NAVAL TRAINING SYSTEMS CENTER
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TECHNICAL REPORT 87-017

INSTRUCTIONAL PROCESSES AND STRATEGIES IN TEAM TRAINING

NOVEMBER 1987

Paula [illegible]uerette

CENTER OF EXCELLENCE FOR SIMULATION AND TRAINING TECHNOLOGY

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The research reported here represents a detailed analysis of the instructional processes and strategies at the Naval Gunfire Support (NGFS) Department, Naval Amphibious School, Little Creek, Norfolk, Virginia, as they relate to NGFS team training. This effort was undertaken to examine the instructional processes and strategies that occur, and to determine their relationship to, and impact upon, the success of NGFS teams in training. NGFS instructors were interviewed, in order to uncover the characteristics of teams which impact the instructional approaches used in team training, as well as determining the factors which cause the instructor to change instructional approaches during training.

These efforts culminated in a model of instructional processes, with particular emphasis on the differential training decisions and instructional strategies employed by instructors while training teams with different levels of skill, knowledge, and attitudes. The model has proven valuable in describing the team-oriented instructional assessments, decisions, strategies, and feedback mechanisms employed by instructors in a team training setting. (CONTINUED)

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FOREWORD

This document represents a report of one of the research projects conducted at the Naval Gunfire Support (NGFS) Department, Naval Amphibious School, Little Creek, Norfolk, Virginia under the U.S. Navy Contract No. N00014-86-K-0472. The report was prepared for the Office of Naval Research, Arlington, VA, 22217-5000 and was sponsored by the Human Factors Division, Naval Training Systems Center (NAVTRASYSCEN), Department of the Navy, Orlando, FL, 32813-7200. Thanks are expressed to Drs. Robert Swezey of Science Applications International Corporation and James Lester of the Office of Naval Research who provided valuable insights during the formative stages of the model development. We are grateful for the assistance of Sandra Jacobson and Teri Pedigo in preparation of this report. Thanks are also expressed to the employees at the Old Dominion University Research Foundation for their attention to many of the technical details of project administration.

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EXECUTIVE SUMMARY

The research reported here represents a detailed analysis of the instructional processes and strategies at the Naval Gunfire Support (NGFS) Department, Naval Amphibious School, Little Creek, Norfolk, Virginia, as they relate to NGFS team training. This effort was undertaken to examine the instructional processes and strategies that occur, and to determine their relationship to, and impact upon, the success of NGFS teams in training. NGFS instructors were interviewed, in order to uncover the characteristics of teams which impact the instructional approaches used in team training, as well as determining the factors which cause the instructor to change instructional approaches during training. These efforts culminated in a model of instructional processes, with particular emphasis on the differential training decisions and instructional strategies employed by instructors while training teams with different levels of skill, knowledge, and attitudes. The model has proven valuable in describing the team-oriented instructional assessments, decisions, strategies, and feedback mechanisms employed by instructors in a team-training setting. Through these process-oriented descriptions, the model has made salient several areas in which team-training interventions are likely to enhance specific instructional processes in operational training systems. Recommendations for interventions based on information gleaned from the model and the prior experience of the research staff are presented.

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INSTRUCTIONAL PROCESSES AND STRATEGIES IN TEAM TRAINING

INTRODUCTION

Considerable resources are devoted to research on training of both individuals and teams. This research is directed, in general, toward identifying, measuring, and understanding variables that impact task performance and, in particular, toward applying this knowledge to improve training systems and instructional processes. Several previous efforts have been directed toward the development of models of the overall training system, and of the processes that take place within training systems. However, these research efforts have tended to ignore, or have not addressed thoroughly, the role, behavior, and impact of the instructor within the instructional system. This despite the fact that instructional designers have argued that the instructor provides many elements essential to the processes of learning. In the team training context, the need for instructor skill and support is especially important, given the dynamics and complexities of operational training arising from the interactions and interdependencies of the number of people involved. Therefore, a fundamental requirement is to make explicit the actions, events, and specific tasks of the instructor that are essential components of the team instruction process. In order to undertake instructional design at the level of teamwork, it is important to understand the characteristics of instructional events that contribute to enhanced team performance.

OBJECTIVES

The overall objectives of the research effort reported here are to: (1) identify, assess, and improve the instructional processes and strategies employed by instructors during the training of operational Navy teams, with reference to a model; (2) provide suggestions of ways to more accurately diagnose the strengths and weaknesses of instruction; (3) use the model as a guide for the generation and development of instructional aids, tools, technologies and procedures for team training systems; (4) serve as the first step in an effort to construct a generic model of the current state-of-the-art instructional processes employed in existing Navy team training systems; (5) aid in the specification of team training design guidelines; and (6) generate recommendations for further research in team training instruction and technology.

ORGANIZATION OF THE REPORT

The present report reviews the development of a model of instructional processes at the Naval Gunfire School (NGFS) Department, Naval Amphibious School, Little Creek, Norfolk, Virginia, as seen by NGFS instructors. The model has been developed to describe how instructors "instruct" teams and how they deal with key team factors at different points during the week-long NGFS

training. The model includes such things as the instructors' assessments of the teams' performance and training needs, the diagnoses and decisions made by instructors, the instructional strategies and tactics employed by instructors, and the content and timing of feedback provided during the course of NGFS team training.

The report expands upon material published earlier by Morgan, Glickman, Woodard, Blaiwes & Salas (1986). It is organized into six sections. The first section, the Introduction, presents an overview of instructional models and describes the problems with current team training design. The next section, Model Development, provides a description of NGFS training process, along with the rationale for developing a model of the NGFS instructional processes. The third section, the Method, describes the procedures and approaches followed in order to develop the model. The fourth section, The Model, presents a general overview of the Instructional Processes Model, followed by a detailed discussion of the processes and strategies employed by instructors during NGFS instruction. The fifth section, Applications of the Instructional Processes Model, discusses several recommendations designed to improve instruction in operational systems, based on the processes described in the model. The final section, the Conclusion, provides a brief summary of the general implications of the findings.

BACKGROUND

Overview of Instructional Models. There are several different directions that an instructional model can follow in order to portray a training process or system. For the most part, the focus of the model will be determined by the anticipated purposes and uses of the model. The following subsections summarize the relevant features of four classes of instructional models - predictive models, prescriptive models, system models, and process models.

Predictive Models. In general, predictive models serve to predict the degree of effectiveness of training, if that training follows a particular, specified course of action. In this case, "prediction" refers to more quantitative measures of training effectiveness such as performance, degree of transfer of training, and time required to attain training criteria (see Rose & Wheaton & Yates 1985).

Prescriptive Models. A second type of model, the prescriptive model, specifies or "prescribes" instructional methods for achieving both cognitive (i.e., "learning how to learn") and behavioral (i.e., content-specific associations, discriminations, generalizations) goals of the instructional process. Prescriptive models outline the use and order of instructional events needed to facilitate specific types of learning, and specify guidelines for selecting the types of instructional media to be used (see Gagne & Briggs, 1979; Briggs, 1977; Aronson & Briggs, 1983).

System Models. Overall system models (e.g., Goldstein, 1986) and notably, the Instructional Systems Development (ISD) methodology and its variants have been developed to provide guidance in the design, development, and evaluation of the training system and its subcomponents. ISD is basically a conceptual framework and methodology that sets the stage for models and design of training. ISD has five phases: (1) analysis - a job analysis is conducted to identify tasks which require training; (2) design - learning objectives are defined for each task as well as a sequence and structure of instruction; (3) develop - tasks are classified into categories, and decision matrices are used to determine media and mode of instruction; (4) implement - instruction is planned and monitored to identify problems; and (5) feedback or control - internal and external evaluations are conducted to assess the effectiveness of the instructional systems development (see TRADOC Pamphlet 350-30, Intervention Procedures for Instructional Systems Development, for further details). While ISD can serve as a general guide, it does not provide a formal and specific model for training design and development. It also must be noted that ISD approaches have dealt almost exclusively with individual training. Teamwork and skill requirements for effective group functioning usually have not been included.

Various models have been developed over the years that augment the ISD process in order to serve certain technical or operational purposes. Training Effectiveness Cost Effectiveness Prediction (TECEP) has been used by training designers to establish cost-effective estimates for instructional delivery systems (Braby, Henry, Parrish & Swope, 1975; Aagard & Braby, 1976). The Training Development Decision Support System (TDDSS) has been used to generate data for making training effectiveness (and cost) judgments for preset performance objectives and for structuring the content of courses (Hawley & Frederickson, 1983).

Process Models. In contrast to these technically oriented system models, process models have been oriented toward describing or guiding the actual instructional events that take place within training curricula (i.e., models of the instructional process). In general, instructional processes include those methods and techniques, both formal and informal, that instructors use to assess system deficiencies, impart knowledge, and provide analytical feedback to those receiving instruction. In the present context, instructional processes refer to those cognitive procedures, instructional decisions, presentation strategies, training approaches, and other processes that instructors employ during training. There are two basic types of instructional process models: those that describe generic instructional processes applicable to a variety of training systems, and those that detail the instructional processes of one particular training system.

Numerous generic instructional process models can be found in the literature. One of the few devoted to teams has been developed by Davis, Gaddy & Turney (1985). They suggest a five phase approach to team skills training which involves identification and preparation of team skills objectives, training of basic team skills, training of team tasks, evaluation of team skills, and finally, evaluation of the team training program. Although developed for a particular group of individuals (i.e., nuclear power plant control room crews), this model is sufficiently general to provide a useful prototype for other team training situations. Several of the more specific models of instructional processes have also been described by previous authors (e.g., Cooper, Glickman, Johnston, Mallamad, Olson, Price, Weiner, & Yedlin, 1979).

Both overall system and instructional process models are useful tools for planning the design, development and operation of effective training systems. Both types of models can be used in the identification and understanding of system problems and the generation of interventions for system improvement.

Problems in Team Training Design

Here a team is defined as "a distinguishable set of two or more individuals who interact interdependently and adaptively to achieve specified, shared, and valued objectives" (Morgan et al., 1986). As noted, the principal focus of training models, and of the training literature in general, has been on the development of individual skills. The model for the development of training systems followed by developers of military training (i.e., the military version of the general ISD model; TRADOC Pamphlet 350-30) reflects this focus. Yet, most Navy operations today depend on the integrated performances of teams of individuals.

Except in a few instances (Davis et al., 1985; Nieva, Fleishman & Reich, 1978), neither the team training literature nor ISD procedures provide conceptual frameworks for the design and evaluation of systems for training teams or their component instructional processes. There is a lack of understanding of those processes that are unique to teams (i.e., those performance factors that constitute what is commonly referred to as "teamwork"; see Glickman, Zimmer, Montero, Guerette, Campbell, Morgan & Salas, in press). Consequently, there is a lack of understanding of how to design and effectively manage team training systems (Alluisi, 1977; Baum, Modrick & Hollingsworth, 1981; Denson, 1981; Dyer, 1984; Goldin & Thorndyke, 1980; Hall & Rizzo, 1975; Nieva et al., 1978; Rizzo, 1980; Kribs, Thurmond & Marks, 1977). The team training literature provides little guidance in such basic areas as the measurement and evaluation of teamwork variables and means of instructing teams. Furthermore, in most team training, systematic feedback on teamwork factors is not built into the system in order to guide and enhance teamwork activities and performance in a systematic fashion. Because of these gaps in knowledge, it is likely that the quality of team training suffers.

A particularly vital aspect of team training involves the methods and procedures used by the instructors. Obviously, training success is heavily dependent upon the skills and knowledge of the instructor, but as yet training systems provide him or her with little guidance in making a choice of the instructional methods and procedures that are most likely to be effective in improving teamwork under given sets of circumstances (cf., Gagne & Briggs, 1979). While instructors typically are told what final minimum performance standards are specified and how much supervised practice of specific kinds is to be given, actual instruction in key teamwork skills occurs adventitiously; only when instructors happen to recognize these skill requirements, evaluate them, and develop ad hoc methods to train them. The instructors have not been trained in how to foster teamwork. Thus, outcomes of training that depend upon effective teamwork for success often are more a matter of chance than deliberate choice (see Morgan, et al., 1986). Given the existing dearth of scientifically developed and systematically applied information about instructional processes (i.e., knowledge about the activities of instructors, their interactions with teams, and the development of these interactions over time), it seems reasonable to expect that the investigation of such processes in greater depth will lead to the discovery of ways to help instructors and to better the quality of team instructional practices.

MODEL DEVELOPMENT

NAVAL GUNFIRE SUPPORT (NGFS)

Based on a specific set of criteria, the Naval Gunfire Support (NGFS) Department was selected as the site for an initial investigation of the ways in which teams evolve and mature during the course of training (see Glickman et al., in press for details). In particular, the Team Evolution and Maturation (TEAM) research focused on the training of the CIC component of NGFS. As a parallel investigation, the corresponding instructional processes and strategies that occur during CIC training were examined in the present context in order to determine the dynamic interactions which occur to influence training.

In order to understand the instructional processes at NGFS, consideration must first be given to the training system in which NGFS training takes place. NGFS training occurs in six distinct, sequential phases over the course of three to five days (typically four days). The formal training schedule is as follows:

(1) Pre-exercise, morning of Day 1;

(2) Basic missions, afternoon of Day 1;

(3) Pre-midterm, Day 2 and morning of Day 3;

(4) Midterm, afternoon of Day 3;

(5) Post-midterm, morning of Day 4; and

(6) Final exam, afternoon of Day 4.

The actual time devoted to each phase of training may vary from the standard schedule to meet the varying needs of ships and contingencies arising in the course of training.

RATIONALE

As depicted in Figure 1, the NGFS training approach consists of three elements: (1) the instructor, (2) the individuals, and (3) the team. As more has been learned about the NGFS training approach, it became increasingly evident that the activities and the magnitude of contribution made by each of these elements change as a function of: (1) the instructor's initial assessments of the team, (2) time, (3) team performance, and (4) key "teamwork" variables. This schematic representation of the interrelationships of these elements is offered to further understanding of NGFS training strategies and processes (see Morgan et al., 1986 for details).

The relative impact of each training element upon the training system is indicated by the size of the box containing that element. As can be seen, the behaviors of the instructors are different for tasks oriented toward team development rather than individual development. Thus, the instructional processes and strategies required in order to make generalizations about Navy team training effectiveness and to begin to provide systematic, valid, and standardized team instruction procedure (in a manner akin to ISD) have to be revealed and systematically examined.

METHOD

Three sources of information were used to develop the Team Instructional Processes Model (TIPM): (1) Naval Gunfire Support School (NGFS) instructors (the primary information source), (2) observations, expertise, and experience of project staff at the training site, and (3) the instructional process literature. A list of interview questions and an interview format were developed with inputs based on the collective technical expertise of the research staff, and on the experience and insight derived from previous interviews with NGFS instructors. A copy of the interview questionnaire is presented in Appendix A. Throughout the iterative interview process, relevant questions were added to the list as they arose. Over the course of several weeks, six of the eight NGFS instructors were interviewed individually using a semi-structured interview procedure. Interviews were taped and later transcribed. Interviews typically lasted from 30 to 45 minutes.

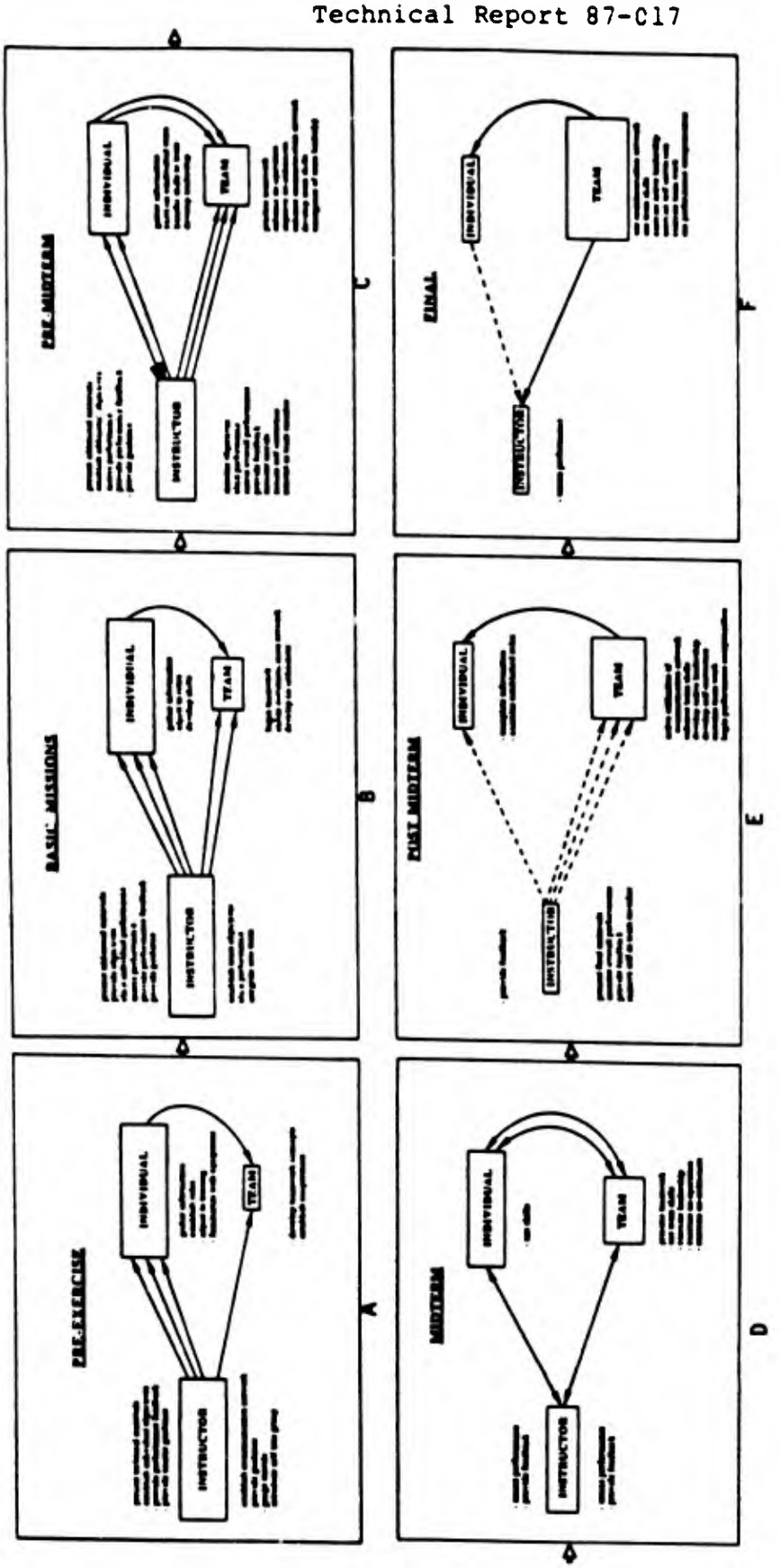


Figure 1. Component Model of NGFS Training. (From Morgan, Glickman, Woodard, Blaiwes, & Salas, Measurement of Team Behaviors in a Navy Team Environment, NTSC TR-86-014, Orlando, FL: Naval Training Systems Center, 1986.)

Once the interview process was complete, the contents of interview transcriptions were summarized and categorized by topic and, when appropriate, were further subdivided into instructor comments pertaining to more effective and less effective teams. These summaries laid the foundation for the schematic representation (i.e., the model) of the instructional processes used in team training contexts.

THE MODEL

OVERVIEW OF THE TEAM INSTRUCTIONAL PROCESSES MODEL (TIPM)

The TIPM is made up of ten stages, each of which contains several instructional events/actions, some of which are parts of the formal training system, and some of which are instructional activities that are not a part of the formal system. The formal processes consist of those instructional materials and activities specified in the instructors' Lesson Topic Guides (LTG). The informal processes range from semi- or non-conscious decision processes, to planned activities (e.g., feedback following midterm and final exams). While these particular processes are not part of the formal Navy team training system, they are integral parts of the actual training process. They occur because the initiative and experience of the instructors are tapped to translate the formal system into a workable training process.

A summary overview of the general Team Instructional Processes Model is shown in Figure 2. Ten stages of instructional processes have been identified:

(1) Pre-training Capability Assessment;

(2) Preliminary Assessment of Needs;

(3) Determination of Training Approach;

(4) Information Presentation;

(5) Mission Performance;

(6) Midterm Evaluation and Debrief;

(7) Determination of Training Approach;

(8) Information Presentation;

(9) Mission Performance;

(10) Final Evaluation and Debrief.

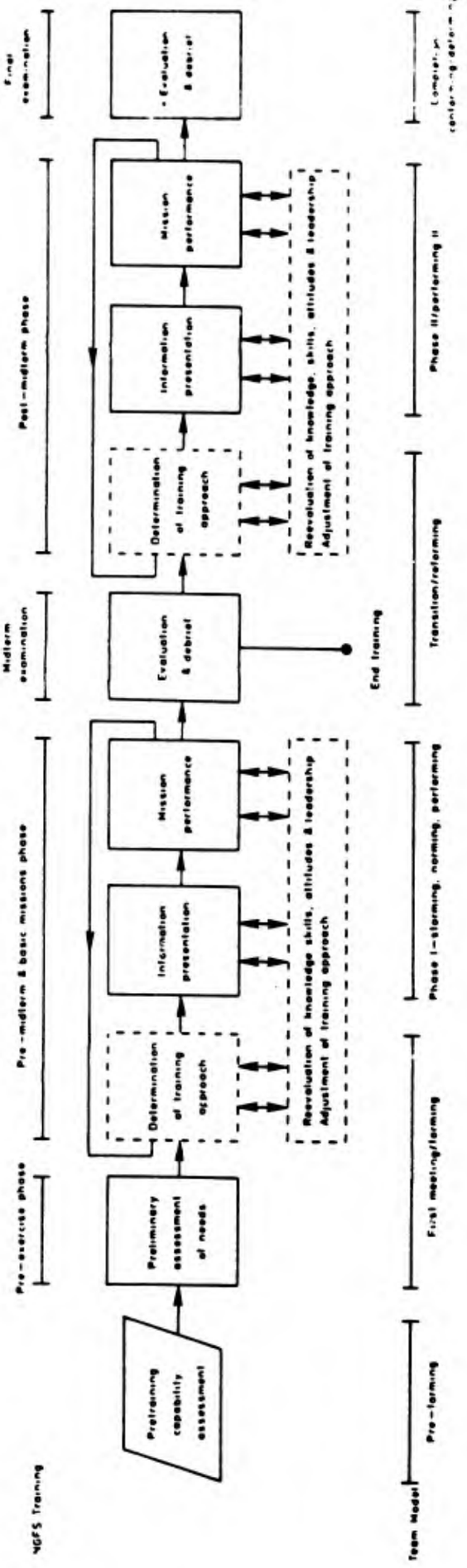


Figure 2. Overview of the Team Instructional Processes Model

Note that the informal instructional processes depicted in the model are shown as dotted lines and the formal processes are shown as solid lines. The stages and instructional events/actions within each stage are represented as non-overlapping for the sake of clarity. In fact, however, sometimes they overlap because component activities occur simultaneously. The ten stages of the model can be directly related to the formal training system as described previously, and as discussed in Morgan, et al. (1986).

The first stage of the TIPM, Pre-training Capability Assessment, is not included at present in the training system at NGFS, but it is included in the model because instructors suggest the need for such assessment prior to training. Instructors recommended that this stage consist of a review of the team's previous experience with NGFS training, both at an individual level and as a team. They suggested that this assessment take place before training begins, so that attention could be given early in training to the deficits revealed in members' task knowledge. At this point, members lacking individual prerequisite skills could either review task-specific information prior to training or, if necessary and feasible, be replaced by another individual with a more adequate background.

The Preliminary Assessment of Needs stage makes up the first morning of classroom training in which job assignments are reviewed, basic information is presented, the purpose of NGFS is articulated, and team members are familiarized with course objectives, contents, and training procedures. During this stage, the instructor, through interactions with the team members, makes an informal assessment of the prior knowledge and present motivation level or "attitudes" of the team members. Because "attitude" is the word that, in most Navy discussions, stands for what comes under the general heading of motivation, attitude is the term that will be used most often in the descriptive commentary in this report. Based on this assessment, the instructor estimates the training needs of the team.

The third stage in the TIPM, Determination of Training Approach, involves the adoption by instructors of a particular approach to be employed in training a particular crew. The shaping of an instructional approach generally begins very early on the first day of training, but is not well developed until basic missions training is underway.

The next two stages, Information Presentation and Mission Performance, involve the presentation of basic mission information to the teams and the guidance of their practice of mission exercises. Practice is, if course, guided, evaluated, and corrected by the instructor. Once a Basic Mission is learned adequately, the team proceeds to the next training mission. Once again this involves the instructor's presentation of mission information, and the team's practice of the mission (in sets of exercises). This is represented in Figure 2 by the loop from Mission Performance back to

Determination of Training Approach. The Reevaluation box that runs across these two stages is meant to indicate that change in the instructor's approach might occur at any point during the two stages.

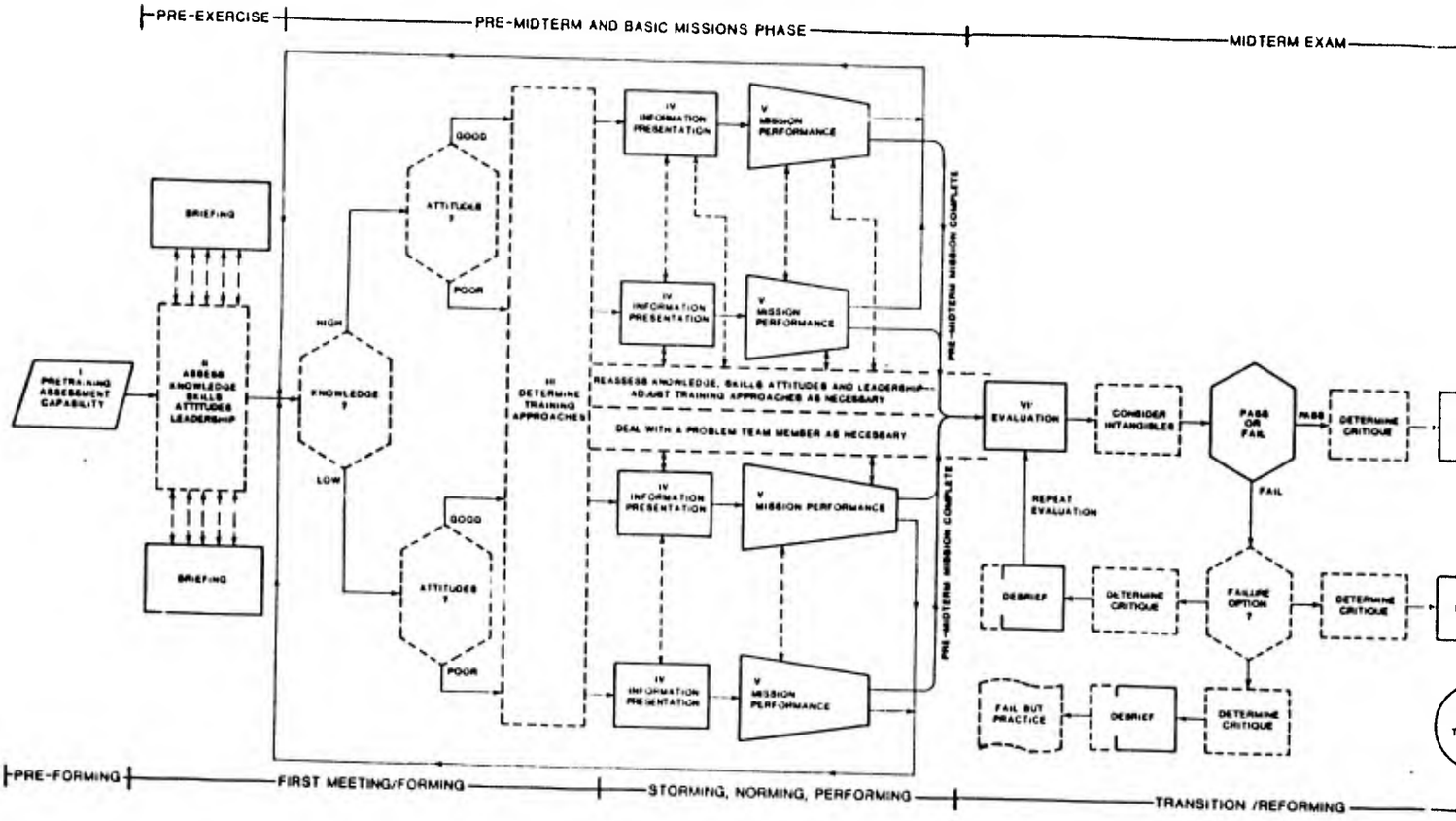
Information Presentation and Mission Performance, along with Reevaluation and Determination of Training Approach, continue until the team is ready for its Midterm (typically on the afternoon of Day Three). During the Evaluation and Debrief stage, teams are formally tested on their ability to perform the missions that they have learned. The instructor's role during this stage is mainly to monitor and score performance on the Midterm examination and to provide feedback on task-related and team-related skills.

The next three stages of training, Determination of Training Approach, Information Presentation, and Mission Performance, involve basically the same instructional processes as the corresponding Pre-midterm stages. These stages begin once a team has completed the Midterm and continue until the team takes its Final Exam (typically on the afternoon of Day Four).

The last stage, Evaluation and Debrief, consists of the Final examination and the feedback to team members regarding their exam performance.

DETAILED DISCUSSION OF THE TEAM INSTRUCTIONAL PROCESSES MODEL

The preceding section provides a general outline of the major instructional processes involved in NGFS training. In order to understand fully the nature of this training, however, it is necessary to examine the specific processes, approaches, and strategies used by instructors in each of the stages of instruction. These activities are depicted in Figure 3. In this figure, the 10 instructional stages are identified across the top of the model, while the formally specified phases of NGFS training are identified across the bottom. As reflected in this model, instructors report that they use somewhat different instructional approaches with the more effective and the less effective teams. Effectiveness is defined in terms of the instructor's estimate of the team's general level of proficiency. According to the instructors, these estimates are based on judgments of the team's attitude and level of prior knowledge. In this case,"attitude" is defined as team members' mental outlooks with regard to the training process, their willingness (or lack thereof) to expend effort and to learn, their affective states, and any other non-task related factor which serves to enhance or undermine training effectiveness. The processes employed with the more effective teams are shown in the upper half of the figure and those used with the less effective teams as shown in the lower half. In reality, there is a considerable amount of overlap between more and less effective teams. However, distinctions have been accentuated in the model for conceptual clarity. Based on combined information from instructor


PRE-EXERCISE
PRE-MIDTERM AND BASIC MISSIONS PHASE
MIDTERM EXAM
PRE-FORMING
FIRST MEETING/FORMING
STORMING, NORMING, PERFORMING
TRANSITION /REFORMING
I PRETRAINING ASSESSMENT CAPABILITY
II ASSESS KNOWLEDGE SKILLS ATTITUDES LEADERSHIP
KNOWLEDGE ?
HIGH
LOW
BRIEFING
BRIEFING
ATTITUDES ?
GOOD
POOR
ATTITUDES ?
GOOD
POOR
III DETERMINE TRAINING APPROACHES
IV INFORMATION PRESENTATION
V MISSION PERFORMANCE
IV INFORMATION PRESENTATION
V MISSION PERFORMANCE
IV INFORMATION PRESENTATION
V MISSION PERFORMANCE
REASSESS KNOWLEDGE, SKILLS ATTITUDES AND LEADERSHIP ADJUST TRAINING APPROACHES AS NECESSARY
DEAL WITH A PROBLEM TEAM MEMBER AS NECESSARY
PRE-MIDTERM MISSION COMPLETE
PRE-MIDTERM MISSION COMPLETE
VI EVALUATION
REPEAT EVALUATION
CONSIDER INTANGIBLES
PASS OR FAIL
PASS
FAIL
DETERMINE CRITIQUE
DEBRIEF
DETERMINE CRITIQUE
FAILURE OPTION ?
DETERMINE CRITIQUE
FAIL BUT PRACTICE
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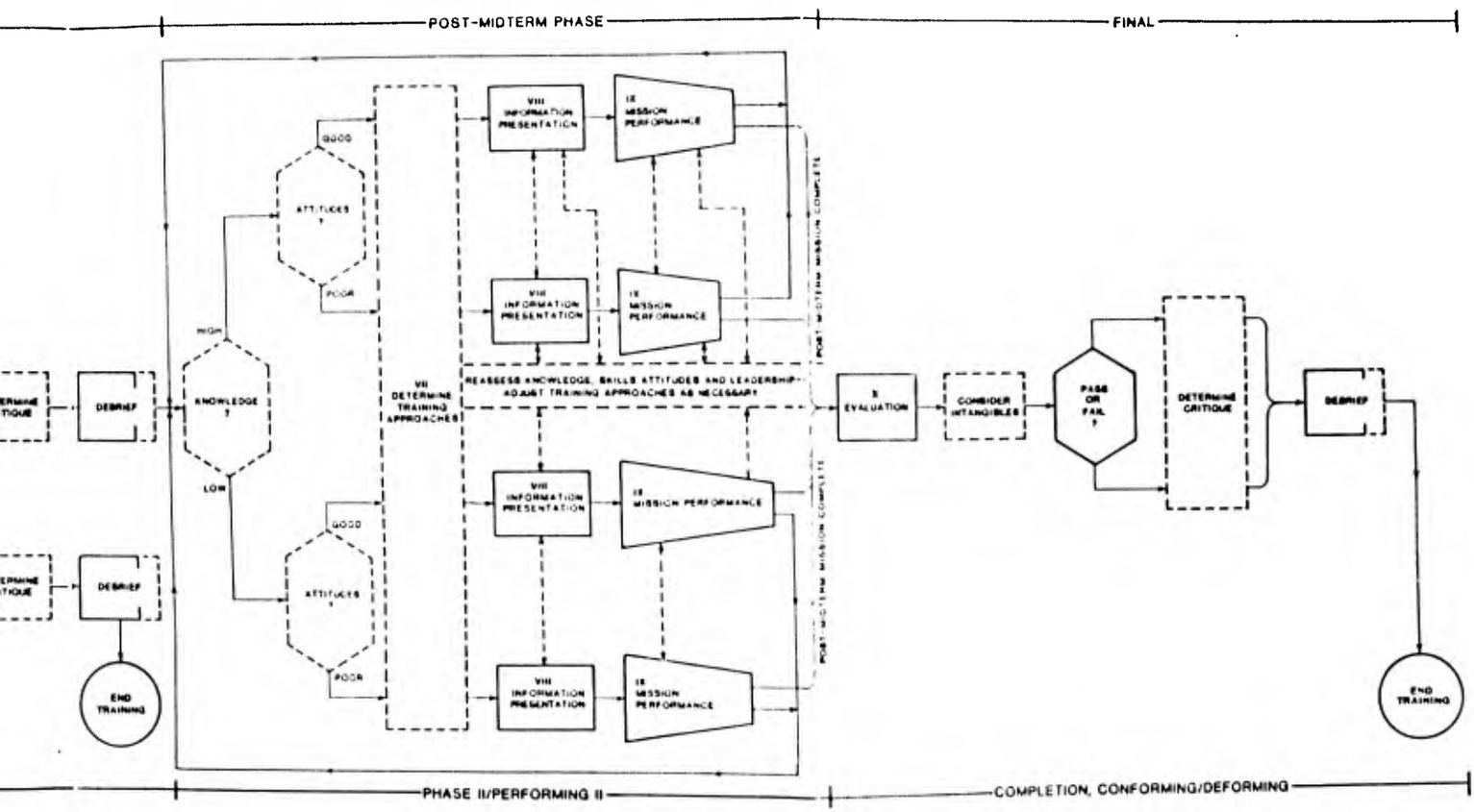

Figure 3. Detailed Stages of the Instructional Processes Model

71-14

reports and from other phases of this research, Table 1 shows the four general categories into which teams are placed, along with examples of prototypical team behaviors. The relative amount of instructor involvement in the training activity that is typical of a given stage of instruction is represented by the size of the box in the model, with larger areas representing greater amounts of time, activity, and role prominence. Of course, there are individual differences in instructor styles. But again, in order to make distinctions clear, the most typical instructor behavior will be emphasized in what follows.

Stage I - Pretraining Capability Assessment

At present, procedures do not exist for assessing a team's capabilities prior to the start of training. It was recommended by several of the NGFS instructors that this stage be included in the model, primarily to emphasize the importance of this process. Instructors suggested that this assessment should evaluate a team's level of competence, both on individual skills and on teamwork skills, prior to the start of training. Early knowledge of this sort would help instructors to recommend remedial work before training begins, and to determine training strategies once a team has begun training.

Stage II - Preliminary Assessment of Needs

The team's training needs are assessed informally by the instructor during the first meeting with a team, and the nature of this first meeting is varied for more and less effective teams based upon this assessment. There is no formal procedure for establishing a team's specific training needs. Thus, instructors must rely on the opinions and insights which they form during the first few hours of observing and interacting informally with the team members.

During the instructor's first meeting with a team, a briefing is conducted in order to discuss the objectives (both individual and team) of NGFS training and to present basic information necessary for conducting the training. In this opening session, which lasts approximately two and one-half hours, the instructor makes a preliminary assessment of the team's training needs. One instructor reported that if he does not know any team members before the start of training, this process "starts out pretty formal and then relaxes as the week goes on and we interact more." If he knows some of the team members, he is "not as formal," and as training progresses, he "gets right in there" with the team members. Another instructor said that he sits down with the team and talks to them to try to determine their level of experience.

TABLE 1

General Categorizations of NGFS Teams
and Prototypical Team Behaviors

Team Attitude	Level of Prior Knowledge: High	Level of Prior Knowledge: Low
Good	o Communicate correct information in proper sequence	o Communicate information incorrectly or in improper sequence
	o Participate interactively during training lectures	o Act as passive learners during training lectures
	o Good comprehension/ execution of individual task skills	o Poor comprehension/ execution of individual task skills
	o Express enthusiasm and inquisitiveness and make positive statements to motivate team	o Express enthusiasm and inquisitiveness and make positive statements to motivate team
	o Cooperate by helping other team members with tasks or by recommending actions	o Cooperate by requesting assistance from instructor when necessary
	o Coordinate information and pass it to proper member at proper time	o Show lack of coordination by failing to communicate information at proper time or being unprepared to act
	o Comprehend specific detailed information	o Comprehend only basic required information
	o Receive instruction in additional (unrequired) information	o Receive instruction in only required basic information
	o Receive feedback primarily for task-oriented skills as required	o Receive a great deal of feedback for both task-oriented and team-oriented skills

TABLE 1 (continued)

	o Practice minimum number of exercises to achieve training proficiency/ Sometimes given additional practice to perfect subtle nuances of training	o Require additional training exercises to achieve training proficiency/ Frequently given additional time to practice
Poor	o Communicate correct information in proper sequence	o Communicate information incorrectly or in improper sequence
	o Participate interactively during training lectures	o Act as passive learners during training lectures
	o Good comprehension/ execution of individual task skills	o Poor comprehension/ execution of individual task skills
	o Express boredom, lack of enthusiasm/interest in training argue among team members	o Express boredom, lack of enthusiasm/interest in training, argue among team members
	o Coordinate information and pass it to proper member at proper time	o Show lack of coordination by failing to communicate information at proper time or being unprepared to act
	o Assist other team members with tasks or information infrequently	o Often fail to cooperate by rejecting instructor assistance
	o Comprehend specific detailed information	o Comprehend only basic information
	o Receive no additional (unrequired) information	o Receive only basic, required information
	o Receive very little feedback and only for task-oriented skills	o Receive feedback only for task-oriented skills
	o Practice minimum number of exercises to achieve trainingproficiency/Rarely given additional practice	o Require additional training exercises to achieve training proficiency/ Rarely given additional practice

Instructors report that for teams judged to be more effective, the briefing is usually conducted in a question-and-answer format that begins with the presentation outlining the aims, contents, and methods of the training that will follow. The instructor encourages active student learning and participation, and may use tactics such as telling jokes to maintain student interest and enthusiasm. The briefing with the teams that subsequently perform more effectively generally lasts a relatively short time.

In contrast, instructors report that the briefings for less effective teams usually invoke a more formal lecture format where trainees are treated as passive learners. The briefing is more task-oriented, with less deliberate emphasis on maintaining trainee interest and enthusiasm. These briefings usually require more time than those for the more effective teams.

The dashed box in the center of Figure 3 symbolizes the informal needs analysis that the instructor conducts simultaneously with the briefing, to "take stock" of the kinds and amounts of prior knowledge and skill that a team brings to the training site, and to evaluate the team's "leadership" and "attitudes." Teams which are cooperative, enthusiastic, and willing to learn are expected to be more easily trained than teams with "negative attitudes" (i.e., uncooperative, pessimistic, and unwilling to learn). One instructor reported that: "If the team has a good attitude I can expect the week to go relatively smoothly. If I walk in on Monday morning and they all just stare at me, I know we are going to be in for a rough week."

Stage III - Selection of Training Approach

The next stage of the model represents those instructional processes involved in the selection of an initial training strategy, and reflects those team-related characteristics which instructors suggest have impact upon this process. Based on the initial estimate of the team's training needs, the instructor decides which instructional approach (e.g., formal, informal, Socratic) should be used with each team during the Pre-midterm and Basic Missions phases of training. The box representing this stage of instruction is drawn in dashed lines in Figure 3 in order to indicate a process conducted informally or sensed implicitly. In general, the instructors claim that their instructional approaches "vary from team to team," responsive to a combination of information inputs about prior knowledge and skill, and existing leadership and attitudes. Of these, the level of prior knowledge and overall team attitude are considered most important in the choice of tactics. The tactic chosen is reflected behaviorally by how the instructor plays his role in the Information Presentation and Mission Performance stages of instruction.

Stage IV - Information Presentation

During the Information Presentation stage, the instructor explains the objectives of the mission and presents mission information to the team. Instructors report that instruction for teams with a lot of prior knowledge and good attitudes tends to be less task-focused, often covering material in a question-and-answer, give-and-take exchange between the crew and its "coach." This type of team generally covers the basic material quickly, allowing the team to receive additional and/or more detailed information than is ordinarily presented. One instructor reported that with this type of team he often sits down and talks about "extra little things; little details here and there." Instructors say that they actually spend less time with high knowledge/good attitude teams (i.e., it is possible to complete these training sessions more expeditiously).

The instructional processes used with high knowledge/poor attitude teams is usually more task-focused. Because of the high level of prior knowledge, material is presented to these teams primarily in a question-and-answer style. However, the team's poor attitude usually creates an obstacle to the coverage of more detailed (i.e., "nonessential") material. Instructors reported that training time for high knowledge/poor attitude teams may be the shortest of all the types of teams because these teams are familiar with the required material but do not want to be bothered with additional effort or information, and/or the instructor is "turned off" by the lack of motivation that is manifested.

The most common instructional approach used with low knowledge/good attitude teams is reported to be a task-focused lecture. The instructor's emphasis is placed on presenting the basic information needed. One instructor reported that he tends to be more formal, "... because I want to be sure that they pick up every piece of information." The material is covered slowly for the low knowledge/good attitude team.

Finally, instruction for the low knowledge/poor attitude team is similar to that of the low knowledge/good attitude team. It usually consists of a task-focused lecture covering the basic material for the mission. However, since this group is not considered to be highly motivated, the length of time the instructors say they are willing to spend with this type of team is usually less than for one that has a similar level of knowledge but comes to training with more enthusiasm. Overall, however, the total amount of time instructors devote to this type of team is still more than for either type of high-knowledge team.

Stage V - Mission Performance

During the Mission Performance stage, the instructor's primary role is to monitor the team's performance and observe their attitudes.

The instructor provides guidance and feedback to the team and takes corrective action to remedy team performance deficiencies as necessary. The relative amount of time an instructor spends interacting with a team during this stage is also represented by the size of the box in the Figure 3. The declining size of the instructor boxes in the Mission Performance stage is meant to show that his involvement with a team diminishes during the later exercises of a mission, as the team becomes more self-sufficient and as the instructor deliberately seeks to facilitate transfer of "ownership" and responsibility." Instructors report that they are typically more involved with the actual individual tasks during the first exercise of a mission and gradually reduce their amount of involvement/assistance during the second and, (if performed) third exercise. The degree to which the box comes to a point at the right side indicates the degree of proficiency and self-sufficiency in performance reached by the team.

As in the Information Presentation stage, the instructor's approach during Mission Performance is influenced by the type of team with which he is working. That is, the level of performance and the attitudes of the team members determine the kind of feedback that is given. For a high performance/good attitude team, the role of the instructor is chiefly that of facilitator. One instructor said that with this type of team he can "sit back and watch, and only step in when they make a mistake." Feedback is largely centered on error correction and mistake avoidance. In fact, one instructor reported that for this type of team he will even first "ask them what they did wrong." The high performance/good attitude team usually is given two exercises, with feedback provided only on the first exercise. Mission training is completed quickly.

The high performance/poor attitude team is the least common of the four types. Instructors indicate that their role with these teams is to serve as a facilitator, providing feedback only for error correction and mistake avoidance. In general, because the team has a poor attitude but high level of skill, instructors give this type of group the least amount of feedback (i.e., they require little technical assistance and do not receive supportive feedback). A high performance/poor attitude team usually performs two exercises, and mission training is completed quickly.

Formal instructor-student role relationships are usually maintained with a low performance/good attitude team. Due to the large number of errors made, instructors have to supervise teams more closely, and thus instructional feedback is quite frequent. With these teams, the principal role of the instructor is to provide feedback for error correction. However, instructors also report that they often engage in supportive feedback to sustain the team's good attitude. The instructor is usually involved in feedback during the first two exercises of a mission, and begins to decrease feedback during the third exercise. As the team becomes more

technically proficient, the instructor detaches himself from the training, transfering "ownership" to the team members. In order to facilitate teamwork development, team members are encouraged to assist each other with taskwork, and support each other through verbal communication and cooperative efforts. Instructors are willing to offer low performance/good attitude teams opportunities to carry out additional exercises in order to increase their knowledge and proficiency, and will continue to contribute supportive feedback. In talking about a team with little previous experience, one instructor claimed that if he has a good attitude team, he puts in extra time and is not watching the clock. This view was echoed by another instructor who said that: "I don't mind working extra with a team that has a good attitude. It's my job to train them to pass the course."

Formal instructor-student role relationships are also maintained for the low performance/poor attitude team. Again the amount of instructor feedback is relatively high due to the large number of performance errors made. However, feedback for the low performance/poor attitude team tends to be focused on error correction. One instructor reported: "With bad teams I have to be much more involved and step in frequently to correct their mistakes." Although training takes a long time and three exercises are usually performed, instructors say that it is unlikely that they will allow this type of team to perform additional exercises. For example, one instructor commented that: "If a team has a bad attitude, I really don't feel that I have to spend any extra time with them."

Instructors vary in their approach to improving "teamwork" skills. One instructor reported that he uses the "cheerleader" method and always tries to be positive, no matter what the situation. Another reported that he will "chew'em out" and then, if that does not work, he will "explain to them the benefits of having a good attitude and getting done early." A third reported that he tries to "tolerate" the team as long as he can, but sometimes he has to "let it out."

Each of the boxes in the Information Presentation and Mission Performance stages is connected to a dashed box which extends across these stages. This reflects the fact that the instructor's approach may change at any point during these stages due to a continuing reappraisal of a team's knowledge, skill, leadership and attitudes. However, this reassessment appears to be a non-systematic process that is rarely, if ever, consciously undertaken by the instructor. At some point in training, when a team has changed in some key aspect (such as an improved attitude), this may be taken into account by an instructor and translated into a re-tuning of training tactics. Currently there are no systematic instructional procedures that aid or encourage periodic evaluation and readjustment of team training.

In addition, a second box runs through the Information Presentation and Mission Performance stages which relates to an instructor's handling of a problem team member. This is also an informal, non-systematic process, as indicated by the dashed lines. When a team member is a serious impediment to the team's success, the instructor may resort to a variety of devices to resolve the problem. Examples of instructor intervention include speaking to the individual, asking the team's GLO to handle the individual, and calling the ship's commanding officer (CO). Handling a problem team member is a progressive process in which the instructor's disposition becomes more serious as the problem continues. For example, one instructor reported that: "The first thing I will do is talk to the senior man in plot. If he can't handle it, then I will take the guy aside and try." Instructors indicate that they do not allow this type of problem to continue past the midterm examination.

Stage VI - Midterm Evaluation and Debrief

Upon completion of the Pre-midterm missions, a team is required to take a formal midterm test that covers all Pre-midterm mission activities and generates evaluation and feedback. In this Evaluation and Debrief stage of instruction, the main function of the instructor is to score the team's performance on the standard set of exercises that constitute the examination. Then, the instructor debriefs the team if it passes the examination (scores 70 or better). If the team fails the examination, the instructor informally considers "intangibles" as well as the more tangible causes of failure. This is indicated by a dashed box in the instructional processes model of Figure 3. The instructor considers such factors as the team's attitude, general level of skill, and unique occurrences (e.g., replacement of a team member during training) in his decision as to whether or not to allow a team to repeat the midterm examination. If a team has manifested poor performance throughout Pre-midterm training, or has demonstrated a poor attitude, the instructor may decide to end training after the midterm examination. More likely, a team that cannot successfully complete the mid-term will remain and review the basics until the end of the week. Teams which are allowed to repeat the midterm will also enter the Debrief portion of this stage after passing the examination. During the Debrief, the instructor provides formal, task- specific feedback regarding errors made on the examination, and an informal critique of performance. This critique provides non-task feedback on performance, and enumerates team strengths and weaknesses (e.g., "teamwork and attitude feedback). Instructors offer suggestions for improvement in problem areas and encouragement for teams to continue trying.

Stages VII, VIII, IX - Determination of Training Approach, Information Presentation, and Mission Performance

After successful completion of the midterm examination, the team enters the Post-midterm phase of training, during which the three stages - Determination of Training Approach, Information Presentation, and Mission Performance - are repeated. The instructor's role during these stages is similar to that during the corresponding Pre-midterm stages. The instructor is involved in providing mission objectives and information, monitoring knowledge and attitudes, and providing feedback concerning team performance. As with the Pre-midterm missions, Figure 3 shows a dashed box running throughout the Post-midterm Information Presentation and Mission Performance stages to indicate a continual, informal evaluation of the team's knowledge, skill level, leadership, and attitudes, and an adjustment of training and feedback approaches based on this information.

Unlike the corresponding Pre-midterm stages, however, there is no box to indicate the handling of a problem team member. If a problem member had been present, the instructor either will have already resolved the problem with that member, will have had the member replaced before the midterm examination, or will have failed the team on the midterm examination.

Stage X - Final Evaluation and Debrief

Once a team has successfully completed the Post-midterm missions, it enters the Final phase of training. The final Evaluation and Debrief stage of instruction occurs at this time. During the Evaluation portion of this stage, the instructor observes and scores a team's performance on a standard final examination. After a team completes the final examination, the instructor once again informally considers "intangibles" and makes a final assessment of the team's attitude. If the team passes the final examination, the instructor prepares a critique of the team's performance. If the team fails, the instructor considers such intangibles as overall performance throughout the week and the amount of time remaining until the scheduled live firing range qualification will take place, and then evaluates the cause of failure (e.g., poor attitude, lack of requisite skills, replacement of a team member). Under certain circumstances (e.g., high performance throughout the week) instructors may decide to allow a team to repeat a portion of the final examination. Instructor's critiques for teams which pass and teams which fail the final examination involve a determination of non-task specific feedback on performance, strengths, and weaknesses. If a team fails the final test, the critique content will consist largely of the instructor's diagnosis of the cause of failure. Instructors report that other factors, such as a team's attitude, influence critique content. For example, teams with poor

attitudes will probably be given very brief critiques. Poor performance/good attitude teams will be encouraged to maintain their positive attitude for future training and to practice after training. Teams with good attitudes which must soon qualify on the live firing range will be given advice concerning what to expect.

The instructor combines this critique with formal, task-specific feedback regarding performance on the final examination, and presents this information to the team in the final debriefing session.

TEAM TRAINING APPLICATIONS OF THE TEAM INSTRUCTIONAL PROCESSES MODEL

The development of a model of the team training instructional processes at NGFS set the stage for understanding how teams are taught. Based on the analysis of these instructional processes and on information gathered in other phases of the present research effort, and incorporating recommendations from the training literature, it is now possible to identify several aspects of the training process that might be changed. The remaining sections of this report discuss several (not all) interventions that might be applied to the enhancement of generic team training processes. The following are suggested for improving instructor functioning:

* Development and implementation of a pre-training capabilities diagnostic instrument
* Standardization of training assessment procedures across teams
* Formalization and standardization of task-related and team-related feedback throughout training
* Development and implementation of procedures and tools for optimizing training strategies based on key team variables

DEVELOPMENT AND IMPLEMENTATION OF A PRE-TRAINING CAPABILITIES DIAGNOSTIC INSTRUMENT

Interviews with NGFS instructors have indicated that problems encountered during training often stem from the fact that one or more individual team members lack the knowledge and/or skills that should be developed prior to the training program. There are two general problems that result from insufficient prerequisite individual skills. First, instructors have to devote too much of their efforts to the training of individual skills instead of developing effective teamwork skills. Second, instructors must contend with and resolve the poor attitudes toward training which often arise from the frustrations or insecurities of those team members who lack prerequisite skills. In both of these situations, the lack of prerequisite individual skills impedes the instructor's

development of team skills such as communication and cooperation, which are vital to the ultimate success of the team as a cohesive, effective unit. Of course, in the practical situation, there are times when shortages exist in personnel with specific skill requirements. The availability of diagnostic instruments would at least make it possible for the instructor to zero in on those who need special help with a minimum of misdirection of energies by the rest of the team.

Overall, the experience of instructors who train teams at NGFS is consistent with what is reported in the literature (e.g., Tuckman, 1965); namely, before team members can focus on developing effective teamwork skills, they must reach some threshold level of competence in their individual knowledge and skills. Thus, weakness in prerequisite skills undermine both the ability and the motivation of team members to build effective teamwork skills. The development of tests of individual skills (both paper-and-pencil and actual hands-on simulations), to be administered prior to the start of training, would be beneficial in pinpointing specific weaknesses in prerequisite knowledge and skills. Members who were deficient in skills and knowledge could be required to review the necessary information and/or practice before the start of training. If time does not permit this, an effort might be made to find a more qualified replacement before the actual training begins.

Thus, it is recommended that tests of individual skills and knowledge be developed based on a combination of information derived from the mission objectives and individual tasks specified in the Lesson Topic Guides, and the expertise of NGFS instructors. These tests would include both paper-and-pencil surveys and actual on-board simulations of the basic task-related skills required in NGFS training, and would be administered to the team by someone designated by the ship's CO, several weeks (or as early as possible) before actual training. The results of this preliminary screening would be evaluated by NGFS instructors, and feedback regarding particular strengths and weaknesses, as well as general recommendations for areas needing improvement would be made. A corollary value of this procedure would be that a more realistic understanding of training needs would become available to the ships' officers as well as to the school staff, and a better basis for communication and collaboration between the two could be established.

It is interesting to note that a pre-training assessment procedure was introduced not long ago at the Anti-Submarine Warfare (ASW) training facility in Norfolk (which is the next research site to be reported upon). Thus, the utility of this diagnostic procedure can be examined on basis of ASW experience.

STANDARDIZATION OF TRAINING ASSESSMENT PROCEDURES ACROSS TEAMS

The above analysis also indicates that instructional processes could be enhanced through the development of additional standardized procedures to evaluate team performance and team training needs. Because no formal, systematic procedures for assessing teamwork have yet been implemented, each instructor must improvise his own method for acquiring the information that he feels he needs in order to improve the effectiveness of teams. If instructors could be provided with standard procedures and instruments, or data for more adequately assessing training needs and performance in this area, this process would be more consistent from team to team and instructor to instructor, and ways to improve the process would be easier to recognize.

As it now stands, the process of determining team training needs is an informal, ad hoc process performed mentally by instructors during the initial briefing. What is assessed, the criteria and procedures used to make assessments, and even whether or not an assessment occurs at all, are determined by the individual instructor's experience, initiative, and intuitive ability to recognize and appraise factors vital to effective team performance. As pointed out earlier, specific, formal procedures exist for assessing taskwork procedures. However, the existing training system provides little formal guidance to instructors regarding what or how to assess teamwork elements reliably. Given the vague and difficult task of defining and measuring teamwork variables, it is unreasonable to expect that instructors will be able to do this in a consistent, effective manner without being provided with appropriate techniques and training. Clearly, if instructors were to have a teamwork training needs assessment procedure available to them, benefits would follow. Such a procedure could be used to find out what teamwork deficiencies exist at the beginning of a team's training. At several points in the week of NGFS training, such instruments might be employed to measure the progress of the team, to provide them with directive feedback, and to give the instructor indications of the degree of effectiveness of the particular team training techniques he uses (and to assess the effectiveness of any innovations/interventions introduced).

In addition, the implementation of a good team training needs assessment method could help instructors to make the appropriate choice of instructional strategies for remedying particular team weaknesses and for exploiting a team's strengths (cf. Goldstein, 1980). As training progresses, the level of team proficiency in certain areas will change. Thus, to maximize the effectiveness of training, it would be beneficial to reassess team needs at several points and to adjust training strategies accordingly. The TIPM shows that, apart from the midterm examination, there are no formal reevaluation processes, and there are no other specific points in

training at which deliberate reevaluations take place. Currently, any reassessments that occur mostly involve an instructor adventitiously noticing a change in some team performance variable. Obviously, it is extremely difficult for instructors to observe all changes in the status of a team on every key variable, let alone make prompt and appropriate training strategy adjustments. There is believed to be a need to formalize and enhance both the initial team training needs assessment and later reevaluation processes. Interventions could include providing instructors with tools for performing these assessments as part of the formal training system. Based on a factor analysis of the self-report data collected from trainees at NGFS, development of this instrument should reflect certain changes in a "teamwork-centered" factor (for further discussion of the factor analysis, see Glickman et al., in press). This factor includes items involving team coordination, communication and cohesion. It is suggested that an evaluation instrument reflecting the changing factor patterns during different stages of team maturation be developed for use during training. This instrument might take the form of a checklist in order to facilitate ease of use and provide minimum interference during the actual training missions. Reassessments might take place at the end of each completed mission or at the end of each day of training. Results of this instrument would provide instructors with indications of areas of teamwork skills which may be deficient and require additional attention.

The value of midterm and final examination information might also be enhanced. At present, midterm and final examinations do not include evaluation of teamwork performance variables. Since these variables have been found to be major determinants of the success of a team, a means for measuring them during midterms and finals should be incorporated.

It is worth noting that the NGFS training process is currently undergoing restructuring, with examinations to be given every day. This is certainly a step in the direction suggested by the current analysis.

FORMALIZATION AND STANDARDIZATION OF TASK-RELATED AND TEAM-RELATED FEEDBACK THROUGHOUT TRAINING

Feedback to teams on key teamwork performance variables should be a part of the formal team training system, both to ensure that feedback is provided, and to monitor the effectiveness of the feedback. After the instructor has formally assessed the needs of a team and/or formally evaluated a team, he should be able to offer feedback to the team on key teamwork variables. The importance of feedback to effective performance has been demonstrated many times in the training literature (Goldstein, 1986). Currently, feedback on teamwork performance variables occurs rarely, and only at the initiative of an instructor. Furthermore, feedback is primarily

related to individual task variables, and rarely relates to the development of teamwork skills. This is largely attributable to the lack of emphasis on teamwork skills in the formal training process. Without formal criteria incorporated in performance appraisal, teamwork development remains a hit or miss affair. In the formal training system, only task outcome measures are taken, and thus feedback in debriefs usually consists of task specific feedback (e.g., "x" number of points were deducted for shots falling 50 meters from the target). The usefulness of the feedback could be increased by combining team-related feedback with task-specific feedback.

Feedback on important teamwork variables such as coordination and communication might be provided more frequently during training and debriefs if instructors were provided with training aids to make it easier to recognize and assess the important teamwork variables. One relatively simple way to help instructors monitor teamwork skills and provide feedback would be to give them a checklist to use while observing the team during exercises. Observations could be relayed to the team during the debrief, along with suggestions for improvement.

DEVELOPMENT AND IMPLEMENTATION OF PROCEDURES FOR OPTIMIZING TRAINING STRATEGIES BASED ON KEY TEAMWORK VARIABLES

Instructional effectiveness might be enhanced through research exploring the relationships between instructional approaches, and team and situational characteristics (e.g., team attitude, level of prior knowledge, stage of training). The result of such research could be the recommendation of instructional approaches for raising the likelihood of optimizing training outcomes given the existence of certain kinds and levels of team characteristics. If a handy method for determining these matches could be made available to instructors to guide their selection of training approaches, added training effectiveness would be expected to follow.

Currently, instructors are provided with little or no guidance in how to most effectively teach "teamwork." Of course, the characteristics of the instructor represent one set of factors in the situational equation. Instructors must be given reasonable latitude to make use of alternatives they are comfortable with and that are consistent with their personal styles of instruction. Instructional strategies should be flexible enough so that, given suggestions of approaches that fit the situation, they can be tailored by the instructor to suit his own style and preferences. While it is unrealistic to expect to find one best method to deal with each contingency, it would be helpful to be able to narrow down rapidly the choice of good alternatives. Programmatic troubleshooting methods are common in equipment repair technology; a similar technology for diagnosis and decision-making applied to teamwork is called for.

The most effective and efficient means of improving the instructional processes in future team training systems may be to adopt empirically-based team training design and development guidelines (Swezey & Salas, 1987) built upon job analyses and learning principles that embrace teamwork as well as individual technical task learning requirements (see Appendix B, Application of Learning Principles, from Kyllonen & Alluisi, 1986). Currently, the only guidelines for team training development are Instructional System Design procedures. ISD, however, is intended to ensure development of effective individual skills training. There is a need to ensure that future team training systems provide for the explicit identification, measurement, and evaluation of teamwork variables. Such guidelines could be developed and integrated with current ISD procedures, or could be provided separately to team training developers. The current research suggests several aspects of training that such guidelines should cover. There is a need for guidelines covering team task analysis. Nieva et al., (1978) have made a start on a team task taxonomy. Typical task analysis procedures are oriented toward identifying only individual tasks and subtasks; they are not oriented toward the identification of less concrete teamwork skills involving interactions among several individuals. In order for teamwork skills to be improved during training, instructors must be able to identify, measure, and develop these skills. In order for this to occur, the team as a whole must be the functional unit of study. Much the same can be said about the desirability of modifying the Instructor's Diagnostic Aid for Feedback in Training (IDAFT; see Andrews & Uliano, 1985) to expand applicability from the individual to the team as a whole.

CONCLUSION

In summary, the guidelines for team training systems development need to be enlarged in scope to incorporate instructional processes designed to develop and enhance teamwork objectives during training. Currently, instructional objectives in team training programs involve the development of proficient taskwork performance almost exclusively. Obviously, task performance should be the ultimate training criterion. Yet, as a result of neglect or omission of specific teamwork objectives and criteria, training is likely to omit the vital teamwork skills component of effective task performance.

Thurmond (1980), Rizzo (1980), and Kribs, Thurmond and Marks (1977) have all pointed to the need for a general framework for developing effective team training instructional strategies. Through a careful examination of the instructional strategies, training decisions, presentation strategies, and feedback procedures of NGFS instructors, the current research provides a basis for designing such an instructional system for NGFS instructors. Specifically, the Team Instructional Processes Model discussed here supports the recommendation of several major procedures/devices for enhancing

team training. These recommendations suggest that team training can be improved by providing: (a) tests to diagnose the pre-training capabilities of team members, (b) procedures for assessing team training needs, (c) methods to enhance task- and team-related feedback, (d) procedures for optimizing training based on changes in key team variables, and (e) instructor training to ensure effective use of tests, procedures and instruments. Future research is planned to develop and test the specific procedures/devices recommended for NGFS. If these recommendations lead to enhanced team training and performance, significant progress will have been made with respect to understanding the elements necessary to improve the design and development of future team training systems.

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APPENDIX A

INSTRUCTOR INTERVIEW QUESTIONNAIRE

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1. Do you have a certain plan/model that you try to follow over the course of the week to get the team from where they are on Monday to where you would like them to be on Thursday?

2. How does a team's performance influence how you instruct? Do you alter how much you interact with a team depending on how experienced the team members are when they come in at the beginning of the week?

3. How much of the way you interact with a team is affected by the particular exercise in which you are training?

4. How do you decide when to intervene in the training process?

5. Are there certain team characteristics which influence how you instruct a team? If so, what are they?

6. Are there certain team characteristics which influence the degree to which you are willing to spend extra time training a team?

7. Does a team affect how you react to them? Do you respond differently to different types of characteristics?

8. Do you train poor performing teams differently depending on whether they have a good or a poor attitude?

9. Does a team's attitude impact how they are going to perform over the course of training?

10. What sorts of things do you do to improve a team's poor attitude or maintain a team's good attitude?

11. How do you handle a team which has one difficult member?

12. When you give a team verbal feedback, does this differ depending on the characteristics of the team? If so, how?

13. How do your briefings on the Midterm/Final examination performance vary with team characteristics?

APPENDIX B

APPLICATION OF LEARNING PRINCIPLES

Learner Strategies Principles

1. Search for meaning while studying.
2. Use strategies for minimizing memory load.
3. Study, study, study.
4. Avoid detention with extraneous details.
5. Permit liberal recall time.
6. Employ advance organizer methods.
7. Employ the recitation method (self-imposed study test).
8. Space practice.
9. Learn parts first.
0. Overlearn skill components.
11. Seek good models of skilled performance.
12. Seek knowledge of results.
13. Concentrate on study material.
14. Relax and adopt a good mood.

Instructional Systems Design Principles

Domain General Principles

15. Task-analyze the learning domain.
16. Organize instructional goals around behavioral objectives.

Learning from Text

17. Provide previews, reviews, and tests.
18. Provide study strategies.

Problem Solving and High-Performance Skills

19. Show positive and negative instances of concept.
20. Identify the goal structure of the problem.
21. Shape successive approximations to target performance.
22. Minimize working-memory load.
23. Keep the learning task interesting.
24. Provide immediate feedback on errors.
25. Maintain active learner participation.
26. Provide instruction in context.
27. Encourage use of general problem-solving procedures.
28. Consider the learning task a rules acquisition task.
29. Avoid changing requirements in midstream.
30. Maximize critical skills trials.

APPENDIX B (continued)

Principles for Designing Learnable Systems

31. Achieve operational fidelity.
32. Mix component training.
33. Train under mild speed stress.
34. Train time-sharing skills.
35. Consider learning ultimate-performance trade-offs.
36. Consider what tasks will be performed by the system.
37. Specify alternative methods for performing tasks.
38. Allow error recovery.
39. Use color/graphics to highlight changing information.
40. Clean display to eliminate irrelevancies.
41. Avoid abstract information; use concrete information.
42. Avoid elaborate rationales for procedural instructions.
43. Create conditions for practice and testing.

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