

TEAMWORK FROM TEAM TRAINING: AN ASSESSMENT OF INSTRUCTIONAL
PROCESSES IN NAVY TEAM TRAINING SYSTEMS

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ABSTRACT

This paper presents findings from a cooperative research effort between the Center for Applied Psychological Studies of Old Dominion University, Norfolk, VA, and the Naval Training Systems Center, Orlando, FL. These studies of Team Evolution And Maturation (TEAM) are designed to investigate the development of teamwork during the training of operational Navy teams. Initial results are summarized in terms of a general model of the phases of team evolution and maturation, a "developmental" research perspective based on this model, prototype procedures for measuring team development during training, and data which provide empirical support for the model and measurement procedures. In addition, findings are presented which help to explicate the instructional strategies and processes employed in team training. The implications of these studies are discussed and recommendations are given concerning interventions for improving team training instructional technology.

INTRODUCTION

In a presentation to the 1985 Interservice/Industry Training Systems Conference, Salas reported that the Human Factors Division of the Naval Training Systems Center had initiated a systematic R&D effort to address several problems associated with previous team training and team performance research (18). He discussed two new programs aimed at establishing guidelines for the training of operational military teams. One of those programs of research is being conducted by the Center for Applied Psychological Studies of Old Dominion University. This research has been designed specifically to investigate the processes involved in the development and evolution of Navy teams in training. The ultimate goal of these studies of Team Evolution And Maturation (TEAM) is to enhance the design of team training systems by (a) providing a greater understanding of the factors that influence the development of teamwork during operational Navy training, and (b) developing interventions to improve the instructional technologies used in Navy team training systems.

The focus of this research on the development of teamwork during team training is rather unique. Although previous authors have acknowledged the dynamic and "organismic" nature of teams (cf. 6, 8, 9, 13, 15), very little research has focused on the developmental processes involved in the time-dependent acquisition of teamwork skills. Most studies have involved fully-mature teams that have already developed the skills required in

interacting and coordinating team performance activities.

The current research is based on the belief that a fuller understanding of the developmental patterns of the behaviors associated with effective intrateam coordination, cooperation, communication, etc. will contribute substantially to the enhancement of team training systems. The purposes of the current paper are to (1) describe this unique research program, (2) summarize results which illustrate the validity of the approach and its measurement procedures, and (3) present conclusions and recommendations that have relevance for the design of future team training systems.

THE "TEAM" METHODOLOGY

The Perspective

The developmental focus of this research is based on the assumption that effective team training will produce measurable changes in team behaviors that enhance the efficiency and effectiveness of teamwork. Thus, it is expected that teamwork will develop through several phases that begin with a loosely organized group of individuals and ends with a highly effective team whose members interact, coordinate, communicate, etc. in ways that are optimum for the performance of their assigned task(s). This perspective, which has provided the general orientation for the current research, is represented in Figure 1.

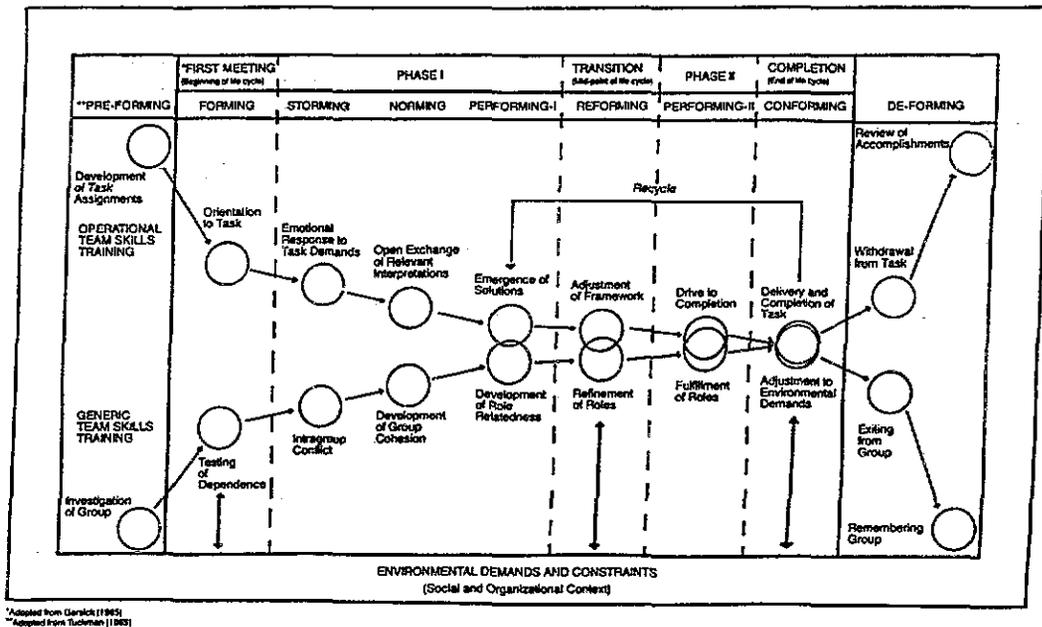


Figure 1. A Generalized Model of Team Evolution and Maturation.

Based on the suggestions of several previous authors (e.g., 1, 2, 3, 4, 5, 10, 11, 19, 20), this model of team evolution and maturation (i.e., the TEAM model) indicates that task-oriented teams evolve through a series of developmental phases (and, presumably, effective team training exercises will enhance the progression of teams through this evolution). Of course, different teams will begin at different stages of development and spend different amounts of time in various phases, depending upon the characteristics of the team members, their past history and experience, the nature of their task, their environmental context, the efficacy of their training, and other variables. In fact, although all the phases in Figure 1 have been identified by previous authors, it should not be expected that all teams will progress through all of these phases during the course of any specific training program. Nevertheless, the model suggests that it should be possible to document the development of teamwork from levels that are characterized by ineptness and exploratory interactions to the final levels of efficient and effective performance.

The model tracks two distinguishable kinds of team activities across the stages of evolution and maturation. As suggested by Tuckman (19), the first set of these activities (represented by the upper row of circles) is related to the development of skills involved in performing the team's assigned technical task(s). That is, a substantial portion of a team's effort will be devoted to the development of "operational skills" (see 7), such as those involved in understanding the task requirements, discovering the rules of performance, learning prescribed communication requirements, acquiring necessary

task information, etc. On the other hand, teams also devote considerable effort to the development of "generic skills" (7; represented by the lower row of circles in Figure 1) that are involved in the development of team interactions, relationships, affects, and coordination. These activities include the establishment of roles, the development of cohesion, the development of team structure, etc. They are essential parameters in the development of successful teams. The TEAM model and its theoretical foundations are discussed in greater detail by Morgan, Glickman, Woodard, Blaiwes, and Salas (17).

The Procedures

In order to test the research perspective outlined above, a battery of data collection devices were developed to (a) measure team demographics (particularly the ranks--or rates--of the team members, and their levels of experience in the Navy and in their current assignment), (b) sample the development of behaviors that are critical to the maturation of teamwork, (c) assess changes that take place in the perceptions of team members concerning the team's knowledge and abilities, motivation, communication skills, coordination, etc., (d) estimate the levels of performance of the team members and the team as a whole, and (e) determine the instructional strategies and techniques used by instructors during team training. In the study reported here (the first of three such studies planned for this project), these instruments were used to measure the development of teamwork in 13 Combat Information Center (CIC) teams undergoing training at the Naval Gunfire Support (NGFS) simulator at the Naval Amphibious School, Norfolk, Virginia.

This research focused on CIC teams for several reasons: (a) the typical CIC team consists of eight team members, (b) CIC is the most critical subsystem of the NGFS activity, and (c) CIC performances require a substantial amount of intrateam interdependency, communication, and interaction. In addition, findings obtained with these teams offer high potential for generalization to many other Navy teams whose operations are similar to that of the NGFS CIC teams. Training of the CIC teams consisted of a one-half day orientation session followed by 3 1/2 to 4 1/2 days of simulation exercises. The simulator training is presented in five phases (Basics, Pre-midterm, Midterm, Post-midterm, and Final), and data concerning the development of teamwork were collected for each phase (at the end of each morning and afternoon training session). On-line performance (criterion) data were also provided by the School from scores on the Midterm and Final test exercises performed by each team. Team membership and position assignments remained the same throughout training.

Only a part of the results are presented here. These were generated primarily from data from a Trainee Self-Report Questionnaire (TSRQ) and semi-structured interviews with NGFS instructors; other results from this study are discussed by Glickman et al (12). The TSRQ is a modification of a similar questionnaire used by James, Gustafson, and Sells (14). Using a five-point Likert scale, each trainee completed this 21-item questionnaire at the end of each morning and afternoon session of training. The items measured the trainees' perceptions of the job knowledge, motivation, role clarity, experience, and training of the other team members, and the overall team's communication, cooperation, coordination, experience, training, and power relationships.

In the period during which the TSRQ (and other TEAM) data were being collected, NGFS training procedures were observed directly, and instructors were interviewed concerning the instructional processes that are employed in NGFS training. One purpose of this effort was to determine how instructors assess the training needs and performance capabilities of teams and how they select appropriate training strategies for use with a given team. The interviews were also aimed at identifying the decisions made by instructors, the instructional strategies and tactics that they employ, and the content and timing of feedback that they provide to trainees.

TEAM DEVELOPMENT

In order to examine the changes that take place in teams as they undergo training, data from the TSRQ were submitted to a series of exploratory factor analyses. Specifically, phase-to-phase transitioning and change were examined by combining TSRQ data from adjacent training phases and factor analyzing each of the resulting groupings of the data. Thus, each of the following four data combinations were factor analyzed: (1) Basics and Pre-midterm, (2) Pre-midterm and Midterm, (3) Midterm and Post-midterm, and (4) Post-midterm and Final. The resulting factor structures were interpreted on the basis of the factors that accounted for

more than 4.0% of the variance for a given data grouping and on the basis of items that had loadings of 0.40 or greater. When taken as a whole, the factor structures present a pattern of results that supports the overall conceptualization of the TEAM model. These results are summarized in Table 1, which shows the percentage of variance accounted for by the factors identified from each of the five training phases.

Table 1
Summary of Factors Identified for
Each Phase of Team Training

TRAINING PHASE	FACTOR IDENTIFICATION		
	TEAMWORK	TASKWORK	TEAM/TASK
BASICS			7.6
PRE-MIDTERM	22.0 5.8	5.5	
MIDTERM	8.0 6.0	8.8	
POST-MIDTERM			26.0 25.8
FINAL			8.4

These data show that the Basics phase of training produced only one substantial factor. This factor loaded most heavily on items related to various aspects of task performance as well as team coordination, cohesion, and communication. It is interpreted as being related to the formation of basic team skills in the earliest stage of training. Two factors were identified in the Pre-midterm and Midterm phases. The first of these is clearly a "teamwork-centered" factor. It consistently loaded on items related to team member's perceptions of activities that involve working with other team members, communication, cooperation, and relationships within the team. The table's double entry for this factor in both the Pre-midterm and Midterm phases indicates that the same factor emerged from both of the analyses of the data groupings that included the data from these two phases. The second factor identified in the Pre-midterm and Midterm phases is identified on the basis of its loadings on items related to the organization and performance of assigned tasks. Items comprising this factor are concerned with efforts to complete the tasks as well as the performance outcomes associated with the tasks. Thus, it is considered to be a task-centered or "taskwork" factor. A single large factor emerged in the final two phases of training. This factor is somewhat different from the one that emerged in the Basics phase. It seems to represent a merger of the two factors identified in the two previous phases. It loads heavily on items associated with both teamwork and taskwork. In

this case, however, these items do not seem to be independent of each other as they were in the prior two phases.

Thus, consistent with the theory underlying the TEAM model, these results indicate that NGFS trainees begin with a wide variety of performance concerns related to the development of team skills. In the second and third phases of training, they express independent concern for teamwork- and taskwork-centered activities. This supports the notion that team members are (a) learning to perform their tasks by discovering the performance rules, exchanging task-related information, learning to operate equipment, etc., while also (b) working to enhance the quality of team interactions by establishing relationships with other team members, developing more efficient patterns of coordination and cooperation, and strengthening team roles, cohesion, etc. Following the Midterm phase, the factors related to these separate kinds of activities merge into a single factor involving both kinds of activities. This suggests that the team has matured to a point where their task- and team-related activities become indistinguishable with respect to their relationship to team performance. In total, these findings provide an initial validation of the model and approach that serve as the basis for this research program.

Data from the TSRQ were also analyzed in order to examine the extent to which the questionnaire items are sensitive to changes in the perceptions of team members across the five phases of training. The results of the separate analyses of variance for each of the 21 items indicated that several of the team-centered and several of the task-centered items yielded significant differences across the phases. Thus, according to the perceptions of the team members, the team's team- and task-related activities are improved as a result of training.

This finding was further explored by examining the data from each TSRQ item separately for groupings of the three most effective teams and the four least effective teams. This division of the teams (into roughly the top one-fourth and bottom one-fourth performers) was made on the basis of performance scores on the Final performance exercise. Again, several of the team-related and several of the task-related items revealed differential patterns for the more effective and less effective teams across the five phases of training.

This result is illustrated in Figure 2, which presents the factor scores for the teamwork and taskwork factors averaged separately for the more effective and less effective teams for each phase of training. These data indicate that in the more effective teams, perceptions about the knowledge of other team members concerning the performance of their assigned duties increased steadily (became more positive) across training. On the other hand, data for the less effective teams indicate that training had a relatively small impact on the perceptions of these teams (particularly the perceptions related to task-related items). In effect, these teams reported that their team members manifested smaller increases in job knowledge as a result of training. The less

effective teams did not benefit from training in the way that the more effective teams did. Thus, it seems that additional attention should be devoted to examining the nature of team training received by these teams.

INSTRUCTIONAL PROCESSES

In summary, the TSRQ data indicate that team behaviors change as a function of training and that, at least for the more effective teams, these changes are reflected in increasingly positive perceptions of the team. Apparently, all the teams enter training feeling pretty good about their abilities. However, as the performance of the more effective teams improves, they express more positive team perceptions; this seems to be less true for the less effective teams. Other data not reported here (see 12) also indicate that the teams which do best enter training with more positive attitudes, benefit from more decisive leadership, engage in a higher proportion of more effective team behaviors (and correspondingly fewer ineffective behaviors), and require less intervention from an instructor.

In an attempt to understand why some teams benefited from training more than other teams (apparently with less "instruction"), an effort was made to document the processes employed by instructors and to determine how they dealt with the varying instructional requirements of different teams. Instructor behaviors were examined through direct observation of NGFS training and by conducting interviews with the instructors. Semi-structured interviews were conducted with six of the eight NGFS instructional staff members. The interviews were then transcribed and summary statements were categorized by topic. When possible, instructor comments were further subdivided in terms of their application to the more effective or less effective teams. Based on the observations and the contents of the interviews, a model was developed to describe the NGFS instructional processes (see 16). The primary purpose of this model was to highlight the instructional decisions, strategies, processes, methods, etc. employed in this team training setting.

While a full discussion of the Instructional Processes Model is beyond the scope of this paper, it should be noted the model identifies 10 process-related stages of NGFS training. Each stage involves several instructional processes, some of which are formally required as part of the prescribed training exercises, while others are informally conducted by instructors. In essence, the model indicates that instructors begin by conducting pre-training assessments of the capabilities and training needs of the teams. These assessments are made very quickly and informally (based only on the opinion, experience, and insights of the instructor) during the team's initial briefing. However, based on these assessments, the instructor selects a training approach (formal, informal, socratic, etc.) for use in later stages of instruction.

Teams are categorized by instructors into at least four types based on their assessed

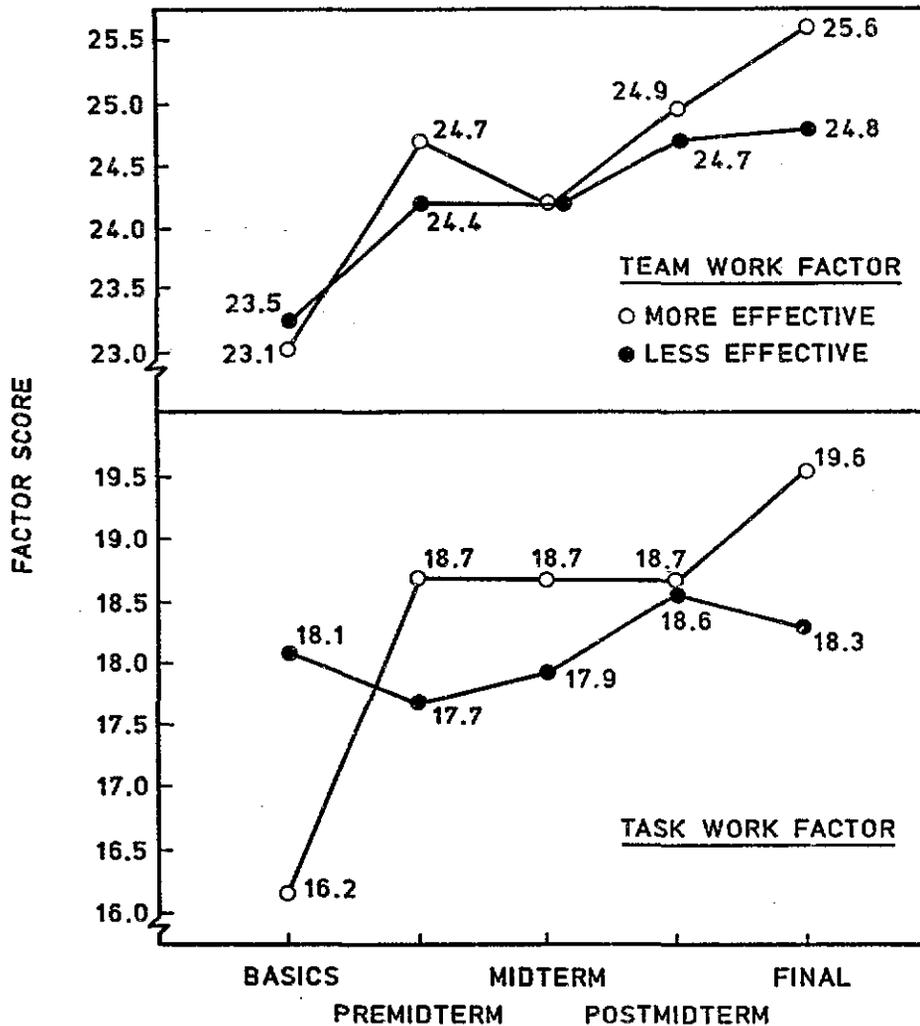


Figure 2. Average Factor Scores for More Effective and Less Effective Teams.

levels of knowledge and attitudes (high and low knowledge crossed with high and low motivation). Considerably different instructional approaches are used in presenting information, guiding the team's performance, and providing feedback to these different types of teams. However, the instructor continuously evaluates the training and adjusts his approach as necessary. Instructors indicate that highly motivated teams are relatively easy to train (although those with low knowledge levels require more time), but that they tend to invest somewhat less effort in the training of teams with low levels of motivation. These teams do not want to be "bothered" with additional information or effort, and instructors are likely to be "turned off" by their lack of motivation.

CONCLUSIONS AND RECOMMENDATIONS

The point here is that on the basis of an informal (probably incomplete and perhaps incorrect) assessment teams are instructed in considerably different ways. Although the system is somewhat self-correcting with respect to instructional approach, it does appear that the teams which could benefit most from team-centered training (those with low levels of motivation) seem to receive less of such training. While this linkage has not yet been firmly established, it can be suggested that the failure of less effective teams to "mature" in terms of the development of teamwork behaviors may be a result of insufficient teamwork training for these teams.

Based on the limited findings to date, it is recommended that formal assessment tools be developed and implemented for use in determining the pre-training levels of task-related skills, teamwork-related capabilities, and motivation and attitudes. In addition, a standardized system should be developed to help the instructor translate the identified levels of abilities and attitudes into clear statements of training needs and approaches. This system should stress teamwork training for teams with low levels of motivation. That is, the system should seek to optimize training approaches on key teamwork variables such as those discussed here. In addition, the training approaches should be standardized so as to provide more formal and consistent feedback to all teams. Other performance aids should also be examined as potential ways to enhance the instructor's ability to assess trainees, monitor critical team behaviors, provide timely feedback, conduct thorough debriefs, etc. Finally, more thorough and formal training sessions should be developed to train instructors to conduct pre-training assessments of trainees, recognize critical team behavior problems, provide appropriate teamwork-centered feedback, etc. The use of videotapes of the performances of effective and ineffective teams might be very useful for such training. While other recommendations are forthcoming from this research program, those identified here should provide an initial basis for substantial enhancements to current team training technology.

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