Effects of Explicit Discussion Guidelines and an Acceptance Goal on the Acceptance and Quality of Group Decisions.

Courtland Merlyn Chaney

Louisiana State University and Agricultural & Mechanical College

Follow this and additional works at: https://digitalcommons.lsu.edu/gradschool_disstheses

Recommended Citation

This Dissertation is brought to you for free and open access by the Graduate School at LSU Digital Commons. It has been accepted for inclusion in LSU Historical Dissertations and Theses by an authorized administrator of LSU Digital Commons. For more information, please contact gradetd@lsu.edu.
INFORMATION TO USERS

This was produced from a copy of a document sent to us for microfilming. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the material submitted.

The following explanation of techniques is provided to help you understand markings or notations which may appear on this reproduction.

1. The sign or “target” for pages apparently lacking from the document photographed is “Missing Page(s)”. If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting through an image and duplicating adjacent pages to assure you of complete continuity.

2. When an image on the film is obliterated with a round black mark it is an indication that the film inspector noticed either blurred copy because of movement during exposure, or duplicate copy. Unless we meant to delete copyrighted materials that should not have been filmed, you will find a good image of the page in the adjacent frame.

3. When a map, drawing or chart, etc., is part of the material being photographed the photographer has followed a definite method in “sectioning” the material. It is customary to begin filming at the upper left hand corner of a large sheet and to continue from left to right in equal sections with small overlaps. If necessary, sectioning is continued again—beginning below the first row and continuing on until complete.

4. For any illustrations that cannot be reproduced satisfactorily by xerography, photographic prints can be purchased at additional cost and tipped into your xerographic copy. Requests can be made to our Dissertations Customer Services Department.

5. Some pages in any document may have indistinct print. In all cases we have filmed the best available copy.
CHANEY, COURTLAND MERLYN

EFFECTS OF EXPLICIT DISCUSSION GUIDELINES AND AN ACCEPTANCE GOAL ON THE ACCEPTANCE AND QUALITY OF GROUP DECISIONS

The Louisiana State University and Agricultural and Mechanical Col. PH.D. 1980

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106
EFFECTS OF EXPLICIT DISCUSSION GUIDELINES
AND AN ACCEPTANCE GOAL ON THE ACCEPTANCE
AND QUALITY OF GROUP DECISIONS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Psychology

by

Courtland Merlyn Chaney
B.S., Louisiana State University, 1974
M.A., Louisiana State University, 1978
August, 1980
I want to thank the chairman of my dissertation committee, Dr. Irving Lane, for his never ending patience, encouragement and advice which enabled me to successfully complete the demanding task of researching and writing a dissertation. This thanks is also in appreciation for everything you did during my graduate school years. You helped to make even the most difficult moments palatable.

I would also like to express my gratitude to the other members of my dissertation committee, Drs. Laurence Siegel, Robert Mathews, Don Williamson and Donald Hoffeld. Your willingness to help and your contributions to my personal and professional development are greatly appreciated.

I also want to give a special thanks to Robert (Bob) Reber and Steve Buco. At an obvious level this thanks is for the assistance you freely gave to me during the data collection and analysis phases of the dissertation research. At a less obvious level I want to thank you for the spirit-raising antics we enjoyed during this last year and, more importantly, for your friendship.

Kathryn Reid, what can I say? I, of course, want to thank you for typing the final draft of this dissertation; but there is so much more to say. A friend like you is a rarity. I love you and value your friendship more than you can imagine.

Finally, and most importantly, I want to thank my loving parents, Merlyn and Virginia Chaney. This dissertation is dedicated to the two of you. A person could not ask for parents better than you. Thank you for everything, but most of all, thank you for just being you.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE PAGE</td>
<td>i</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>METHOD</td>
<td>19</td>
</tr>
<tr>
<td>RESULTS</td>
<td>29</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>40</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>44</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>47</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>48</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>49</td>
</tr>
<tr>
<td>APPENDIX D</td>
<td>50</td>
</tr>
<tr>
<td>APPENDIX E</td>
<td>52</td>
</tr>
<tr>
<td>APPENDIX F</td>
<td>53</td>
</tr>
<tr>
<td>APPENDIX G</td>
<td>54</td>
</tr>
<tr>
<td>APPENDIX H</td>
<td>55</td>
</tr>
<tr>
<td>VITA</td>
<td>56</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adjusted Mean Acceptance Scores as a Function of Explicitness of Instructions and Sex</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Analysis of Covariance Summary Table Adjusted by Mean Rank Talent for the Comparison of Explicitness and Sex Conditions as Factors Influencing Individual Acceptance Scores</td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>Adjusted Mean Individual Improvement Scores as a Function of Explicitness of Instructions and Sex</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Analysis of Covariance Summary Table Adjusted by Mean Rank Talent for the Comparison of Explicitness and Sex Conditions as Factors Influencing Individual Improvement Scores</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>Mean Group Improvement Scores as a Function of Explicitness of Instructions and Sex</td>
<td>35</td>
</tr>
<tr>
<td>6</td>
<td>Analysis of Variance Summary Table for the Comparison of Explicitness and Sex Conditions as Factors Influencing Group Improvement Scores</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>Mean Time (in minutes) Required by Groups to Solve the NASA Problem as a Function of Explicitness of Instructions and Sex</td>
<td>37</td>
</tr>
<tr>
<td>8</td>
<td>Analysis of Variance Summary Table for the Comparison of Explicitness and Sex Conditions as Factors Influencing the Time Required by Groups to Solve the NASA Problem</td>
<td>38</td>
</tr>
</tbody>
</table>
ABSTRACT

EFFECTS OF EXPLICIT DISCUSSION GUIDELINES AND AN ACCEPTANCE GOAL ON THE ACCEPTANCE AND QUALITY OF GROUP DECISIONS

A study was conducted using a total of 144 male and female college undergraduates to determine whether an explicit statement of the group goal of acceptance along with specific discussion guidelines on how to achieve this goal could have a facilitative effect on the quality and/or acceptance of the solution reached by a group. Hypotheses were generated from Hoffman's hierarchical model of the group problem-solving process and previous research. The results revealed nonsignificant increments in individual acceptance, individual and group improvement, and time required by groups to reach a decision, as a result of providing a greater amount of explicitness of the group goal and procedures promoting attainment of that goal. The results also revealed a significant main effect for sex on group improvement scores which indicated that male groups were more effective than female groups. Correlations between self-report measures of satisfaction and a behavioral measure of acceptance indicated that the two measures are highly correlated. The results are interpreted as providing modest support for the importance of the implicit-explicit dimension of Hoffman's hierarchical model. It was concluded that more extensive training in the use of the present intervention technique may be needed to maximize its benefits.
INTRODUCTION

The survival and progress of organizations depend upon the effectiveness of their decision-making processes. In discussing the characteristics of an effective decision Maier (1952; 1963) indicated that there were two different dimensions that could be considered relevant: (1) the objective quality of the decision and (2) its acceptance by the persons who have to implement it. Other theorists (Hoffman, 1979a; Vroom and Yetton, 1973) have also referred to the distinction between the quality and acceptance of decisions. Moreover, there is evidence that managerial personnel can distinguish between quality and acceptance and the different degrees of priority of these two elements in different decision situations (Maier and Hoffman, 1964; Newstrom, 1972).

The present research focused on the dimension of acceptance in problem solving. More specifically, it was concerned with determining whether an explicit statement of the group goal of acceptance along with specific guidelines on how to achieve this goal would have an effect on the quality and/or acceptance of the solution reached by the group. Before discussing the present research in detail, a review of the relevant literature in group problem solving will be given.

Review of Literature

In Maier's (1950) original research on problem solving, he focused his attention on discussion leadership and the democratic leadership technique. He found that a leader, if skilled and possessing ideas, could conduct a discussion so as to obtain a quality of problem solving that surpasses that of a group working
with a less skilled leader. He also concluded that even an unskilled leader using the democratic leadership technique could obtain cooperation and acceptance of the solution as well as improve solution quality. Maier and Solem (1952) found that a discussion leader who conducted a discussion which permitted the expression of minority opinions could contribute to the quality of group thinking. This initial work set the stage for subsequent research on the quality and acceptance of solutions by problem solving groups. Since research frequently has dealt with the quality and acceptance dimensions separately, the survey of literature pertaining to each dimension will be presented separately.

Quality. Maier and Maier (1957) compared a developmental and a free type of discussion leadership with respect to the degree to which they influenced the quality of the group decision. The developmental discussion technique requires that the group focus and decide on sub-topics in the discussion before making the final decision. The developmental discussion technique was found to be superior to the free discussion technique with respect to decision quality. Maier and Maier (1957) believed that the obtained difference would have been greater if the leaders had been more highly skilled, and subsequent research supported the use of trained developmental discussion leaders to improve solution quality (Maier and Hoffman, 1960b).

Maier (1960) stated that an impersonal and acceptable evaluation process was needed to help provide for the selection of high quality solutions. Maier (1960, 1963) thus developed his solution screening technique which uses screening principles to evaluate the possible solutions objectively and impersonally in an effort to upgrade solution quality. The screening principles are classified as negative and positive. The two negative principles that screen out solutions are (1) solutions transferred from other problems should be rejected; and (2) solutions that are supported by facts or interpretations of facts that are challenged by
other group members should be rejected. The two positive principles that help select solutions for consideration may be stated as follows: (1) solutions founded upon unchallenged facts or unchallenged interpretations of facts (taken from the problem situation) should be selected for consideration and evaluation; and (2) when exceptions to a trend in expected results can be satisfactorily explained, solutions based upon the trend should be selected for further consideration. Solutions that are selected by the positive principles are then evaluated during group discussion in terms of cost, the possibility of integrating solutions, the strength of the factual information supporting the solutions, and acceptability to group members. Maier (1960) states that this evaluation process is designed to make use of group discussion only after the screening process has forced a thorough consideration of the facts in the situation. His research indicates that solution quality can be upgraded through the use of this technique (Maier, 1960).

In another attempt to develop a means for improving solution quality, Maier and Hoffman (1960a) asked groups to solve a problem twice on the assumption that the second problem-solving session would give the groups the opportunity to explore the different possible solutions more completely because they would be free of the need to make a rapid decision. A human relations problem was used in this study and the solutions to the case problem were classified as old, new or integrative. A significantly higher proportion of second than first solutions was found to be of the integrative type which was considered to be the highest quality. There was no significant difference in group member satisfaction for the first and second solutions though there was a slightly higher mean satisfaction for groups which arrived at integrative solutions (Maier and Hoffman, 1960a).

Maier and Hoffman's (1960a) findings led them to conclude that groups are solution-minded and that this interferes with effective problem solving because
people are more concerned with making a decision than with carefully evaluating the problem (Maier, 1963; Maier and Solem, 1962). The desire to reach a solution quickly is termed solution-mindedness, while concern for exploring the character of the problem situation thoroughly prior to selecting a solution is termed problem-mindedness (Maier and Solem, 1962). Maier and Solem (1962) attempted to test the hypothesis that the tendency for groups to evaluate solutions quickly, in their haste to reach a solution, interferes with effective problem solving. The procedure used by Maier and Solem (1962) was designed to improve the quality of group decisions by delaying the group's evaluation of obvious alternatives. The leaders of the problem-solving groups in the experimental condition were instructed to explore the factors associated with the problem thoroughly with their group members before settling on a solution. The solutions reached by the groups in the control and experimental conditions were classified as old, new or integrative, with integrative considered to be the type of highest quality. The effect of the experimental instructions was to produce more than three times as high a proportion of integrative solutions. The results were interpreted as support for the position that procedures which prevent immediate selection of a solution and which cause the group to examine decision-making situations as problems to solve tend to increase the number of alternative solutions considered by the group and thus increase the quality of group problem solving (Maier and Solem, 1962).

The composition of problem-solving groups was the focus of some of the research dealing with solution quality (Hoffman, 1959; Hoffman and Maier, 1961a). Hoffman (1959) found that groups composed of people heterogeneous with respect to personality were superior in solving problems to groups composed of people homogeneous with respect to personality. This finding was later replicated with a variety of problems (Hoffman and Maier, 1961a). Hoffman and
Maier (1961a) also reported that mixed-sex groups tended to produce higher quality solutions than all-male groups.

Hoffman, Harburg and Maier (1962) attempted to test the hypothesis that conflict generated by increasing the resistance of subordinate members of a group to a solution offered by a superior could increase the frequency of high quality solutions. The results obtained in this role-playing experiment supported this hypothesis. This led Hoffman et al. (1962) to conclude that the expression and consideration of opposing points of view in an atmosphere of mutual influence could help in achieving problem solutions of both high quality and acceptance. In a later study Maier and Hoffman (1965) concluded that disagreement in group problem solving could lead to hard feelings or innovation depending primarily upon the attitude of the discussion leader. Maier and Hoffman's (1965) research utilized a role-playing format in which a leader attempted to induce three subordinates to accept a change in their work procedure. Innovative solutions (those of the highest quality) were most frequently obtained in groups in which the leaders viewed some of their subordinates only as sources of ideas and not as problem workers. Maier and Hoffman (1965) also reported acceptance (as measured by the participants' estimate of the solution's effectiveness) invariably to be a higher for the innovative solutions than for either of the lower quality solutions and it was positively related to the leader's perception of his subordinates as idea people. Though the measure of acceptance used here could be interpreted as a measure of perceived solution quality, it was interpreted as evidence that the quality of the solution could provide a source of satisfaction.

The Hoffman et al. (1962) emphasis on the expression and constructive resolution of conflicting points of view (which is termed substantive conflict) in the realization of a group's fullest potential is consistent with the position of
others (Hall and Williams, 1966; Hoffman, 1979b). Hall and Williams (1966) conducted a study which was designed to compare the decision-making performance of established and ad hoc groups under conditions of high and low substantive conflict. Substantive conflict was found to be facilitative in established groups but resulted in little differential performance in ad hoc groups. Hall and Williams (1966) concluded that ad hoc groups respond to conflict in a manner designed to bring about compromise thus avoiding disagreements; whereas, established groups seem to view conflict as symptomatic of unresolved issues and use procedures designed to bring about the constructive resolution of those differences.

In addition to the research discussed above, which was primarily concerned with discussion techniques, group characteristics and the skill and/or attitude of the leader, Maier and his associates (Hoffman and Maier, 1961b; Maier, 1970a; Maier and Casselman, 1970a, 1970b, 1971; Sashkin and Maier, 1971) have devoted attention to individual and sex differences in problem solving. Hoffman and Maier (1961b) noted that problem-solving research has consistently shown males to be better problem solvers than females. Maier and Casselman (1970b) attempted to relate SAT scores and problem-solving ability in males and females. Their results indicated that females scored significantly lower than males on the SAT Math and on insight problems but did equally well on the SAT Verbal. They interpreted their results as indicating that the superior performance of males on the insight problems might be due to a qualitative difference in cognitive styles between males and females.

In subsequent research on sex differences in problem-solving ability, Maier and Casselman (1971) found additional evidence that males are better problem solvers; however, they also reported that sex differences in problem solving may depend on the type of process required by the problem. Maier and Casselman
(1971) used different types of problems, some requiring the generation of key ideas (the process of idea-getting, Maier, 1963; Maier and Casselman, 1971); and others requiring the ability to make fine distinctions. Their conclusion was that there is a sex difference in problem solving and that the difference resides more in women's failure to make essential distinctions in aspects of the problem than in their inability to generate ideas.

The improvement of decision-making performance by means of group dynamics (laboratory) training and a normative intervention in the group process was the focus of research by Hall and Williams (1970) and Hall and Watson (1970). Hall and Williams (1970) found that groups composed of individuals who had undergone group dynamics training consistently performed more effectively than untrained groups on measures of decision quality, utilization of resources and creativity. In summarizing the elements of effective group functioning identified in previous research, Hall and Williams (1970) indicate that groups will perform more effectively when:

1. Democratic or "participative" leadership is employed so that:
   a. the interpersonal climate will be relatively free of power-based constraints;
   b. all members feel that they share equally in opportunities for influencing the direction of group effort;
   c. there is opportunity for "emergent" leadership based on relevant expertise and group needs.

2. Flexible patterns of communication are used so that:
   a. all members are able to participate equally and at will;
   b. minority opinions are encouraged and, consequently, more likely to be voiced.

3. A cooperative "problem-solving" approach to discussion is employed rather than a competitive "win-lose" approach, so that:
   a. disagreements may be viewed as substantive rather than affective and, therefore, tolerated;
   b. individual members become more sensitive to the ideas and reactions of others.

4. Members deal openly and candidly with one another so that:
   a. "hidden agendas" or personal needs do not distort the handling of the task;
   b. feelings of resistance or doubt can be discussed and resolved at the time they are experienced, rather than remaining latent barriers to commitment.
Decision techniques which favor a sharing of responsibility via a protection of individual rights are used, rather than techniques which place the responsibility clearly in the hands of but a portion of the group membership, so that:

a. all share equally the burden of performing the necessary task and social-maintenance functions required by the above actions;
b. all members feel a sense of responsibility for group success.

Acceptance. The issue of the acceptance of the solution by group members was the sole focus of a study conducted by Hoffman and Maier (1959). This study was concerned with the problem of how to distribute a reward fairly among the members of a group. In order to examine the results of permitting groups to resolve a problem of fairness, a problem which involved a conflict among individual needs in a group was needed. Hoffman and Maier (1959) created such a problem and presented it to groups of students in an undergraduate psychology course. The problem involved the distribution of points, which would be added to the students' final grades, among the group members. The points awarded to each group could not be divided evenly and a failure to agree on an allocation of points would have resulted in a net loss of points to the entire group. Acceptance of the group's decisions as measured by reported satisfaction with the solution was reported as high. Hoffman and Maier (1959) reported that satisfaction with the solution was principally related to the extent to which the students felt free to express their ideas about the issue and to their satisfaction with the amount of influence they had over the solution.

In a subsequent study, Hoffman and Maier (1961a) again found satisfaction with solutions to be strongly correlated with the members' satisfaction with the amount of influence they had over the solution. Hoffman, Burke and Maier (1965) noted that factors such as amount of participation, amount of felt psychological participation as well as the members' feelings of satisfaction with the amount of influence they had over the solution have been reported as related to the acceptance of the solution on the part of group members. These various
explanations all seem to imply that the level of satisfaction (and thus acceptance) is independent of solution quality (Hoffman, Burke and Maier, 1965); though there is some evidence that the quality of the group solution can provide a further source of satisfaction (Maier and Hoffman, 1960a; Maier and Hoffman, 1965).

The relative contributions of participation and influence to the acceptance of decisions in problem-solving groups were examined by Hoffman, et al. (1965). Twenty groups solved the Assembly Problem which involves a seven-person group that assembles carburetors in a series of sequential operations. An instance of inadequate production is described and the problem involves discovering the best means of obtaining maximum productivity. The comments of group members about different solutions were recorded; and their reports of their satisfaction with their influence over the solution and the solution itself were obtained after the discussion. The group members' total participation, attempted influence, and actual influence over the solution were each correlated with two questionnaire measures of satisfaction. Individual responses to two questions ("How satisfied are you with the solution reached by your group?" and "How satisfied are you with the amount of say or influence you had over the solution reached by your group?") were made on a six-point scale ranging from very dissatisfied to very satisfied. Only the group members' actual influence, as measured by the number of supportive statements they made about the solution adopted by the group, was significantly correlated with their satisfaction. Hoffman et al. (1965) concluded that a group member will be satisfied the more he/she expresses support for the solution adopted by the group; and group members should thus be encouraged to express their opinions about solutions both to increase acceptance and to improve the quality of group decisions.
Hall and Watson (1970) assumed that much of a group's performance, whether effective or ineffective, is determined by the attitudes of group members toward the group's potential and their shared perceptions of what constitutes appropriate member behavior. Thus Hall and Watson (1970) conducted a study to determine if groups instructed in how to achieve consensus could perform better than uninstructed groups. The instructions given to the experimental groups provided discussion guidelines which were designed to define and legitimize certain group member behaviors considered necessary in the constructive resolution of conflict and in the achievement of consensus. The guidelines, which were presented in written form and then elaborated upon verbally, included the following: (1) opinions should be presented as lucidly and logically as possible though you should avoid arguing for your position, (2) view differences of opinions as natural and helpful rather than as a hindrance, (3) do not change your mind only to avoid conflict, and (4) explore the reasons underlying apparent agreement to make sure that people have arrived at similar solutions for the same or complementary reasons before incorporating such solutions in the group decision (Hall and Watson, 1970).

Hall and Watson's (1970) results indicated that the instructed groups produced qualitatively superior decisions and that this performance increment was due to the group members' willingness to abandon individual pre-discussion decisions in favor of novel group-generated judgements. The Hall and Watson (1970) study is unique in that it was designed to modify interpersonal aspects of the group decision-making process. Another significant characteristic of this study is that the problem selected by Hall and Watson (1970) was the NASA Moon Survival Problem which can be scored according to an objective criterion of correctness. This is of interest because most of the research on solution quality had been previously conducted with problems for which no objectively correct answer exists.
The Problem-Solving Process. As the research on the quality and accept-
ance of group generated solutions proceeded, the focus of the research shifted to
the problem-solving process itself (Hoffman, 1965; 1978; 1979b; Hoffman and
Maier, 1964; 1967). Hoffman and Maier (1964) developed a method for
quantifying the problem-solving interaction in a group. They developed their
system because previous systems (e.g. Bales, 1950) for observing the group
process coded general types of behaviors without regard to their specific
relevance to the problem under discussion. Hoffman and Maier (1964) wanted to
relate the statements of the group members directly to the solution finally
adopted by the group. They distinguished among several different types of
remarks made during the discussion. The different types of remarks included
descriptions of solutions, arguments supporting a given solution, expressions of
agreement and criticism, etc. The tabulation of the number of favorable and
unfavorable remarks made about a given solution provided a measure of the
valence (cf. Lewin, 1947) of that solution for each individual and thus the group.
Their results indicated that the most important factor in determining the
members' acceptance of a solution (as measured by their rated satisfaction with
the group's solution) was the amount of influence they actually exerted over the
final decision (Hoffman, Burke and Maier, 1965; Hoffman and Maier, 1964; 1967).
The actual influence each subject exerted over the adopted solution was
measured in terms of the number of favorable comments each subject made
toward the solution during the course of the group discussion. This finding was
interpreted to suggest that acceptance can be increased if each group member is
encouraged to express his/her feelings about the solution to be adopted
(Hoffman, 1978; Hoffman and Maier, 1967). Hoffman (1978) indicates that the
expression of favorable opinions will presumably promote commitment to the
decision. He also notes that the expression of unfavorable feelings may be
facilitative by relieving tension and thus resistance and/or by promoting a search for new and possibly superior alternatives.

The research of Hoffm an and Maier (1964, 1967) set the stage for the subsequent elaboration of the valence model by Hoffman (1979b). Hoffman's (1979b) summary of the research conducted on the valence model culminates in his presentation of a hierarchical model of the group problem-solving process (Hoffman, 1979c). Hoffman (1979c) begins the presentation of his model by defining a group as an open system in which many processes occur simultaneously. The model incorporates three dimensions: (1) task-maintenance, (2) implicit-explicit, and (3) localized-normative.

The task-maintenance processes of group functioning that Hoffman (1979c) discusses also have been addressed by others (Bales, 1950; Benne and Sheats, 1948; and Schein, 1969). The task processes identified refer to those processes directed toward solving the problem. Hoffman (1979c) includes problem-solving procedures and, at the most general level, the stages of problem solving in his task process category. In discussing task functions more specifically, Schein (1969) identifies certain task-related behaviors that he believes must occur to some degree for the group to progress. These behaviors include opinion seeking and giving, information seeking and giving, clarifying and elaborating, summarizing and consensus testing. The maintenance processes identified by Hoffman (1979c) refer to those processes concerned with the ability of the group members to interact effectively with each other (Bales, 1950; Benne and Sheats, 1948; Collins and Guetzkow, 1964; Schein, 1969). Schein (1969) indicates that it is necessary for group members to be concerned with the maintenance of good relationships in order for the group to be an effective problem-solving instrument. Group maintenance processes include activities which ensure that members have an opportunity to make contributions, encourage members to
make their points, help members feel that the group climate is one of acceptance, and which permit the expression of conflict and the resolution of disagreement.

The implicit-explicit dimension identified by Hoffman (1979c) refers to the observation that problem-solving procedures and task-maintenance processes occur during problem solving whether the group members are aware of them or not. Hoffman (1979c) elaborates on this particular point by identifying an implicit level and a manifest level of group functioning. He indicates that the movement of group discussion proceeds from stage to stage implicitly by means of the valence-adoption process. That is to say, alternative solutions accumulate differing valences at an implicit level during the course of the group discussion, and it is this accumulation of valence that ultimately results in the selection of a solution. The task processes can be made explicit when group members consciously choose to use a specific task-related procedure (e.g., brain-storming, Osborn, 1957) or when, for example, a member refers to a stage explicitly by saying, "First, we have to define the problem." In either case, the explicitness of the procedure allows the group members to make a conscious and shared choice to proceed in a given manner.

The implicit-explicit dimension identified by Hoffman (1979c) is also considered relevant to the maintenance processes. In discussing maintenance processes and the acceptance of solutions by group members, Hoffman (1979c) indicates that norms regulating the acceptance of members' feelings and differential goals are fundamental to the acceptance of group-generated solutions. He considers norms which govern group behavior to be the procedures for solving the maintenance problems of groups. As with task procedures, these norms are considered to operate implicitly or explicitly.
It is the reference to implicit and explicit norms that addresses the localized-normative dimension (Hoffman, 1979c). Hoffman (1979c) notes that, though it is convenient to think of a group as a set of people who operate in a uniform manner, the relationships of each individual to the group are often quite different. When events or dynamics which occur in the group only affect one or a few members, then those events or dynamics are said to be localized. This is often the case when the group discussion procedures and/or expected group behavior is dealt with at an implicit level. That is, when task procedures and maintenance processes are not explicitly addressed in the group, the appropriateness of different procedures and behaviors is left to the interpretation of the individual group members (i.e., localized). If, on the other hand, the procedures and maintenance processes can be dealt with explicitly, then those events or dynamics will be based on a mutually understood group norm (i.e., normative). Hoffman (1979c) indicates that group norms which permit the open expression of feelings, which promote substantive conflict, and which handle differences of opinions as opportunities for innovation often produce creative solutions with substantial member acceptance.

In discussing implicit and explicit group processes, Hoffman (1978; 1979b) indicates that the importance of making things explicit cannot be overemphasized. The principal advantages of explicitness are that it enhances the understanding among group members and it helps to focus their energies on the same set of issues. In discussing explicit processes considered advantageous to the group problem-solving process, Hoffman (1979b) noted the following: (1) the willingness of leaders and members both to ask and to entertain questions, (2) the explicit solicitation of members' opinions and feelings toward the end of the meeting to ensure consensus, (3) the encouragement of group members to state the advantages and disadvantages they see in a solution, and (4) the presence of a
norm permitting the discussion of such norms. The development and maintenance of a norm to discuss norms is also an objective of some organizational consultants (Argyris, 1973; Hoffman, 1979a; Schein, 1969).

LSU Group Problem-Solving Research. A final study of interest in this review of literature is an unpublished one conducted at Louisiana State University (Lane, Mathews, Chaney, Errfmeyer, Reber, and Teddlie, 1980). Lane et al. (1980) designed their study to determine the effects of (1) having an acceptance goal (explicitly stated or absent), (2) having a quality goal (explicitly stated or absent) and (3) sex (male and female) on the acceptance and quality of group decisions. Their research utilized the NASA Moon Survival Problem (Hall and Watson, 1970). This task was selected for use in the research because it could be scored according to an objectively correct answer, thus yielding an objective measure of solution quality (Hall and Watson, 1970).

A unique feature of the Lane et al. (1980) study pertains to the dimension of solution acceptance. Prior to the research at LSU, acceptance invariably had been assessed via self-report measures of satisfaction with the solution, with the opportunity to influence the group solution, and/or with the amount of influence the subject had over the group solution (Hoffman, 1979b; Hoffman, Burke and Maier, 1965). The LSU research, however, used a behavioral measure of acceptance of the group solution. In this research, the subjects first solved the NASA problem alone. Then the subjects were placed in a group setting and asked to solve the problem as a group. Finally, when the subjects indicated that they had reached a group solution, they were asked to solve the problem again individually. The extent to which their third solution was the same as or similar to their group's solution was considered an indication of whether the group members accepted their group's solution as their own. In addition, by having subjects solve the problem as second time individually, Lane et al. (1980) were able to
determine how much improvement each subject demonstrated as a result of the group problem-solving session.

Their results indicated that the explicit instructions to reach the solution that was most acceptable to everyone resulted in significantly greater decision acceptance and in marginally significant improvement in individual and group solution quality. However, they found no differences in solution quality or acceptance as a function of explicit instructions to strive for the best solution. Finally, no sex differences in group problem solving quality or acceptance were found in the Lane et al. (1980) study. The significant difference that Lane et al. (1980) found in acceptance as a function of stating explicit acceptance instructions in consistent with the importance that Hoffman (1979b) attributes to making group procedures and objectives explicit.

The Present Study

Origin and Purpose. One possible reason for Lane et al. (1980) obtaining only marginally significant higher solution quality as a result of making the goal of acceptance explicit may be that their subjects were not aware of discussion procedures that could be used to strive effectively for acceptance. Therefore, the present research was designed to determine if the explicit statement of the group goal of acceptance plus the presentation of explicit discussion guidelines on how to achieve it could have an increased effect on both the quality and acceptance of group decisions.

Characteristics. In considering both the previous and the present research on solution quality and acceptance, two factors appear prominent. First, with the exception of the behavioral measure of acceptance used in the LSU study (Lane, et al., 1980), acceptance invariably has been assessed via self-report measures of satisfaction with the solution or of satisfaction with the amount of influence over the group solution (Hoffman, 1979b; Hoffman, Burke and Maier,
The present study employed both a behavioral measure and self-report measure of acceptance of (or satisfaction with) the group solution in an effort to enhance our understanding of the dimension of acceptance.

Second, most of the research on solution quality has been conducted with problems for which no objectively correct answer exists. This has resulted in the subjective classification of solution quality into categories such as "old", "new", or "innovative" (Maier, 1965; Maier and Hoffman, 1960; Maier and Solem, 1962). Though an effort was made to hold constant the criteria for the classification and evaluation of solutions in past research, a more objective means for assessing solution quality appeared desirable. Thus a problem for which there is an objectively correct answer was selected for use in this study (Hall and Watson, 1970).

Hypotheses. The hypotheses for this study were generated from the implicit-explicit dimension of Hoffman's (1979c) hierarchical model and previous research.

Hypothesis 1: It was hypothesized that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the greater would be the individual acceptance of the group generated solution.

Hypothesis 2: It was hypothesized that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the greater would be the individual improvement in solution quality as a result of participation in the group problem-solving session.

Hypothesis 3: It was hypothesized that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the higher would be the quality of the group solution.
**Hypothesis 4:** It was hypothesized that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the longer would be the group problem-solving session. It was reasoned that any special attention given to the group process, on the part of the group members, as a result of the explicit statement of the group goal and discussion guidelines would require more discussion time.

Finally, because of inconsistent research findings no specific hypotheses were offered concerning sex differences on any of the dependent measures involved in the present study. There is evidence that males are generally better problem solvers than females (Hoffman and Maier, 1961; Maier and Casselman, 1970a; 1970b); however, Lane et al. (1980) found female groups to do as well as male groups on the NASA problem.
METHOD

Subjects The subjects were 72 male and 72 female undergraduates enrolled in psychology classes. The students were volunteers and were given extra credit for their participation in the study.

Design The research employed a 3 (explicitness of instructions) X 2 (sex) experimental design. The three levels of explicitness were: (1) no explicitness — in which neither the goal of the group problem-solving session nor the procedural guidelines were explicit, (2) goal explicitness — in which only the group problem-solving goal (to produce the solution that is most acceptable to everyone) was explicit, and (3) goal plus procedure explicitness — in which both the group goal (acceptance) and the guidelines for achieving it were explicit.

Instruments The problem solving task used in this study was the NASA Moon Survival Problem (Hall and Watson, 1970) which is presented in Appendix A. Limited biographical information (age, sex) was collected from the students and recorded at the top of the NASA answersheet. The task requires the students to think of themselves as members of a space crew which is forced to land on the moon some 200 miles from its rendezvous point. Fifteen items of equipment are identified as intact and undamaged. Students were required to rank these items in order to their importance for survival in allowing the crew to reach the rendezvous point. An expert answer for this task has been obtained from the Crew Equipment Research Section of the NASA Manned Spacecraft Center at Houston, Texas (Hall and Watson, 1970), and therefore, performance on the task can be evaluated on the basis of an objectively correct answer. The correctness of either an individual's or group's rank ordering of the 15 items involved in the
NASA problem can be assessed by summing the absolute value of the deviations of each item in the individual or group rank order from the expert rank order of the items. This summed deviation represents an error score, the magnitude of which is inversely related to decision quality. Thus the NASA problem can provide a numerical index of solution quality ("decision adequacy," Hall and Watson, 1970) at both the individual and group levels. Since individual and group rankings were to be obtained in the present study, both an individual and group answersheet was used (see Appendix A and B). A copy of the NASA problem answer key is presented in Appendix C.

The second instrument which was used in this study was the post-experimental questionnaire which is presented in Appendix D.

Procedure  
Before the students arrived for the experimental session, each of two experimenters had been informed as to which level of explicitness condition he had been randomly assigned to run. When eight students of the same sex arrived for the experiment, four students were randomly assigned to each of the two male experimenters and then each group of students and an experimenter entered their own experimental room.

The procedure for the students in all three conditions began identically. The students were seated in chairs located along the perimeter of the room. The experimenter began by reading the following:

We are interested in the way people solve problems. We are going to ask you to solve a problem, first by yourself and later in a group. Let us start by my reading the problem.

At this point the experimenter distributed a copy of the NASA problem individual answersheet (see Appendix A) to each student and read the problem aloud to the students. After reading the statement of the problem aloud, the experimenter continued by reading the following instructions:
What we would like you to do now is rank the 15 items by yourself in terms of their importance to your survival. Please take about 10 minutes now to complete your rankings.

The students also were instructed to fill out the information blanks at the top of the answer sheet. Upon completing this first ranking of the items, the students were instructed to seat themselves at a round table which was located in the center of the room. The procedure, at this time, varied for each of the three explicitness conditions. The different instructions for each explicitness condition constituted the independent variable manipulation and are described separately below.

**Group Problem-Solving Instructions for the Goal Explicitness Condition.**

The instructions to the students in the goal explicitness condition were as follows:

Now, we would like you to solve the same problem again as a group. Once again we would like you to try to arrive at a ranking of the 15 items, but this time as a group. Please try to arrive at the solution that is most acceptable to all the members of your group. Take as much time as you need, because it is of great importance that your group "strives to produce the solution that is most acceptable to everyone." This goal is so important that I am placing a statement of it on the board and giving you a handout that states this goal as the goal of your group.

At this point the experimenter placed the phrase "strive to produce the solution that is most acceptable to everyone" on the board and he distributed a copy of the "goal explicitness" handout (see Appendix E) to each student. The experimenter then distributed a copy of the NASA problem group answersheet (see Appendix B) to each participant and instructed them to complete the information blanks at the top of the answer sheet. The experimenter then read the following:

Would everyone please record your group's ranking on your group answersheet. Periodically, while your group is working on the problem, I will give you a reminder to keep this goal in mind. (The experimenter then pointed to the statement of the goal on the board and restated it.) Now begin.
During the first ten minutes of the group problem-solving session, the experimenter interrupted the group discussion twice at five-minute intervals and pointed to the statement of the goal on the board stating:

Remember, it is of great importance that your group strives to produce the solution that is most acceptable to everyone. Please continue.

Group Problem-Solving Instructions for the Goal Plus Procedure Explicitness Condition. The instructions to the students in the goal plus procedure explicitness condition were as follows:

Now, we would like you to solve the same problem again as a group. Once again we would like you to try to arrive at a ranking of the 15 items, but this time as a group. Please try to arrive at the solution that is most acceptable to all the members of your group. Take as much time as you need because it is of great importance that your group "strives to produce the solution that is most acceptable to everyone." This goal is so important that I am placing a statement of it on the board and giving you a handout that states this goal as the goal of your group.

At this point the experimenter placed the phrase "strive to produce the solution that is most acceptable to everyone" on the board and he distributed a copy of the "goal plus procedure explicitness" handout (see Appendix F) to each student.

The experimenter then read the following:

We believe and research has shown that your group can arrive at a group answer that is most acceptable to everyone by using all of your group members and their ideas, opinions and feelings. We want each of you to contribute to solving this problem as a group. To help you solve this problem as a group we have identified several guidelines we want you to follow as you work on the problem. These guidelines are presented on the handout I just gave you. We want each of you to follow these guidelines in discussing the problem and arriving at your group solution to the problem.

The guidelines which were read to the students are listed below. The summary statement of each guideline, as indicated by the quotation marks, was placed on the board immediately below the statement of the group goal as each guideline was read to the students.
1. "Ask others for their information and opinions." Ask your group members questions if you are not clear on any particular point. Check the opinions and ideas of your group members as your group solves the problem.

2. "Present your opinions and ideas." Be sure to indicate your opinions and ideas to your group. You may have good ideas but, unless you present them to your group, they cannot be used.

3. "Openly express disagreement." If you disagree with someone in your group about the ranking of the items, indicate that you have a different opinion and explain why. It is desirable to disagree openly and frankly with others so you can use your differing opinions to better understand the problem.

4. "Encourage everyone to participate." You should encourage each other to participate in the discussion and follow the guidelines we are reviewing now. If someone has participated relatively little, an effort should be made to get him/her involved in the discussion.

5. "Ensure that all agree with the final group solution." Asking for statements about the advantages and disadvantages seen in a solution helps group members feel secure in indicating their doubts and opposition. Checking for each member's opinions and feelings toward the end of the meeting will help ensure that everyone agrees with the final group solution.

After reading the five guidelines to the students and placing a summary statement of each on the board, the experimenter distributed a copy of the NASA problem group answersheet (see Appendix B) to each participant and instructed them to complete the information blanks at the top of the answersheet. The experimenter then read the following:

Would everyone please record your group's answer on your group answersheet. Periodically, while your group is working on the problem, I will give you a reminder to keep this goal in mind (The experimenter then pointed to the statement of the goal on the board and restated it) and to follow these guidelines during the group session (The experimenter then pointed to the summary statements of the guidelines on the board and restated each). Now begin.

During the first ten minutes of the group problem-solving session, the experimenter interrupted the group discussion twice at five-minute intervals and pointed to the statement of the goal and guidelines on the board stating:

Remember, it is of great importance that your group strives to produce the solution that is most acceptable to everyone. Also remember it is equally important that you follow the guidelines listed here.
1. Ask others for their information and opinions.
2. Present your opinions and ideas.
3. Openly express disagreement.
4. Encourage everyone to participate.
5. Ensure that all agree with final group solution. Please continue.

Group Problem-Solving Instructions for the No Explicitness Condition. The instructions to the students in the no explicitness condition were as follows:

Now, we would like you to solve the same problem again as a group. Once again we would like you to try to arrive at a ranking of the 15 items, but this time as a group. Please try to pretend that you are on the moon. Take as much time as you need because it is of great importance that your group "strives to pretend that you are on the moon." This is so important that I am placing this statement on the board and giving you a handout containing this statement.

At this point the experimenter placed the phrase "strive to pretend that you are on the moon" on the board and he distributed a copy of the "no explicitness" handout (see Appendix G) to each student. The placement of this phrase on the board and the distribution of the "no explicitness" handout were considered to be neutral with respect to the dependent variables. These steps were included to control for extraneous procedural differences. The experimenter then distributed a copy of the NASA problem group answersheet (see Appendix B) to each participant and instructed them to complete the information blanks at the top of the answersheet. The experimenter then read the following:

Would everyone please record your group's ranking on your group answersheet. Periodically, while your group is working on the problem, I will give you a reminder to keep this in mind (The experimenter then pointed to the statement posted on the board and restated it.) Now begin.

During the first ten minutes of the group problem-solving session, the experimenter interrupted the group discussion twice at five-minute intervals (again as a procedural control) and pointed to the statement on the board stating:

Remember, it is of great importance that your group strives to pretend that you are on the moon. Please continue.

At the completion of the group problem-solving phase of the experiment, the procedure became the same again for participants in all three conditions.
When the students indicated that they had reached a group solution, they were instructed to return to their original seats. The experimenter then distributed another copy of the NASA problem individual answersheet (see Appendix A) to the participants. The following instructions were read to the students.

We would like you to rank the items again, one last time, by yourself. Please take a few minutes to fill out your final opinion on the ranking of these items. It is not necessary to follow your initial set of rankings or your group ranking.

When you complete your final ranking, please give all your materials to me. Then I will give you a short questionnaire to complete concerning your feelings about this study.

Please do not discuss this study with any other students since they may wish to participate. Thank you very much.

After completing their final ranking, their various answersheets were collected and they were given a short questionnaire (see Appendix D) to complete concerning their feelings about their group problem-solving experience. The experimenter then collected all materials, distributed research credits, thanked the students for their participation, and dismissed them.

In summary, the subjects first were given a problem worksheet and asked to solve the NASA problem alone. Then the subjects were placed in a group setting, given a second problem worksheet, and asked to solve the problem as a group (in one of the three explicitness conditions). Finally, when the subjects indicated they had reached a group solution, they were given a third problem worksheet and asked to solve the problem again individually.

Dependent Variables The dependent variables involved in the present study included both behavioral and self-report measures of solution quality and acceptance, and a measure of the amount of time each group required to solve the problem. Before the dependent variables can be described, the scores which had to be obtained in order to calculate the dependent variables will have to be described. These scores are labeled Quality 1 \( (Q_1) \), Quality 2 \( (Q_2) \), Quality 3 \( (Q_3) \) and Mean Rank Talent and are described below.
Scores Used to Calculate Dependent Variables. As previously stated, the behavioral measure of the quality (correctness) of a ranking of the items can be assessed in terms of the sum of the absolute value of its deviations from the expert rank order. Since the students solved the NASA problem three different times, three different solution scores were possible. **Quality One** \( (Q_1) \) is the label which was given to the score reflecting the correctness of the first individual ranking of the items.

The **Quality Two** \( (Q_2) \) score, which is the measure of the quality of the group solution, is the same for all four subjects in each group. The \( Q_2 \) score was derived by summing the absolute value of the deviations of each item in the group rank order from the expert rank order of the items.

The **Quality Three** \( (Q_3) \) score is derived from the third ranking of the items (which is the second individual ranking). The \( Q_3 \) score was derived by summing the absolute value of the deviations of each item in this third ranking of the items from the expert ranking of the items. Since the \( Q_3 \) score reflects the participants' final individual rankings, the \( Q_3 \) score may vary for each individual in the group.

The **Mean Rank Talent** score is the fourth score that had to be determined before the dependent measures could be calculated. Mean Rank Talent is determined by first calculating the mean of the initial individual ranks for each of the 15 items. Then, these mean ranks for each item are subtracted from the expert rank for that item. Finally, the absolute values of these deviation scores are summed to produce Mean Rank Talent which represents a measure of the initial talent present in the group (Slevin, 1978). In addition to its use in calculating one of the dependent measures (see below), Mean Rank Talent was used as the covariate in the analysis of covariance for individual dependent measures (see data analysis section).
Once the above-mentioned scores were determined, the behavioral measures of solution quality and acceptance could be calculated. A distinguishing feature of the dependent measures used in this study is that some are individual and others are group measures. Since individual and group data were analyzed separately (see data analysis section), the individual and group dependent measures will be discussed separately at this time.

Individual Measures. There were two individual measures. The first was an individual improvement score and the second was an acceptance score.

The Improvement (I) score for each student after their involvement in the group problem-solving session was measured by subtracting the students' final individual problem-solving score ($Q_3$) from their initial individual problem-solving score ($Q_1$). To the extent that the $Q_3$ score is an improvement over the $Q_1$ score, it may be inferred that the participants were able to benefit from the group experience and this benefit was manifested in a more accurate solution score.

The Acceptance (A) score of each individual group member was assessed by summing the absolute value of the deviations of the students' third ranking of the items from their group's ranking of the items. To the extent that their third ranking is the same as or similar to their group's ranking, it may be inferred that the group members kept (i.e., accepted) the group's solution as their own.

In addition to these behavioral measures, self-report measures were obtained from each group member by the use of a post-experimental questionnaire (see Appendix D). The questionnaire items were designed to measure perceived solution quality, perceived satisfaction with and acceptance of the group solution, and related factors.

Group Measures. There were two group measures. The first is group improvement which was determined by substracting the score of the group
solution ($Q_2$) from the Mean Rank Talent score. As indicated earlier, both $Q_2$ and Mean Rank Talent are error scores, the magnitudes of which are inversely related to solution quality. $Q_2$ should be more accurate (i.e., lower) than Mean Rank Talent. Therefore, the greater the difference between these two solution quality measures ($\text{Mean Rank Talent} - Q_2$), assuming $Q_2$ is lower than Mean Rank Talent, the greater is the effectiveness of the group and the quality of its solution.

The second group measure was the amount of time each group required to solve the NASA problem.

**Data Analysis** Separate analyses were performed on individual and group measures. Individual subject data (i.e., individual improvement scores and acceptance scores) was analyzed by a 3 (explicitness of instructions) X 2 (sex) factorial analysis of covariance with Mean Rank Talent as the covariate. Moreover, experimental group was included in the analysis as a nested factor since subjects were nested within groups.

A 3 X 2 analysis of variance with level of instruction explicitness and sex as the main factors was performed on the Group Improvement and time data. The questionnaire data was analyzed by a nested 3 (explicitness of instructions) X 2 (sex) analysis of variance.

Also, since previous research had employed a self-report measure of satisfaction with the group solution as a measure of acceptance (Hoffman, 1979b; Hoffman and Maier, 1959), correlations were computed between the questionnaire items measuring satisfactions (adapted from Hoffman, 1979b) and the behavioral measure of acceptance.


RESULTS

Tests of Hypotheses  Hypothesis 1 stated that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the greater would be the individual acceptance of the group generated solution. In order to test this hypothesis the individual acceptance scores were calculated for each person. Table 1 presents the adjusted mean individual acceptance scores classified by explicitness of instructions and sex. An analysis of covariance with Mean Rank Talent as the covariate was performed on these data. Table 2 presents a summary of this analysis of covariance. The analysis revealed that the main effect for explicitness was marginally significant, \( F(2,29) = 2.03, p < .08 \). Table 1 indicates that the mean acceptance score was 10.886 for the no explicitness condition, 8.563 for the goal explicitness condition and 7.011 for the goal plus procedure explicitness condition. The order of the means was as hypothesized. Therefore these data provide some support for Hypothesis 1.

Hypothesis 2 stated that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the greater would be the individual improvement in solution quality as a result of participation in the group problem-solving session. In order to test this hypothesis the individual improvement scores were calculated for each person. Table 3 presents the adjusted mean individual improvement scores classified by explicitness of instructions and sex. An analysis of covariance with Mean Rank Talent as the covariate was performed on these data. Table 4 presents a summary of this analysis. The analysis revealed that the main effect for explicitness did not approach significance (\( F < 1.0 \)). Therefore these data provide no support for
Table 1. Adjusted Mean Acceptance Scores as a Function of Explicitness of Instructions and Sex.

<table>
<thead>
<tr>
<th></th>
<th>No Explicitness</th>
<th>Goal Explicitness</th>
<th>Goal Plus Procedure Explicitness</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>10.443</td>
<td>8.569</td>
<td>8.237</td>
<td>9.083</td>
</tr>
<tr>
<td>Female</td>
<td>11.328</td>
<td>8.556</td>
<td>5.784</td>
<td>8.556</td>
</tr>
<tr>
<td>Overall</td>
<td>10.886</td>
<td>8.563</td>
<td>7.011</td>
<td></td>
</tr>
</tbody>
</table>

Note: The acceptance score reflects the extent to which the individual subject's third ranking of the items was the same as or similar to their group's ranking. Thus smaller acceptance scores indicate greater individual acceptance of the group generated solution.
Table 2. Analysis of Covariance Summary Table Adjusted by Mean Rank Talent for the Comparison of Explicitness and Sex Conditions as Factors Influencing Individual Acceptance Scores.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction Explicitness</td>
<td>2</td>
<td>176.52</td>
<td>2.03</td>
<td>.08a</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>9.61</td>
<td>.11</td>
<td>.74</td>
</tr>
<tr>
<td>Explicitness x Sex</td>
<td>2</td>
<td>35.47</td>
<td>.41</td>
<td>.67</td>
</tr>
<tr>
<td>Mean Rank Talent</td>
<td>1</td>
<td>131.14</td>
<td>1.51</td>
<td>.23</td>
</tr>
<tr>
<td>Groups/Sex x Explicitness</td>
<td>29</td>
<td>86.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects/Groups/Sex x Explicitness</td>
<td>108</td>
<td>53.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aOne-tailed probability value.
Table 3. Adjusted Mean Individual Improvement Scores as a Function of Explicitness of Instructions and Sex

<table>
<thead>
<tr>
<th></th>
<th>No Explicitness</th>
<th>Goal Explicitness</th>
<th>Goal Plus Procedure Explicitness</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>11.651</td>
<td>15.277</td>
<td>16.127</td>
<td>14.351</td>
</tr>
<tr>
<td>Female</td>
<td>8.615</td>
<td>7.019</td>
<td>10.938</td>
<td>8.857</td>
</tr>
<tr>
<td>Overall</td>
<td>10.133</td>
<td>11.148</td>
<td>13.532</td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Analysis of Covariance Summary Table Adjusted by Mean Rank Talent for the Comparison of Explicitness and Sex Conditions as Factors Influencing Individual Improvement Scores.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction Explicitness</td>
<td>2</td>
<td>140.09</td>
<td>.43</td>
<td>.33a</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>1043.59</td>
<td>3.20</td>
<td>.09</td>
</tr>
<tr>
<td>Explicitness x Sex</td>
<td>2</td>
<td>82.25</td>
<td>.25</td>
<td>.78</td>
</tr>
<tr>
<td>Mean Rank Talent</td>
<td>1</td>
<td>429.38</td>
<td>1.32</td>
<td>.26</td>
</tr>
<tr>
<td>Groups/Sex x Explicitness</td>
<td>29</td>
<td>325.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjects/Groups/Sex x Explicitness</td>
<td>108</td>
<td>113.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*One-tailed probability value.
Hypothesis 2. The analysis, however, indicated a marginally significant main effect for sex, $F(1,29) = 3.20, p < .09$. Table 3 indicates that males demonstrated greater individual improvement scores (14.351) than did females (8.857). This is interesting since males also started out with a marginally significant ($p < .08$) better initial score on the problem than did females.

Hypothesis 3 stated that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the higher would be the quality of the group solution. In order to test this hypothesis, the Quality One scores were computed. The mean of these Quality One scores is presented in Appendix H, classified by experimental condition. These Quality One scores and the Quality Two scores were used as the basis for computing group improvement scores. Table 5 presents the mean group improvement scores classified by explicitness of instructions and sex. An analysis of variance was performed on these data. Table 6 presents a summary of this analysis of variance. The analysis revealed that the main effect for explicitness was not statistically significant ($F \leq 1.0$). Thus Hypothesis 3 is not supported by the data. The analysis did reveal a significant main effect for sex, with $F(1,30) = 8.07, p \leq .008$. Table 5 indicates that males were able to improve their group score (10.528) significantly more than females (2.209).

Hypothesis 4 stated that the greater the amount of explicitness of the group goal and the procedures promoting attainment of that goal, the longer would be the group problem-solving session. In order to test this hypothesis the time each group required to solve the problem was recorded. Table 7 presents the mean group problem-solving times classified by explicitness of instructions and sex. An analysis of variance was performed on these data. Table 8 presents a summary of this analysis. The analysis revealed no significant difference for instruction explicitness ($F \leq 1.0$). Thus there is no support for Hypothesis 4.
Table 5. Mean Group Improvement Scores as a Function of Explicitness of Instructions and Sex.

<table>
<thead>
<tr>
<th></th>
<th>No Explicitness</th>
<th>Goal Explicitness</th>
<th>Goal Plus Procedure Explicitness</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>8.083</td>
<td>11.667</td>
<td>11.833</td>
<td>10.528</td>
</tr>
<tr>
<td>Female</td>
<td>1.625</td>
<td>0.250</td>
<td>4.750</td>
<td>2.209</td>
</tr>
<tr>
<td>Overall</td>
<td>4.854</td>
<td>5.958</td>
<td>8.291</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Analysis of Variance Summary Table for the Comparison of Explicitness and Sex Conditions as Factors Influencing Group Improvement Scores.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction Explicitness</td>
<td>2</td>
<td>36.96</td>
<td>.48</td>
<td>.31&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>622.92</td>
<td>8.07</td>
<td>.008</td>
</tr>
<tr>
<td>Explicitness x Sex</td>
<td>2</td>
<td>21.88</td>
<td>.28</td>
<td>.76</td>
</tr>
<tr>
<td>Residual</td>
<td>30</td>
<td>77.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>One-tailed probability value.
Table 7. Mean Time (in minutes) Required by Groups to Solve the NASA Problem as a Function of Explicitness of Instructions and Sex.

<table>
<thead>
<tr>
<th></th>
<th>No Explicitness</th>
<th>Goal Explicitness</th>
<th>Goal Plus Procedure Explicitness</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17.72</td>
<td>19.90</td>
<td>25.21</td>
<td>20.94</td>
</tr>
<tr>
<td>Female</td>
<td>18.69</td>
<td>13.83</td>
<td>21.36</td>
<td>17.96</td>
</tr>
<tr>
<td>Totals</td>
<td>18.20</td>
<td>16.87</td>
<td>23.28</td>
<td></td>
</tr>
</tbody>
</table>
Table 8. Analysis of Variance Summary Table for the Comparison of Explicitness and Sex Conditions as Factors Influencing the Time Required by Groups to Solve the NASA Problem.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction Explicitness</td>
<td>2</td>
<td>494,615.5</td>
<td>1.34</td>
<td>.14(^a)</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>289,444.0</td>
<td>.78</td>
<td>.38</td>
</tr>
<tr>
<td>Explicitness x Sex</td>
<td>2</td>
<td>140,160.3</td>
<td>.38</td>
<td>.69</td>
</tr>
<tr>
<td>Residual</td>
<td>30</td>
<td>369,389.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)One-tailed probability value.
Additional Analyses  Correlations were computed between the questionnaire items measuring satisfaction with the group solution (adapted from Hoffman, 1979b) and the behavioral measure of acceptance. The correlation between responses to the statement "I am satisfied with the amount of influence or say I had over my group's decision" and the individual acceptance scores was significant (rho = -.43, p < .0001). Moreover, the correlation between responses to the statement "I am satisfied with the solution reached by my group" and the individual acceptance scores was also significant (rho = -.45, p < .0001). Thus the self-report measures of satisfaction were found to be highly significantly correlated with the behavioral measure of acceptance.

The questionnaire responses to each of the 15 items were entered in separate nested analyses of variance. The analyses indicated a significant difference among experimental conditions for only one questionnaire item. The results indicated a significant main effect for instruction explicitness, F (2,30 = 6.84, p < .004), indicating that the students in the goal explicitness and goal plus procedure explicitness conditions more strongly agreed to the statement "I am satisfied with the amount of influence or say I had over my group's decision" than the students in the no explicitness condition.
DISCUSSION

The results of the present study indicate that moderate improvements in group effectiveness can be obtained via explicit verbal instructions, but instruction explicitness alone is insufficient to obtain statistically significant increments in group effectiveness. The results indicated nonsignificant increases in individual acceptance, individual and group improvement as well as the time required by the groups to reach a group decision as a result of providing a greater amount of explicitness of the group goal and procedures promoting attainment of that goal. The pattern of results obtained for each of the dependent measures is in the hypothesized direction and is consistent with what would be expected on the basis of Hoffman's (1979c) hierarchical model of the group problem-solving process.

The marginally significant increment in individual acceptance and the moderate increases in individual and group improvement scores as a result of the explicit acceptance goal and discussion guidelines are consistent with the findings of Lane et al. (1980). They found increases in both individual acceptance and solution quality as a result of instructing problem-solving groups to strive for acceptance. Their explanation for the performance improvements was that a more favorable climate for offering and discussing ideas may be present in ad hoc groups in which striving for acceptance is normative. This explanation seems to be a reasonable one to account for the moderate improvements in group effectiveness found in the present study.

The observation that the differences in group effectiveness did not reach a significant level indicates that, though goal and procedure explicitness are of some value, they are not sufficient to produce significant performance
increments. The value of the present intervention technique could possibly be increased if individuals were trained to employ the discussion guidelines utilized in the present study. Training in these guidelines would provide the basis for the development of discussion skills in addition to assuring that the desired group behaviors would become normative. The speculation that additional training in the technique may be necessary in order for groups to function more effectively is consistent with the research of others (Hall and Williams, 1970; Maier, 1950; 1963; Maier and Hoffman, 1960b; 1965).

The consistent improvements in group effectiveness found in the present study, however, seem to indicate that the present intervention technique may be of some practical value though it did not produce statistical significance. This statement is made cautiously. However, the technique employed did produce several beneficial trends in group effectiveness with no apparent negative consequences.

The results of the present study also indicated that males, in addition to beginning with initially higher quality individual solutions to the problem, were able to improve both their individual and group scores more than females. The superiority of males over females in this problem-solving situation is consistent with most of the previous research on sex differences in problem solving (Hoffman and Maier, 1961b; Maier and Casselman, 1971), though it is in sharp contrast with the findings of Lane et al. (1980). Lane et al. (1980) found that while males initially had higher quality individual solutions to the NASA problem than did females, these differences disappeared in the group problem-solving sessions. There appears to be no apparent explanation for these contradictory findings. This discrepancy between the results of the Lane et al. (1980) study and the present study and the fact that most of the studies concerning sex differences in group problem solving are a decade old (Hoffman
and Maier, 1961b; Maier and Casselman, 1970a; 1971) is an indication that future problem-solving studies may wish to investigate further the effects of the sex variable on group problem solving.

Since previous research had employed a self-report measure of satisfaction with the group solution as a measure of acceptance (Hoffman, 1979b; Hoffman and Maier, 1959), correlations were computed between the questionnaire items measuring satisfaction (adapted from Hoffman, 1979b) and the behavioral measure of acceptance used in the present study. The highly significant nature of these correlations indicates that self-report measures of satisfaction with the group solution are reasonable measures of the extent to which group members accept their group generated solutions. This finding should lend credence to the self-report measures of satisfaction which have been used as measures of acceptance in previous research. It is hoped, however, that behavioral measures of acceptance will be used in future research whenever possible.

The finding that students in the goal explicitness and goal plus procedure explicitness conditions more strongly agreed to the statement "I am satisfied with the amount of influence or say I had over my group's decision" than the students in the no explicitness condition may be interpreted as support for the conclusion that the explicit acceptance goal and discussion procedures provided a more favorable climate for offering and discussing ideas. Since this questionnaire item is one of the self-report measures of satisfaction which was found to be highly significantly correlated with the behavioral measure of acceptance, this finding tends to support the position that the greater the explicitness of the acceptance goal and procedures promoting attainment of that goal the greater will be individual acceptance of the group generated solution.

In conclusion, the present research provides a modest amount of support for the importance of the implicit-explicit dimension of Hoffman's (1979c)
hierarchical model of the group problem-solving process. However, since goal and goal plus procedure explicitness instructions did not result in statistically significant increments in group effectiveness, though the results were in the expected direction, it seems reasonable to conclude that training in the use of these procedures may be necessary in order for this type of intervention strategy to be maximally valuable. Furthermore, additional research is needed to determine how to apply Hoffman's (1979c) group problem-solving model more effectively.
REFERENCES


Lane, I., Mathews, R., Chaney, C., Erffmeyer, R., Reber, R. & Teddlie, C. Effects of making the goals of acceptance and quality explicit on group decisions. Unpublished manuscript, Louisiana State University, 1980.


APPENDIX A

THE NASA MOON SURVIVAL PROBLEM

Instructions: You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200 mile trip.

Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance in allowing your crew to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through number 15, the least important.

1. Box of matches
2. Food concentrate
3. 50 feet of nylon rope
4. Parachute silk
5. Portable heating unit
6. Two .45 caliber pistols
7. One case dehydrated Pet Milk
8. Two 100-lb. tanks of oxygen
9. Stellar map (of the moon's constellation)
10. Life raft
11. Magnetic compass
12. 5 gallons of water
13. Signal flares
14. First aid kit containing injection needles
15. Solar-powered FM receiver-transmitter
APPENDIX B

THE NASA MOON SURVIVAL PROBLEM

Instructions: You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200 mile trip.

Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance in allowing your crew to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through number 15, the least important.

1. Box of matches
2. Food concentrate
3. 50 feet of nylon rope
4. Parachute silk
5. Portable heating unit
6. Two .45 caliber pistols
7. One case dehydrated Pet Milk
8. Two 100-lb. tanks of oxygen
9. Stellar map (of the moon's constellation)
10. Life raft
11. Magnetic compass
12. 5 gallons of water
13. Signal flares
14. First aid kit containing injection needles
15. Solar-powered FM receiver-transmitter
## APPENDIX C

**ANSWER KEY FOR THE NASA MOON SURVIVAL PROBLEM**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Box of Matches</td>
<td>Useless since there is no oxygen on the moon.</td>
</tr>
<tr>
<td>4</td>
<td>Food concentrate</td>
<td>Satisfies basic energy requirements.</td>
</tr>
<tr>
<td>6</td>
<td>50 feet of nylon rope</td>
<td>Useful in scaling cliffs, tying injured together, etc.</td>
</tr>
<tr>
<td>8</td>
<td>Parachute silk</td>
<td>Protection from sun's rays.</td>
</tr>
<tr>
<td>13</td>
<td>Portable heating unit</td>
<td>Only useful if on the dark side of the moon.</td>
</tr>
<tr>
<td>11</td>
<td>Two .45 caliber pistols</td>
<td>Possible source of self-propulsion.</td>
</tr>
<tr>
<td>12</td>
<td>1 case dehydrated Pet Milk</td>
<td>Duplicates food concentrate in bulkier form.</td>
</tr>
<tr>
<td>1</td>
<td>Two 100-lb. tanks of oxygen</td>
<td>Absolute necessity for life support.</td>
</tr>
<tr>
<td>3</td>
<td>Stellar map (of moon's constellations)</td>
<td>Most important means of determining position and directions.</td>
</tr>
<tr>
<td>9</td>
<td>Life raft</td>
<td>CO₂ bottle possible propulsion device.</td>
</tr>
<tr>
<td>14</td>
<td>Magnetic compass</td>
<td>Virtually useless since magnetic field on the moon isn't polarized.</td>
</tr>
<tr>
<td>2</td>
<td>5 gallons of water</td>
<td>Absolute necessity to sustain life.</td>
</tr>
<tr>
<td>10</td>
<td>Signal flares</td>
<td>Possible distress signal once close enough to mother ship to be seen.</td>
</tr>
<tr>
<td>7</td>
<td>First aid kit containing injection needles</td>
<td>Injection needles fitted to suit aperture quite useful.</td>
</tr>
<tr>
<td>5</td>
<td>Solar-powered FM receiver transmitter</td>
<td>Only useful if line-of-sight transmission is possible with limited transmission range.</td>
</tr>
</tbody>
</table>
APPENDIX D

POST-EXPERIMENTAL QUESTIONNAIRE

SSN___________________

EVALUATION OF GROUP EXPERIENCE

Instructions: This questionnaire consists of a series of statements about your experiences in your group. You will find that you agree with some and disagree with others. Please indicate your own personal reaction to each statement by responding according to the following six choices. In the parentheses to the left of each statement, write the number of the choice that best represents your degree of agreement or disagreement.

Choices: (1) Totally disagree
(2) Disagree very much
(3) Tend to disagree
(4) Tend to agree
(5) Agree very much
(6) Totally agree

( ) I am satisfied with the amount of influence or say I had over my group's decision.

( ) I am satisfied with the solution reached by my group.

( ) The people in my group freely expressed their feelings or emotions.

( ) Everybody participated in the discussion in my group.

( ) My group definitely achieved a high quality solution.

( ) My group's final solution was definitely acceptable to everyone in the group.

( ) My group did not seem to have leadership.

( ) The group's decision reflected my own opinion.

( ) Disagreement among group members was openly expressed.

( ) Everyone agreed with the final group solution.

( ) My opinion about some or all of the items is reflected in my group's decision.

( ) A few people dominated the discussion in my group.

( ) I would be willing to work with these same people on other types of problems.
I liked the method our group used to solve the problem.

My group closely followed the procedure outlined in the instructions.
Group Goal: It is important to us that your group strives to produce the solution that is most acceptable to everyone.
Group Goal: It is important to us that your group strives to produce the solution that is most acceptable to everyone.

Group Discussion Guidelines:

1. Ask others for their information and opinions. Ask your group members questions if you are not clear on any particular point. Check the opinions and ideas of your group members as your group solves the problem.

2. Present your opinions and ideas. Be sure to indicate your opinions and ideas to your group. You may have good ideas but, unless you present them to your group, they cannot be used.

3. Openly express disagreement. If you disagree with someone in your group about the ranking of the items, indicate that you have a different opinion and explain why. It is desirable to disagree openly and frankly with others so you can use your differing opinions to better understand the problem.

4. Encourage everyone to participate. You should encourage each other to participate in the discussion and follow the guidelines we are reviewing now. If someone has participated relatively little, an effort should be made to get him/her involved in the discussion.

5. Ensure that all agree with the final group solution. Asking for statements about the advantages and disadvantages seen in a solution helps group members feel secure in indicating their doubts and opposition. Checking for each member's opinions and feelings toward the end of the meeting will help ensure that everyone agrees with the final group solution.
Group Goal: It is important that your group strives to pretend that you are on the moon.
APPENDIX H

MEAN QUALITY ONE SCORES AS A FUNCTION OF EXPLICITNESS OF INSTRUCTIONS AND SEX

<table>
<thead>
<tr>
<th></th>
<th>No Explicitness</th>
<th>Goal Explicitness</th>
<th>Goal Plus Procedure Explicitness</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>37.083</td>
<td>38.333</td>
<td>38.833</td>
<td>38.083</td>
</tr>
<tr>
<td>Female</td>
<td>39.292</td>
<td>38.917</td>
<td>43.083</td>
<td>40.431</td>
</tr>
<tr>
<td>Overall</td>
<td>38.188</td>
<td>38.625</td>
<td>40.958</td>
<td></td>
</tr>
</tbody>
</table>
VITA

Courtland Merlyn Chaney was born in Baton Rouge, Louisiana, on September 29, 1952. He graduated from Istrouma High School in Baton Rouge, Louisiana, in 1970. He entered Louisiana State University in the fall of 1970, majoring in Business Administration-Law. As a result of interest in several fields he subsequently majored in Political Science, Speech, and Psychology, and received the Bachelor of Science in General Studies in December, 1974. He is a member of the Alpha Sigma Lambda and Psi Chi honorary societies. In August, 1975, he enrolled in Graduate School at Louisiana State University, majoring in Industrial-Organizational Psychology. He received the Master of Arts degree in Psychology at Louisiana State University in August, 1978. His contact with international students and his foreign travel nurtured his interest in cross-cultural issues and international affairs. This interest led him to study the Spanish and Portuguese languages as well as developing an interest in French and German. He is a candidate for the Doctor of Philosophy degree at the summer commencement, August, 1980.
EXAMINATION AND THESIS REPORT

Candidate: Courtland Merlyn Chaney

Major Field: Psychology

Title of Thesis: Effects of Explicit Discussion Guidelines and an Acceptance Goal on the Acceptance and Quality of Group Decisions

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Donald A. Williamson

Robert Matthews

Date of Examination:

June 24, 1980