and junior divisions, Circular P1J1: The Formative Years, states that arithmetic learning experiences in the junior division will enable the child to:

"relate the members of one set to members of another set using ideas of correspondence and mapping, including the interpretation and development of graphs, charts, maps, models, and other forms of representation."

The philosophy prefacing these guidelines emphasizes the merits of an individualized approach to education, stating:

"It is the policy of the Government of Ontario that every child have the opportunity to develop as completely as possible in the direction of his or her talents and needs... The responsibilities of [teachers, principals, and supervisory officials] include... assessing each child's learning on a continuous basis to ensure learning at a level and rate that are in keeping with individual abilities."

Assume that you, as a group, have been given the responsibility of developing an individualized unit which will enable the children in the junior division of your school to use the above mathematical concepts with understanding.

Formulate a specific, written plan for such a unit. Do not prepare the actual material to be used by the children themselves, but describe it clearly enough that other teachers would have little difficulty implementing your ideas.

You will have forty-five minutes to complete your plan. Your effectiveness in planning will be compared with the effectiveness of other groups. Prepare the best plan you possibly can.

APPENDIX 2

PROCEDURAL PLANNING INSTRUCTIONS

## APPENDIX 2

### PROCEDURAL PLANNING INSTRUCTIONS

Before you begin working on the problem itself, you must spend no less than five minutes and no more than ten minutes on a preliminary task, that of formally determining the procedures your group will follow to best achieve its goals in developing its plan.

You might decide whether or not a chairman or a recorder is needed, and which group members will fill which roles. You might decide how disagreements that arise are to be resolved: will a simple majority rule or will the agreement of each member be sought? You might decide how to approach the problem itself. Should it be analyzed into sub-problems first, should certain factors be isolated for individual consideration, or will it be attacked as one unit? Should each person be allowed to state his opinion initially before discussion begins, or should individuals state their opinions during the discussion? Should certain criteria for a good solution be defined ahead of time or should suggested solutions be criticized as they appear?

Spend the first five minutes discussing just what procedures your group will follow, without beginning to solve the problem itself until you have your problem-solving strategy clearly defined and agreed upon by your group.

APPENDIX 3

BRAINSTORMING INSTRUCTIONS

## APPENDIX 3

### BRAINSTORMING INSTRUCTIONS

When your group begins to suggest ideas for the problem's solution, you must follow the following procedures:

- (1) No criticism whatsoever of ideas is to be expressed until all of the ideas of each member have been put forward and written down.
- (2) Free-wheeling is welcomed. The wilder the idea the better; it will be easier to tame down such ideas later than to think up new, exciting ideas.
- (3) Suggest as many ideas as possible, no matter how ridiculous they seem. The greater the number of ideas, the more likely it is that good ideas will be among them.
- (4) Combine and improve upon previous ideas as well as suggesting new ideas. Turn two or more ideas given by others into a third idea and join it with still others to make a fourth.

Work as quickly as you can to suggest as many ideas as possible. Two secretaries may be needed to jot every one down, as they should be fired out instantly, one after the other, as soon as they occur. Make as long a list as you possibly can. Do not criticize any idea until every member has run out of suggestions, and then examine the list together.

APPENDIX 4

COMBINATION INSTRUCTIONS

## APPENDIX 4

### COMBINATION INSTRUCTIONS

#### Step One

Before you begin working on the problem itself, you must spend no less than five minutes and no more than ten minutes on a preliminary task, that of formally determining the procedures your group will follow to best achieve its goals in developing its plan.

You might decide whether or not a chairman or a recorder is needed, and which group members will fill which roles. You might decide how disagreements that arise are to be resolved: will a simple majority rule or will the agreement of each member be sought? You might decide how to approach the problem itself. Should it be analyzed into sub-problems first, should certain factors be isolated for individual consideration, or will it be attacked as one unit? Should each person be allowed to state his opinion initially before discussion begins, or should individuals state their opinions during the discussion? Should certain criteria for a good solution be defined ahead of time or should suggested solutions be criticized as they appear?

Spend the first five minutes discussing just what procedures your group will follow, without beginning to solve the problem itself until you have your problem-solving strategy clearly defined and agreed upon by your group.

#### Step Two

When your group begins to suggest ideas for the problem's solution, you must follow the following procedures:

- (1) No criticism whatsoever of ideas is to be expressed until all of the ideas of each member have been put forward and written down.
- (2) Free-wheeling is welcomed. The wilder the idea the better; it will be easier to tame down such ideas later than to think up new, exciting ideas.
- (3) Suggest as many ideas as possible, no matter how ridiculous they seem. The greater the number of ideas, the more likely it is that good ideas will be among them.

- (4) Combine and improve upon previous ideas as well as suggesting new ideas. Turn two or more ideas given by others into a third idea and join it with still others to make a fourth.

work as quickly as you can to suggest as many ideas as possible. Two secretaries may be needed to jot every one down, as they should be fired out instantly, one after the other, as soon as they occur. Make as long a list as you possibly can. Do not criticize any idea until every member has run out of suggestions, and then examine the list together.

APPENDIX 5

RATING SCALE

APPENDIX 5

RATING SCALE

A. Response to philosophy of concern for the individual

1. Provision for various initial student abilities

All students are intended to begin the program at the same level.	The program provides more than one different entry points, reflecting more than one level of ability.	The program provides several entry points, reflecting several levels of ability.	The program provides a wide range of entry points, reflecting many initial levels of ability.
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2. Provision for various rates of student learning

All students are intended to follow the same steps at the same rate.	Most students are intended to follow the same steps at the same rate, but some provision has been made for exceptional cases.	Several different combinations of steps and rates are possible to enable students to proceed at several different speeds.	The progression rate could vary widely, depending on the student, from a careful repetition of similar concepts to a rapid movement from the simple to the advanced.
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3. Provision for individual interests

A great variety of activities encompassing many different interests is provided.	Some variety of activities is provided.	Most students are intended to follow the same set of activities, but some provision has been made for exceptional cases.	All students are intended to follow the same set of activities.
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4. Provision for various types of learning behavior

<p>A range of behaviors is required, from simple recall to more complex operations.</p>	<p>The activities call for several different kinds of learning behavior.</p>	<p>Most of the intended behavior is of one type, with one or two exceptions.</p>	<p>All activities call for the same type of learning behavior, whether simple recall, comprehension, application, analysis, synthesis, or evaluation.</p>
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5. Use of various learning media

<p>All activities require the use of the same media by the child, whether concrete models, written explanations, illustrations, or oral reports.</p>	<p>Most of the activities require the use of the same media by the child, with one or two exceptions.</p>	<p>Several different media may be used by the child.</p>	<p>A wide variety of media may be used by the child, from concrete models to more abstract forms.</p>
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6. Provision for various social situations

<p>The child always works in the same social situation, whether always individually, in a small group, or with the class.</p>	<p>The child usually works in the same social situation, with one or two exceptions.</p>	<p>Some variety of social situations has been provided, although one situation is frequently repeated.</p>	<p>The child works in various social situations at various times.</p>
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7. Provision for the child to relate to the peculiarities of his own community situation

The activities involve many relations with, and applications to, the local community.	Some references are made in the activities to the local situation.	Most activities are unrelated to the local situation, with one or two exceptions.	The activities are not related to the local community at all, but are general in nature.
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B. Response to required content

1. Provision for educational experiences enabling the child to relate the members of one set to another, using ideas of correspondence and mapping

Most activities are only vaguely related to the above concepts.	Some activities are closely related to the above concepts.	Most activities are closely related to the above concepts.	Every activity is directly related to the above concepts.
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2. Inclusion of educational experiences enabling the child to interpret and develop graphs, charts, maps, models and other forms of representation

The program includes activities related to none of the above concepts.	The program includes activities related to one or two of the above concepts.	The program includes activities related to most of the above concepts.	The program includes activities related to all of the above concepts.
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3. Provision for evaluation of the acquisition of these concepts

No evaluation is provided for.	Very little evaluation is provided for.	Some, but not a complete, evaluation is provided for.	An initial evaluation of ability, an ongoing evaluation during the learning activities themselves, and a final evaluation are provided for.
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C. Response to ease of implementation requirement

1. Cost of implementation of the program

Considerable expenditures would be necessary to implement this program.	Several non-routine expenditures would be necessary to implement this program.	Some non-routine expenditures would be necessary to implement this program.	No unusual expenditures would be necessary to implement this program.
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2. Administrative problems inherent in implementation of the program

The program would cause no scheduling or organizational problems.	The program could be implemented with few scheduling or organizational problems.	The program if implemented would result in some scheduling or organizational difficulties.	The program if implemented would cause serious scheduling or organizational difficulties.
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3. Adaptability of the program to various teacher preferences

In order to implement the program, all teachers would have to conform to one teaching pattern.	In order to implement the program, all teachers would have to conform to the basic teaching pattern, with one or two exceptions.	The program requires some quite specific teacher behaviors, but also accomodates some variety of teaching patterns.	A wide range of teacher preferences could be accomodated in this program.
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4. Clarity of description

The program is described clearly enough to be implemented without any problems of interpretation.	The program is fairly clearly described and could be implemented with only a few problems of interpretation.	The program is vaguely described and if implemented would cause some serious problems of interpretation.	The program is described in a very confusing manner and so would be extremely difficult to implement.
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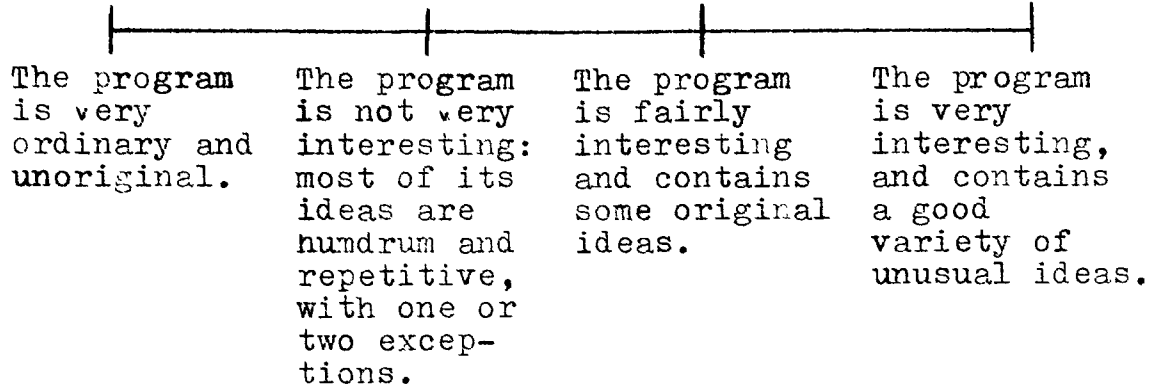
D. General organization of plan

1. Logic and organization of program

The organization of the program is poor: it is difficult to follow.	The organization of the program is fair: it is difficult to follow because of several poorly placed or disorganized sections.	The organization of the program is good, with only one or two sections poorly placed or disorganized.	The program is logically organized and so is easy to follow.
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E. Variety and originality of plan

1. Creativity and interest level of the program



APPENDIX 6

RAW SCORES

APPENDIX 6

RAW SCORES

Group	Condition	Score		Average Score
		Judge 1	Judge 2	
1	1	19.00	20.00	19.50
2	2	19.00	21.50	20.25
3	4	31.50	25.50	28.50
4	2	30.67	26.50	28.59
5	3	25.50	25.60	25.55
6	4	24.00	24.00	24.00
7	4	23.00	28.00	25.50
8	4	21.00	21.50	21.25
9	4	33.00	29.50	31.25
10	3	37.50	31.50	34.50
11	3	25.50	26.00	25.75
12	3	22.00	23.50	22.75
13	4	27.00	28.50	27.75
14	1	19.50	15.50	17.50
15	2	18.00	15.00	16.50
16	3	22.50	18.00	20.25
17	3	21.50	23.00	22.25
18	3	15.50	16.00	15.75
19	2	24.00	21.00	22.50
20	2	28.50	23.50	26.00
21	1	16.00	18.00	17.00
22	4	32.00	27.00	29.50
23	2	28.50	28.00	28.25
24	1	20.00	22.00	21.00
25	1	21.50	20.50	21.00
26	4	33.00	27.00	30.00
27	3	32.00	30.00	31.00
28	1	13.50	12.50	13.00
29	2	25.00	25.50	25.25
30	1	11.50	13.50	12.50
31	2	23.50	28.50	26.00
32	1	18.00	22.50	20.25
33	4	30.00	24.00	27.00
34	2	21.50	24.00	22.75
35	3	28.50	32.50	30.50
36	1	16.17	18.50	17.34

APPENDIX 7

ABSTRACT OF

The Effect of Procedural Planning  
and Brainstorming Techniques on Group  
Performance Using a Curriculum Task

## APPENDIX 7

### ABSTRACT OF

#### The Effect of Procedural Planning and Brainstorming Techniques on Group Performance Using a Curriculum Task<sup>1</sup>

Derived from a concern over the lack of empirically-based guidelines accompanying the recent push in Ontario for teacher curriculum development in all areas, this study examined three methods of improving teacher planning.

The phase theory of group interaction implied that procedures designed to increase group effectiveness in the orientation, alternative generation, and critical choice phases of problem solving would increase overall group task performance as well. The techniques of the preplanning of problem-solving strategy by group members and brainstorming were therefore tested, both individually and in combination, in relation to group performance on a curriculum task.

It was hypothesized that groups which preplanned their problem-solving strategies, used brainstorming techniques, or used both of these procedures would be more effective in their curriculum deliberations than groups which did not follow any of these procedures, with the greatest difference occurring between the combination groups and the controls.

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<sup>1</sup> Bonnie L. Viney, master's thesis presented to the School of Graduate Studies of the University of Ottawa, Ontario, June 1977, x-87p.

Thirty-six groups of two to five teachers from three school boards in the Ottawa area were asked to plan a mathematics unit on graphing at the junior level according to specifications in the current Ministry guidelines. Each of these teacher groups was randomly assigned to one of four treatments.

In the control condition, groups were given no directions as to how to plan the unit. In the procedural planning condition, however, teachers were asked to spend the first five minutes determining exactly what problem-solving strategies they would follow. Groups in the brainstorming condition were directed to implement this technique of rapid, non-critical idea generation at any point in their planning where ideas were being sought. Finally, in the combination condition teachers were instructed to both preplan their problem-solving strategies and to use brainstorming techniques.

The thirty-six written unit plans were evaluated by two impartial judges using a rating scale derived directly from the requirements inherent in the Ministerial guidelines themselves.

Analysis of the group scores revealed a significant increase in effectiveness over the control groups by both procedural planning and brainstorming groups, with the

greatest increase occurring in the combination condition. It was concluded that the experimental interventions made were successful in improving group performance on a curriculum task.

The following recommendations were made for educational practice. Teachers voluntarily developing curriculum in small groups in a school setting could significantly increase their effectiveness by resisting the impulse to begin immediately to plan units. Instead, the first five minutes of deliberation should be spend preplanning group strategy. In addition, throughout their deliberations, whenever ideas are being sought, teachers should implement a brainstorming technique. These procedures would considerably improve the plans made.

It was suggested that, if teacher curriculum development is indeed the key to responsive schools, capable of adapting to both a wide range of individual needs and frequently changing societal concerns, then the training of teachers in techniques such as these, designed to increase planning effectiveness, must receive a high priority.