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TECHNICAL REPORT
TARGETS FOR TEAM SKILLS TRAINING

by

John R. Turney
Stanley L. Cohen
Lauren Greenberg

GP-R-43017
April, 1981

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Block (20) Abstract (con't)

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The available team training research literature was found to be extremely limited. Therefore, more studies are recommended which explicitly operationalize coordination communications for a variety of tasks with clear performance criteria. An important element in such research involves the development of support systems such as strategy planning and team performance feedback mechanisms which encourage desired team coordination communications to take place.

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SUMMARY

This paper explores what the research literature has to say about improving team skills through training. Primary emphasis is placed on team training in military contexts although this literature is supplemented by other relevant research and review material.

The review points to team member coordination as practiced through communications as the central team skill theme. Both the frequency of occurrence and the content of coordination communications were found to differentiate between better performing and worse performing teams. Moreover, the research showed that through the introduction of appropriate support systems, teams could be trained to use targeted coordination communications more frequently.

The available team training research literature was found to be extremely limited. Therefore, more studies are recommended which explicitly operationalize coordination communications for a variety of tasks with clear performance criteria. An important element in such research involves the development of support systems such as strategy planning and team performance feedback mechanisms which encourage desired team coordination communications to take place.

INTRODUCTION

Team skills are inherent in every task which requires persons to work together. In fact, a team skill can be defined as competence in working with others to accomplish tasks requiring team member coordination. Moreover, interactions between team members are a fundamental element in team skills. Communications of one form or another are how team members exchange information, obtain feedback on their previous task performance, and receive new assignments among other necessary team task requirements.

Team training can play various roles in meeting task requirements for team skills. At the most fundamental level, it can involve bringing persons together and training them to perform a technical task which requires them to interact. Or team training can focus more directly on team skills through training material designed to develop these skills apart from any formal technical task requirements. For example, many team-building and awareness training programs are developed along these lines. The important point is whether the team training provided helps to develop team skills which contribute to effective team functioning and task performance. Team skills in one form or another will always be practiced by team members when they are performing a task which demands team member coordination. The question to which this literature review is directed is what team skill targets have been found to benefit through direct attention during training so that their utilization by team members has paid off in measurable outcomes?

Our literature review strategy consisted of identifying military and civilian training and group dynamics research studies where attempts have been made to isolate the effects of specific team skills. Each relevant study was examined using the team skill training model presented in Figure 1 as a guide to what to look for. This model outlines the classes of variables which are relevant to the team training process. At the center of the model is the training format itself consisting of the training techniques or interventions used to develop specific team skills. These techniques may vary from formal classroom training to role playing exercises to task simulations.

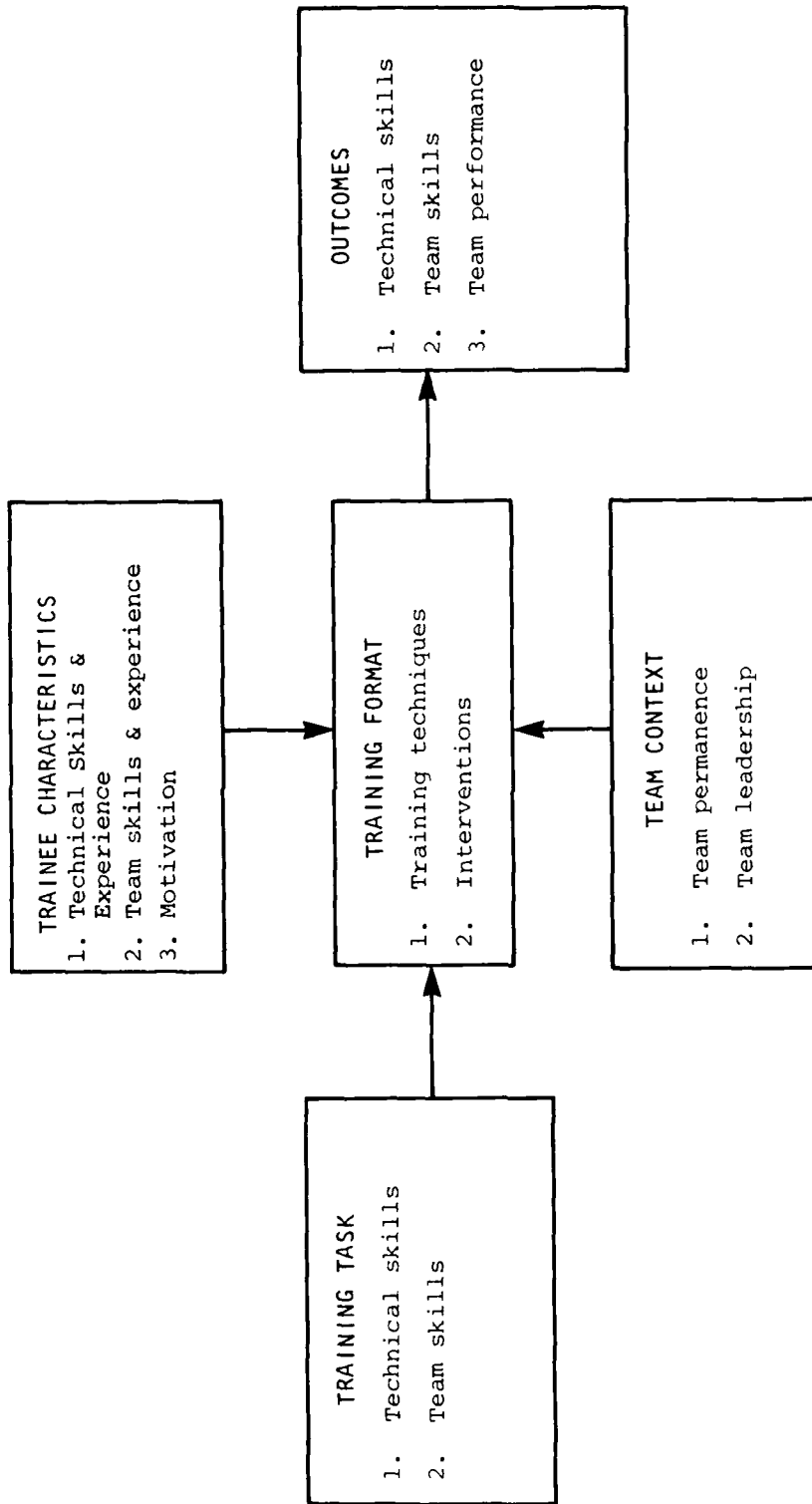


Figure 1. A Team Skills Training Model

Team skills training may be embedded within total task training or it may be separated out as a training element. Moreover, it is important to consider the manner in which team skills are defined or operationalized so that they can serve as clear targets for training techniques.

Surrounding the training format are three (3) variable classes which can contribute to the form which it takes. At the left of the model, we have the tasks and skills which are to be learned during training. As we noted earlier, for certain types of training, team skills may be sub-elements of the total technical task while for other types, the team skills themselves are the primary training targets. The second variable class focuses on characteristics of the persons being trained. These characteristics include not only technical skills and experience which trainees bring with them to training but also relevant earlier team skills training and experience. Also included is the motivation of team members to work together. The third variable class incorporates team context factors such as whether the team being trained is a permanent one which will remain intact after training. Moreover, if the team is intact, does it have a member who is formally in charge or not as will be the case during actual task performance?

The final consideration at the right of the model are the training outcomes. These outcomes may cover improvements in team skills like communications and increases in technical skill levels. However, the critical outcome is team performance. Therefore, team and technical skill acquisition need to be related to how effectively the team performs the training task. The best evaluation of training impact involves examining team performance of the target tasks in actual field conditions. However, because such evaluations are complex and costly, primary emphasis is usually placed on changes in team outcomes which occur during the course of training programs.

LITERATURE SELECTION

The team skills training model was placed in a matrix format to facilitate input from each study to every variable class. The variable classes include (1) team skills targetted in the study and how they are operationalized; (2) the training technique or intervention utilized; (3) the nature of the team task performed; (4) any relevant trainee or subject characteristics; (5) information on the team context; and (6) the measurable outcomes used to determine the impact of team skills training or interventions. The matrix with the selected studies placed into it is presented in Table 1. A total of fourteen (14) studies were included in the matrix. The primary selection criterion was that a study targetted specific team skills within a military context. Eight (8) studies qualified under this criterion.

The remaining six (6) studies addressed team skills within small group laboratory situations using civilian subjects. They did not utilize training techniques but instead incorporated some intervention in their design which was intended to influence targetted team skills. These studies were selected because they complemented or supported the team skill focus in the military training research studies. In several cases, they represent a larger body of laboratory research. We did not attempt to incorporate the entire group dynamics literature within the matrix because we did not find that this approach contributed to the primary focus on appropriate targets for team skills training in military contexts. Moreover, this literature has been adequately reviewed elsewhere (e.g., Collins, 1977; Nieva et al., 1978).

Many potentially relevant studies were eliminated from consideration for the matrix because of the absence of a clearly defined team skill focus. For example, a study by Fox and Lorge (1962) referred to team skills introduced during training simply as "group dynamics." In addition, a number of reviews have been written describing team functioning in military contexts. These reviews address specific team skills and discuss their contributions to effective team functioning. However, no actual interventions directed at team skills took place as part of these studies. We found this literature

I. General Interpersonal Team Skills

| STUDY | TEAM SKILL TARGETS | TRAINING TECHNIQUE or INTERVENTION | TASK |
|---|--|--|--|
| Winsted (1978) | <ol style="list-style-type: none"> 1. Team Awareness 2. Role Identification 3. Decision Making 4. Leader-member Relations 5. Defining Future Objectives | Team building exercises with facilitator assistance. | Team skills improvement programs. |
| Aplander (1975) | <ol style="list-style-type: none"> 1. Role Identification 2. Planning 3. Organizing 4. Coordination | Questionnaire data feedback and discussion focusing on supervisor-subordinate differences in role perceptions. | Reduce survey data differences. |
| Hackman & Kaplan Study II (1974) | Implicit vs. explicit maintenance of interpersonal relationships. | Groups encouraged to discuss team member relationships, goals and strategies prior to task performance. | "Advice Board" responding to human relations problems. |
| Kaplan (1979) | Performance strategies. Expressive vs. suppressive maintenance of interpersonal relationships. | Discussion groups directed towards a conversation about interpersonal skills prior to task performance. | "Advice Board" responding to human relations problems. |

TABLE 1

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S TRAINING MATRIX

| TASK | TRAINEE CHARACTERISTICS | TEAM CONTEXT | OUTCOMES |
|---------------------------------------|----------------------------------|------------------------------------|---|
| improvement | Four Navy and Coast Guard teams. | Intact teams | No significant differences in such survey indicators as command communications, decision making, and peer group facilitation in comparison with control groups. However, control groups were also undergoing a form of team development. |
| key data | Civilians in four industries. | Supervisors and their subordinates | More similar supervisor - subordinate role perceptions as revealed by the readministration of questionnaire. |
| "hard" responding relations problems. | Undergraduates; male and female. | Temporary teams | Team members attained more satisfaction in interpersonal discussion groups but also found group activity taxing. In addition, these groups had lower performance quality than groups where no discussion of interpersonal issues was allowed. |
| "hard" responding relations problems. | Undergraduates | Temporary teams | No significant differences in such areas as task performance, task experience, satisfaction, and knowledgeability about social interaction of group. Experimental groups were more emotionally taxed after discussion of interpersonal relationships. |

II. Communications as a Team Skill

| STUDY | TEAM SKILL TARGETS | TRAINING TECHNIQUE OR INTERVENTION | TASK | CR |
|--|--------------------------------------|---|---|-------------------------|
| Briggs & Johnston (1966) Williges, Johnston & Briggs (1966) | Verbal communications opportunity | Open or closed verbal communications channel. | Radar control simulator | 2- P. 1 |
| Guetzkow & Dill (1957) | Organizational efficiency | Written communications channels available or unavailable. | Group process to determine missing piece of information through message exchange. | 5- un- ca- st- |

| TASK | TRAINEE CHARACTERISTICS | TEAM CONTEXT | OUTCOMES |
|---|---|------------------|---|
| control simulator | 2-person Air Force pilot radar control teams | Temporary teams. | Communications facilitated team performance only when a more efficient information channel (e.g. visual display) was not available. |
| process to determine piece of information message exchange. | 5-man teams of undergraduate engineering students | Temporary teams. | Open communications enhances organizational planning |

III. Coordination Communications as a Team Skill

| STUDY | TEAM SKILL TARGETS | TRAINING TECHNIQUE OR INTERVENTION | TASK |
|--------------------------------|---|--|---|
| Krumm & Farina (1962) | Coordination through communications. | Interactions integral to task. | B-52 flight simulator |
| McRae (1966) | Coordination through communications. | Interactions integral to task. | Switch coordination. |
| Federman & Siegel (1965) | Coordination through communications. | Interactions integral to task. | Helicopter anti-sub warfare simulator. |

| TASK | TRAINEE CHARACTERISTICS | TEAM CONTEXT | OUTCOMES |
|-------------|----------------------------|------------------|--|
| Simulator | Pilot and navigator crews. | Intact teams. | More effective crews used more messages containing planning, opinions, and evaluation. There was no significant difference in communication volume. |
| Simulation. | Army enlisted men. | Temporary teams. | More effective teams specified more actions and exchanged more information. No significant differences among teams in specifying procedures for task accomplishment, and performance efficiency. |
| Sub warfare | 6-man Navy flight teams. | Intact teams. | More efficient crews exchanged more information and opinions for coordination. They were also more willing to modify their behavior and change their views as a function of different options. |

IV. Support Systems, Coordination Communications, and Performance

| STUDY | TEAM SKILL TARGETS | TRAINING TECHNIQUE OR INTERVENTION | TASK | TRAINING CHARACTERISTICS |
|---|---|--|--|-----------------------------------|
| Siegel & Federman (1973) | Coordination and adaptation through communications. | Team follow-up discussions of simulator problems and effective communications. Role playing of communications situations. | Helicopter anti-sub warfare simulator. | 6-man Navy flight team |
| Thurmond & Kribbs (1978) | Coordination under emergent task conditions. | Team debriefing to discuss performance and roles. | Computer assisted coordinated training scenarios. | 2 man Army teams |
| Shure, Rogers, Larsen & Tammone (1962) | Planning for task accomplishment. | Varied allotment of time for planning and organizing for task. | Discovery of common symbols among team members. | 5 man team of undergrad students. |
| Hackman, Brousseau & Weiss (1976) | Task strategy planning. | Groups given reading materials and initial structure to develop strategy planning skills. | Team effort to assemble various electrical components from "order lists" | 4 man team of undergrad students. |

| TASK | TRAINEE CHARACTERISTICS | TEAM CONTEXT | OUTCOMES |
|---------------------------------------|--|------------------|---|
| Sub warfare | 6-man Navy flight teams. | Intact teams. | Teams with follow-up training made more use of coordination communications. However, there were no performance differences between follow-up and non-follow-up teams. |
| Coordinated jobs. | 2-man Army teams | Temporary teams. | Performance efficiency was better for teams receiving coordinated training but only on tasks requiring coordination |
| Common symbol members. | 5-man teams of undergraduate students. | Temporary teams. | Groups with planning time allocated were more effective and showed a reduction in redundant and inefficient messages across trials. |
| To assemble "components" into "units" | 4-man teams of undergraduate students. | Temporary teams. | When team members had unequal task information, explicit strategy discussion teams had higher productivity. These teams also showed more flexibility in approaches to task accomplishment, shared leadership, and more interaction. |

to be helpful in defining team skills and describing team skill relationships. Implications of these studies for the research findings derived from the matrix will be discussed later.

TEAM SKILLS LITERATURE REVIEW

We have divided the matrix studies into four (4) categories. In each category, we have first presented the research which was conducted in a military training context. Following this research, we have listed a representative sample of studies conducted with temporary teams which have implications for Navy team skills training. The first set of four studies address a variety of team interpersonal skills at a general level. No clear-cut improvements in team performance are attributable to the team skills training and interventions which take place in these studies. The second set of three studies look at communications as a team skill and suggest that competence in communications involves more than simply giving team members the opportunity to communicate. The third set of three studies focuses more specifically on communications content as it serves teams to achieve effective coordination. The fact that there are differences in communications content between more effective and less effective teams suggests that focusing on interactions in team skills training is a promising path to pursue for improving team performance. The final set of four studies show that training or other team interventions which support or encourage certain types of critical team member interactions to take place can, in fact, produce this desired team skill impact. These changes in team interactions are shown to relate to improvements in team performance.

Turning now to an examination of the first set of studies, we find that the training technique or intervention running throughout consists of some form of team member discussions intended to improve interpersonal skills. In a study involving Navy personnel, Winsted (1978) tried to improve team effectiveness through team building exercises. These exercises, covered within a program called Task Oriented Team Development (TOTD), addressed team awareness, role identification, decision-making, and leader-member relations. No significant performance differences were found between the four Navy and Coast Guard teams engaging in the program and control groups. However, the control groups were receiving another version of team development exercises at the same time. Moreover, as Winsted points out, the exercises did not appear relevant to Navy tasks.

In other studies representing the focus on team skills per se, Apler (1975) attempted to reduce the differences in supervisor-subordinate role perceptions through team discussions of questionnaire data collected from the participants. The data addressed such issues as planning, organizing, role identification, and team and management effectiveness. A post-discussion survey indicated more similarity in role perceptions but no measures of team performance were taken.

The third and fourth studies examined strategies for maintaining interpersonal relationships in teams through group discussions. Hackman and Kaplan (1974, Study II) maintained that adaptive maintenance encouraging discussions of team member relationships would improve satisfaction and team performance. They found that while teams which engaged in such discussions were more satisfied, the performance of control teams was superior. Hackman and Kaplan assumed that for different types of tasks requiring more emotional involvement, the discussions would contribute to performance improvements. In a later study, Kaplan (1979) focused the discussions more specifically on the nature of social interactions occurring within a team. However, again no significant performance differences were found between experimental and control groups for the same task.

These research studies deal with interventions which target team skills outside of the context of formal operational task requirements. The assumption is that team skills development within this context will generalize to team performance of formal tasks. This assumption characterizes a broad range of team building programs currently available which have evolved from the sensitivity training tradition. Campbell and Dunnette (1968) have reviewed the research evidence for this type of team skills training and concluded that while it does seem to produce observable behavioral changes, its utility for improving performance has yet to be demonstrated. They go on to say that the type of interpersonal sensitivity which the training addresses needs to be better defined and related to specific task contexts. In a more recent review, Smith (1976) indicated that Campbell and Dunnette's conclusion remains accurate. Therefore, the type of team skills training represented by the first set of studies which address interpersonal skills at a general level

outside of a specific task context do not show any consistent relationships to team performance.

The second set of studies deal with communications as a team skill. Communications may be viewed as the central element of team skills since all team member relationships must occur through some form of interpersonal interaction. This set of studies focuses upon opportunities for team members to communicate.

Two similar studies examined the extent to which verbal communications facilitated team task performance in a radar control simulator. Briggs and Johnston (1966) and Williges, Johnston, and Briggs (1966) conducted studies which indicated that verbal communications facilitated team performance only when a more efficient information channel was not available. In this case, that channel involved visual information display. Verbal communications only served to add "noise" to the system.

Guetzkow and Dill's (1957) study fits within the context of the extensive volume of research on communications networks. They examined the effects of varied opportunities for team members to exchange written information on team performance by opening or closing channels between members. Their results showed that greater opportunities for communications encouraged team member strategy planning and selection of the best persons for particular positions. This supports the conclusion reached by Shaw (1971) in his review of communications network research. He found that a decentralized network was most efficient for solving complex problems while a centralized structure worked best for simple problems. The type of planning and task assignment activities found by Guetzkow and Dill in open channel networks can be viewed as contributing to the development of appropriate team processes for complex types of tasks.

The third set of studies focuses on the content of communications as it relates to team performance. The team skill referred to in all three studies included here is coordination. All of the studies focus on military personnel performing different tasks. In addition, all of them involve content analyses

of team members interactions to help understand the nature of coordination as a team skill.

Krumm and Farina (1962) examined communications among pilot and navigator crews during training in B-52 flight simulators. Using objective performance measures to differentiate between good and bad crews, they found that the more effective crews made use of more messages containing information on courses of action, opinions, and evaluations.

McRae (1966) found somewhat different results than Krumm and Farina examining Army teams performing a switch coordination task. She found that rather than emphasizing organizational types of content, more effective teams exchanged more information concerning task specific issues rather than organization or planning issues. In fact, organizational communications were of low volume and varied little across task trials. As these results were not what she had predicted, McRae offered several possible explanations. Among them was the nature of the task itself which may have had too few dimensions and responses requiring organizational communications. Secondly, the more productive teams may have engaged in the coordination stage early in their interactions and developed an effective system requiring little in the way of organization communications during later task trials. In fact, evidence of this type of communications later on may indicate a failure on the part of a team to effectively coordinate their activities.

Finally, Federman and Siegel (1965) examined the communications content of Navy flight crews in a helicopter anti-submarine warfare simulator. Their primary interest was in coordination as the team skill expressed through communications. For this type of training task, the researchers found more evidence of information and opinion interchanges in teams performing more proficiently. In addition, more of the information and opinions provided in these teams were in response to specific requests from team members than in less proficient teams. Also of interest is the finding that more proficient teams showed a greater tendency to modify behavior and break mental sets as a result of discussions focusing on opinions (e.g., "it seems to me...") and options (e.g., "what would happen if...").

The content analyses performed in these three studies demonstrate that the team skill of coordination as operationalized through team member communications content does differentiate between more effectively performing and less effectively performing teams. This is an important point in and of itself. It indicates that there is potential benefit to be gained from team skills training which focuses on improving team proficiency in coordination communications. Moreover, for the tasks examined, specific types of important communications include competence in organizing, information exchange, planning, and evaluating options.

The final set of four studies examines actual team interventions targetted at team skills with the objective of improving team performance. The first two studies involve actual military training situations while the second two represent research conducted in small group laboratory settings.

Siegel and Federman (1973) followed up the Federman and Siegel study described in the last section by attempting to improve team competence in using the types of communications found to differentiate between more proficient and less proficient crews. Post-task team member structured discussions and role playing exercises were used to stress critical communications for experimental groups of Navy flight crews. Examination of data collected from experimental teams and control teams where no team skills training was introduced showed significant differences in the use of the targetted communications. However, no performance differences were discovered perhaps because the control teams had more initial experience performing the anti-submarine warfare simulation task. While the performance differences were not significant, the utility of custom tailoring communications content to task training was demonstrated in this study.

Coordinations as a team skill was also the target of training examined by Thurmond and Kribs (1978). The training task involved Army artillery tactical firing simulations under integrated and emergent team conditions. The researchers introduced team debriefings which focused on discussions of past performance and future role assignments. While there was no direct determination of team skill acquisition in terms of team member interactions

or activities, team performance was better for teams receiving the special training. The effect was only significant for task simulations where coordination was necessary.

Both of the above studies focused on the development of team skills during training by providing special opportunities for team members to discuss their relationships and develop coordination strategies for accomplishing tasks. The importance of making such provisions was also demonstrated in two small group laboratory studies. Shure et al. (1962) varied time provided teams to plan and organize themselves. They found that groups given separate planning time performed the experimental task significantly faster than other groups. The trained teams developed a more consistent information and answer exchange system. In the second study, Hackman et al. (1976) first trained teams in strategy planning using material especially developed for the task-at-hand. They found that the teams so trained demonstrated more flexibility in their approaches to the task, had more shared leadership, and interacted more than other teams. They were also more productive but only for tasks structured so as to require team member coordination. The researchers also emphasized the importance of custom tailoring the strategy-planning activity to task conditions if it is to "take" with team members feeling comfortable using it.

The last set of studies demonstrates that team skills targetted training can produce the intended change in team member interactions. There is potential for team performance improvement as well although the Siegel and Federman results were not statistically significant. Moreover, these studies emphasize the importance of establishing an appropriate structure or support system for the development of desired coordination team skills. This system involved structured post-task team member discussions in the Siegel-Federman and Thurmond-Kribs studies. The Shure et al. and Hackman et al. studies concentrated on pre-task strategy planning discussions among team members. All of the studies custom-tailored these sessions to the task before the team which in each case required coordination among team members.

SUMMARY OF RESEARCH FINDINGS

In summary, the research studies which we have included within the matrix suggest a number of conclusions about the nature of team skills training. First of all, team skill interventions which are not tied directly to formal task requirements are likely to have minimal impact on team performance. Secondly, team member coordination as practiced through communications is the central team skill theme running through the research. However, the frequency of occurrence and content of the communications make a difference in team performance. Too much communications where the task does not require it can be just as dysfunctional as too little communications of the type required for task accomplishment. The content of effective coordination communications includes organizing, exchanging task-related information, and evaluating options although the exact "mix" varies from task to task. The fact that good teams can be differentiated from bad teams in terms of these categories reinforces their contribution to team performance. Finally, it was shown that teams could be trained to use targetted coordination communications more frequently. Appropriate support systems were found to aid in this effort. Structured discussions focusing on task performance and strategy planning were the types of systems relied upon. During strategy planning sessions, team member interactions dealt with courses of action to take, exploration of alternative procedures, and discussion of ways to achieve better team member coordination.

There are a number of limitations in the available studies which fit into the matrix, beyond the small number to begin with. First of all, the research focused on small teams of from two to six persons. Therefore, team skills training within the context of large teams and between teams could not be examined. Secondly, the team context was not addressed in any study. Therefore, no conclusions could be reached about the utility of training team skills to teams which will remain intact versus teams which are only temporary. Finally, the only clear trainee characteristic which could be identified was whether teams consisted of military personnel or civilians. Such issues as team member task competence, previous team experience, and motivation were

not addressed. All of these are important issues. However, at the same time, their absence does not detract from the primary conclusion reached from the matrix research. Team skills training targetted on coordination communications can change these communications in a way likely to contribute positively to team performance in tasks requiring coordination.

TRAINING RESEARCH ISSUES DISCUSSED IN THE TEAM SKILLS LITERATURE

As we indicated earlier, team skills and team training in military contexts have been addressed in a number of different reports. In reviewing these reports, we found four recurring themes which are related to the conclusions we arrived at from the research matrix. They cover the nature of team skills, their operationalization, criteria for evaluating their impact, and task dimensions associated with team skills. Let us consider each one in turn.

In discussions of the nature of team skills, the primary common elements running through the reviews include coordination and interaction. For example, Hall and Rizzo (1975) in their survey of Navy training personnel found that the primary purpose of team training was believed to be teaching coordination. This involved developing complementary or supplementary behaviors among team members. Alexander and Cooperband (1965) saw team training as involving coordinated activity required by the uncertainties of the task and situational contexts. The Rand report (1980) on improving training of Navy teams also emphasized the need for adaptive training to achieve coordination of unrehearsed actions.

Interaction was stressed by Wagner et al. (1977) who indicated that team training is a necessary addition to individual training for tasks requiring interaction and "other team skills." Moreover, Nieva et al. (1978) in defining team skills as team performance functions refer to these functions as indicators of what a team does in the interactive effort to get work done.

Coordination is defined by Steiner (1972) to consist of decisions as to who is to do what, when. Obviously, making these decisions and carrying them out relies on interactions among team members. Therefore, interactions can be viewed as an inherent part of the coordination process. Moreover, other team skills which are mentioned within the literature seem to relate to coordination in one way or another. For example, collaboration as referred to by Hewitt, O'Brien, and Hornik (1974) involves interactions among team members as they make mutual adjustments to carry out interdependent tasks. Cooperation as

referred to by Alexander and Cooperband (1965) includes learning other team member needs and pacing activities to fit these needs. Team adaptation functions as described by Nieva et al. (1978) include team member mutual adjustments to complement each other in accomplishing the team task. This is said to encompass "cooperation." It is difficult to see clear-cut, practical distinctions among these team skills labels. Rather, they all seem to focus on interactions among team members required as they work together to accomplish a task whether the interactions are called coordination, collaboration, or cooperation.

In addition, there are a number of dimensions discussed in the literature as team skills which may be more appropriately viewed as part of the support system for team skill or coordination effectiveness. For example, there is team or system awareness which Biel (1962) defines as an understanding of the interrelationships among work roles and tasks. It incorporates what is referred to in the RAND report as empathy toward roles played by other team members. This type of understanding may contribute to the practice of effective coordination by team members but it is not a direct part of the interactive process they are engaged in. As Hall and Rizzo (1975) point out, team awareness is best viewed as a social condition affecting team coordination.

Another example of such a support system is team member motivation which Nieva et al. have pointed out includes team performance norms, performance rewards, and team orientation. These contributors to motivation help to determine the extent to which individual team members will expend effort to achieve effective coordination. A final example of a support system involves knowledge of results or performance feedback. This topic has received considerable attention in the team training literature. (See Briggs & Johnston, 1967, for a review of the research on knowledge of results). Knowledge of results can be viewed as a direct part of the coordination process as team members respond to each other's actions. However, in a more formal sense as represented through supervisory performance feedback or equipment feedback, knowledge of results supports team coordination by providing team members with information on past efforts which point to requirements for future improvements.

Directly related to the nature of team skills is how to operationally define them. All of the reports reviewed noted this issue as a major problem facing team skills training, evaluation, and research. For example, Hall and Rizzo (1975) noted that coordination viewed as a type of interactive behavior is difficult to describe, define, or measure. Wagner et al. (1977) cited the need for unambiguous operational definitions of skills such as coordination, integration, and cooperation. On the other hand, there was less clarity on how to resolve the problem. Where attempts were made, the focus was placed on functions or activities performed by team members working together. Nieva et al. (1978) specified four team performance functions with from three to six subcategories. The functions are team orientation, organization, adaptation, and motivation. Actual behavioral or interactive operationalization of these functions and their subcategories was left for future research. Alexander and Cooperband (1965) and the RAND (1980) report stressed team strategies for conveying information and making decisions. Both reports singled out an interest in how interactions among team members resulted in coordinated activities under varying task and situational conditions. However, the specific combination of interactions or coordination strategies defining a team skill or a skilled team were left for others to determine.

The third theme covered in all of the team skills reports consists of the issue of performance criteria for team training. This theme encompasses more than operationalizing team skills per se although that is certainly an element. It raises a more fundamental question of the overall objectives of any team training program. If a case is to be made that training persons as teams yields critical benefits beyond training persons as individuals, then criteria for team training accomplishments must be specified. As Hall and Rizzo (1975) pointed out, training objectives on intended course outcomes are notably absent in most training programs. Collins (1977) stressed the need for objective, situation specific measures of team training achievement and effectiveness.

Beyond the issue of the benefits of team training which simply brings persons together is the more specific issue of whether team training which targets team skills is beneficial. As indicated in the reports, team training at the general level has not been adequately evaluated. However, the focus

here is on specific team skills training and this is where the operationalization of team skills becomes critical. As Nieva et al. (1978) note, the basic questions involve what team skills are to be trained and how team proficiency will be measured in terms of those skills. The literature provides no clear guidance on the criterion issue.

The final theme has a much clearer direction. This theme addresses task dimensions which should be used to identify appropriate tasks for team training. The basic distinction made here is between structured, predictable tasks and unstructured, evolving tasks or what Boguslaw and Porter (1962) refer to as established and emergent tasks. All of the reviewers agree that team training should focus on emergent tasks where there are significant requirements for teams to adapt to changing task and situational conditions. Under these conditions, as pointed out in the RAND report, team members must not only change behaviors but also coordinate new behaviors. Nieva et al. (1978) add task interdependence to task emergence as a second dimension for determining team skill requirements. In other words, emergent tasks must also be characterized by significant requirements for team member coordination for team skills training to have an impact.

Referring to these two dimensions, if we were to look for tasks where team skills training has the highest likelihood of impact, we would consider what Alexander and Cooperband (1965) refer to as high task load conditions. These would be tasks where unstructured events occur rapidly under time stress, where there is a heavy demand placed on coordinated information processing and other team member activities, and where there is "noise" in the input. We might characterize such task types in the extreme as "emergent emergencies." Such task conditions place heavy emphasis on team adaptive strategies and procedures as they are expressed through team skills like coordination.

RELATIONSHIP OF REVIEW THEMES TO TEAM SKILLS TRAINING RESEARCH

We have just discussed how the nature of team skills, their operationalization, criteria for evaluating their impact, and task dimensions associated with team skills are viewed in the open literature. We will now take a look at how these views relate to the findings of the research reported in the team skills training matrix. Our first conclusion from the review was that the nature of team skills could be described parsimoniously as focusing on the competence of team members in coordinating their separate tasks or activities. Other labels such as collaboration or cooperation basically describe the same skill process. Moreover, team member interactions which also received much attention in the reports as a team skill are better viewed as the "delivery system" for coordination. This perspective is supported by the research in the team skills training matrix. The Krumm and Farina (1962), McRae (1966), Siegel and Federman (1973), and Thurmond and Kribs (1978) studies all targeted coordination. Moreover, the first three of these studies did so by looking at interactions among team members

A number of dimensions were covered in the reports which we felt were more appropriately viewed as part of a support system for team skills. They included team awareness, knowledge of results in certain forms, and team member motivation. While none of these specific dimensions were addressed in the matrix studies, certain aspects of support systems were covered. For example, Federman and Siegel (1973) and Thurmond and Kribs (1978) made use of task follow-up discussions to examine performance, discuss roles, and plan future task strategies. Shure *et al.* (1962) and Hackman *et al.* (1976) allocated planning time and provided planning strategies for teams. These types of sessions can be considered as providing support for team skill competence by allowing teams to develop interactive strategies while not actually practicing coordination skills. Presumably, this reduces the task load pressures which occur during actual team task performance.

The second theme raised in the reports which we reviewed involved the issue of operationalizing team skills. No clear-cut guidance was found on this issue. However, where there was more discussion than simply

acknowledging this to be a critical problem, the emphasis was on delineating functions and activities performed in a team which characterized a team skill construct. Again, it is important to emphasize that a team skill construct is simply a convenient label used to describe a class of events, objects, or, in this case, behaviors. Therefore, if coordination is the target team skill it must be operationally defined in terms of behaviors or interactions considered by researchers, a panel of training experts, or someone else to represent coordination-in-practice. In the research matrix where coordination was the target team skill, it was operationized in terms of communications content categories by Krumm and Farina (1962), McRae (1966), and Federman and Siegel (1973). For example, Federman and Siegel developed the four factors of evaluative interchange, hypothesis formulation, leadership control, and conditional "what if" statements while McRae used eight (8) organization and task-specific interaction categories. Thurmond and Kribs (1978) operationalized coordination in terms of the task requirements for team members to work together. The primary emphasis in the research studies is placed on operationalizations in terms of actual team member interactions. Moreover, the nature of the interactions which characterize the coordination construct may vary from one task to another.

The third theme discussed was performance criteria for team training. These criteria were found to be noticeably lacking at even a general level to allow comparisons between team and individual training. The importance of separating team skills criteria from performance criteria when evaluating the impact of team skills training is shown in several of the matrix research studies. For example, Siegel and Federman (1973) found change in the practice of coordination operationalized in terms of communications categories for experimental groups. However, there were no significant differences in performance between experimental and control groups with no coordination training. The fact that the coordination training had an effect on communications led the researchers to look for possible explanations as to why no performance differences were discovered and they found that crews in the control teams had more task experience initially than crews in the experimental condition. Moreover, in studies where performance change is found, separate indicators of team skills change help to support the relationship between team performance and team skills competence as demonstrated in the Shure et al. (1962) and

Hackman et al. (1976) studies. Longitudinal and experimental-control group research incorporating objective measures of team skills are effective methods for evaluating the utility of team skills training. However, clear-cut performance measures are critical to this research. The approach taken in the matrix research studies was either to use training devices like simulators where such measures were available or to develop laboratory exercises with such criteria built into them.

The final theme which we covered addressed the nature of task dimensions where team training is appropriate. Emergent tasks with interdependent sub-elements were found to be the primary dimensions discussed in the reports. Studies by Briggs and Johnston (1966) and Thurmond and Kribs (1978) in the matrix emphasized the importance of task interdependence by showing that only for tasks requiring team member coordination will the practice of such a team skill improve performance. The emergent task dimension was not considered directly in the matrix research as there was no evidence of intentional variation of task conditions in any of the studies. However, Siegel and Federman (1973) and Hackman et al. (1976) noted the increased flexibility in team member strategies and modification of perspectives after the occurrence of team skill interventions.

CURRENT STATUS OF TEAM SKILLS TRAINING RESEARCH

The nature of team skills, their operationalization, team performance criteria, and task dimensions all must be considered in formulating and conducting team skills training research. Figure 2 draws upon the discussion of these themes as they are covered in the review and training research literatures to summarize a model for team skills training research. At the left of the model are team skills. We have singled out coordination as the primary team skills construct because we feel that it adequately represents competence in working together which is the basic characteristic of a team skill.

At the heart of the model are interaction behaviors which form the operational definition for the team skill. While some writers have expressed dissatisfaction with the emphasis placed on interactions and communications in the team skills literature, we see no alternative at the present. Interactions among team members are the forms which team skills assume. Moreover, the nature and content of these interactions which define competence in coordination may vary from one task to another. Therefore, coordination as a team skill may have to be defined differently as a function of the task context in which it is being applied.

We consider support systems to be critical to the development of training programs to improve team skill competence. Attempts to train team members directly on appropriate types of interactions are likely to fail because of the unrealistic requirement made of team members to actively monitor their interactions themselves. What is more likely to work is the development of task structures, strategy discussion procedures, and performance feedback mechanisms which encourage certain types of team skill interactions to take place. Some types of supports could be useful both during team training and as part of on-going field team activities. For example, procedures designed to aid a team in discussing adaptive coordination strategies for novel task conditions during team training could be used for similar purposes in real-world settings. Team leadership is also an important part of the support system. Leadership tends to be ignored completely in the team training literature. However, given the leader's role in military teams and in other

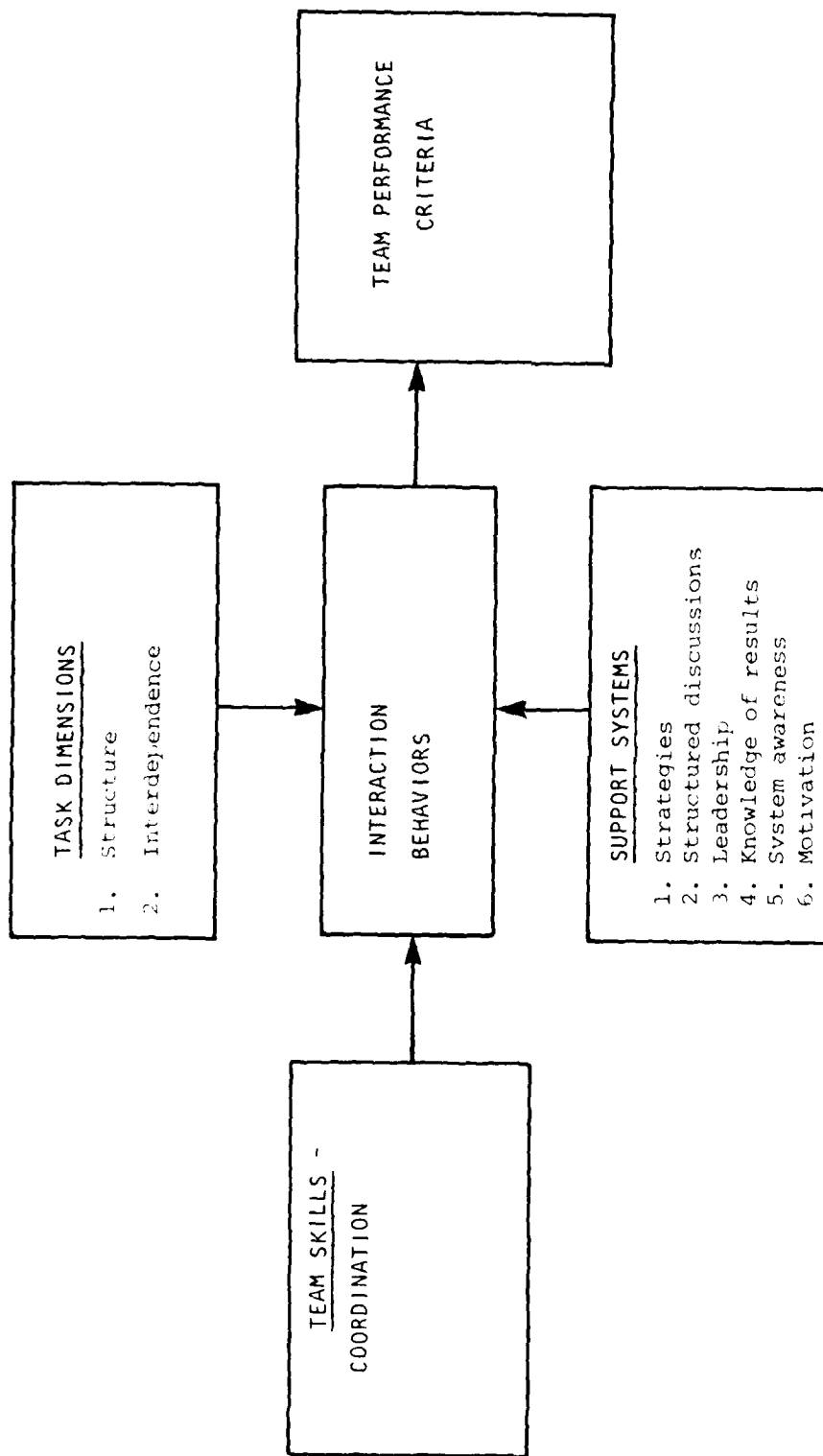


Figure 2. A Conceptual Model for Team Training Research

her influence on task structure and team member interactions, it is necessary to build formal leadership into team skills training research.

The model also shows that task dimensions are an important consideration as they influence team member interactions. It is obviously desirable to focus team training research on tasks where team coordination interactions are most likely to make a difference. Unpredictable, evolving tasks with interrelated sub-elements seem to best represent this requirement.

Of equal importance is clearly establishing the linkage between team coordination communications and team training performance criteria. This entails not only the delineation of valid team performance measures but also the establishment of valid team skills interaction measures. It also involves the identification and measurement of other training interventions in addition to those involving team skills which may contribute to a change in team performance.

One fact which became obvious to us early in our literature review was the limited amount of research available where specific team skills interventions had occurred. This lack of research activity was noted by Campbell in his exploration of training research for the Annual Review of Psychology in 1971 where he indicated that training teams as coordinated units should be a more active research topic given its potential importance in organizations. Nine years later in the same publication, Goldstein (1980) reached a similar conclusion noting that "in view of repeated calls for more understanding of team training, the lack of theoretical and empirical work is disappointing (p. 237)." Moreover, Collins (1977) figured out that an average of less than two training research studies per year were conducted between 1970 and 1976. Our review for the team skills training matrix covered fourteen relevant research studies and we had to extend our definition of team skill intervention to include non-training as well as training research contexts.

Team skills training research has been difficult to conduct particularly given the fact that research on the impact of team skills on team performance has not provided much guidance. If there is to be any real support for

team skills training research in the Navy, the immediate requirement is to demonstrate the value of team skills targetted training in straightforward, short-term research studies. Previous research which might serve as a model for such a study is the work done by Siegel and Federman (1973). Let us briefly describe how this study fulfills the requirements laid out in the model for team training research in Figure 2.

Siegel and Federman began with a content analysis of communications data collected from teams performing on an anti-submarine helicopter simulator. Twenty-eight communications categories were used which were found through factor analysis to yield three consistent dimensions across two separate data collections. The factors included providing/requesting information and options, evaluative interchanges, and providing/requesting opinions. It was then determined that these communications factors were related to independent measures of team proficiency in the performance of the anti-submarine warfare training tasks. Therefore, at this stage of the study, the researchers had operationalized coordination team skills in terms of identifiable and measurable interaction behaviors for a specific training task. They had also demonstrated that these team skills related to team performance criteria.

The next step in the research was to build the team skills into the training program. This was done through follow-up structured team discussions of earlier task performance where instructors kept focusing on the three communications factors. Role-playing exercises were also used to simulate real situations where team member roles were designed to incorporate positive and negative interactions suggested by the communications factors. These two activities formed the support system for developing the interactive team skills.

The evaluation of the impact of the team skills training involved comparing the performance of sixteen teams which engaged in this training with sixteen control teams. The relevant communications team skills of both sets of teams were also compared. The results showed that the team skill trained groups exhibited more frequent communications across the critical interaction categories. However, no significant performance differences were

discovered between the two sets of teams. Unfortunately, the control teams had more experience in performing the task which may have accounted for the results.

While the Siegel and Federman research did not yield significant performance differences between team skill trained and untrained groups, it still serves as a prototype for what is required to establish the targets for and utility of team skills training. The first step involves the identification of team skills operationalized as interaction behaviors which relate to team performance criteria for a given on-line Navy training task. Primary focus should be placed on emergent tasks with substantial requirements for team member interdependence since these types of tasks are most likely to have significant team skill - task performance linkages. The second step is to determine support systems for critical team skills. These systems include formal team training scenarios and aids as well as team strategies for emphasizing and reinforcing team skills. These strategies could incorporate structured discussions as well as aspects of leadership, knowledge of results, system awareness, and motivation. The third step in the research effort entails actual evaluation of the impact of the team skills targeted training. Standard experimental - control group and longitudinal research designs are necessary. Moreover, as we have already emphasized, it is important to have separate measures of team skills interactions and team performance so that any relationships between them can be clearly demonstrated.

Given the current status of team skills training research where there are few examples of studies which include these three steps, it is important to show that team skills targeted training does make a difference in the performance of critical Navy tasks. The first studies should focus on emergent, interdependent training tasks with explicit, straightforward performance criteria. Team coordination skills should be operationalized in terms of interaction content. Various content coding schemes are currently available to categorize team interactions (e.g., Bales, 1950; Rosen, Billings, & Turney, 1975). These systems can be custom-tailored to meet practical task requirements. Initial studies should be short-term and low cost with

simple team training inputs similar to the team member discussion scenarios and role-playing exercises used by Siegel and Federman. This type of study will satisfy essential initial requirements for addressing gaps in current research and establishing justification for more substantial future research on team skills training under complex team task conditions.

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