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A LIFE-CYCLE APPROACH TO IMPLEMENTING AND EVALUATING ARMY TRAINING PROGRAMS

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Life Cycle Evaluation concept was developed to provide a systematic approach to implementation and use issues for Army training programs. Two areas are focused on. First, a systematic approach to implementation is required so that the new program is integrated aggressively into the user's organization. Second, after implementation a careful evaluation must be conducted on how the program has changed (during implementation) and its actual(in the field), as opposed to potential(during R&D), effectiveness. In this paper the Life Cycle approach is illustrated by examples taken from the evaluation of the Army's MILES-TES program.

A Life-Cycle Approach to Implementing & Evaluating Army Training Programs

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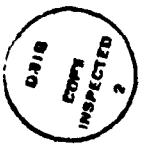

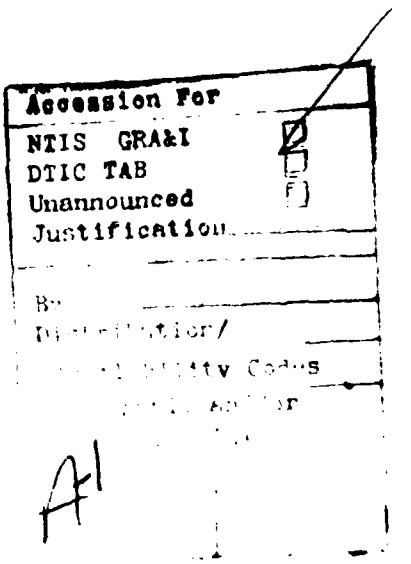

Abstract

Obtaining a 100% return from a training program involves more than attention to research and development or to procuring the best "off-the-shelf" program available. Attention must be given to two areas. First, a systematic approach to implementation is required so that the new program is integrated aggressively into the user's organization. Second, if a training program survives implementation and is used routinely, maximum return on the investment is still not assured. The problem is that the program as used is seldom, and maybe never, identical to the program that was developed. A careful evaluation must be conducted on how the program has changed and its actual, as opposed to potential, effectiveness. The Life Cycle Evaluation concept was developed to provide a systematic approach to implementation and use issues for Army training programs. In this paper the Life Cycle approach is illustrated by examples taken from the Life Cycle Evaluation of the Army's MILES-TES program.

A Life-Cycle Approach to Implementing & Evaluating Army Training Programs[1]

Training Programs--"Wasteful Expenditures"?

Generally there is a widespread feeling that the money spent on research, development, and procurement of training devices and training programs has not had its intended effect. For example, the former commander of the Army's training development organization, General Starry (1979), has stated,

> Recently, I had the TRADOC Inspector General survey the utilization rates of some of the most expensive simulations and training devices that TRADOC has produced for field use. The return was that, if we're lucky, we're getting no more than twenty percent return on our investment.

The problem is that getting a 100% return from a training program involves more than attention to research and development or to procuring the best "off-the-shelf" programs available. It involves careful attention to the process of implementation and a recognition that for implementation to be successful, typically both the program and the organization must change to better fit each other. There is a growing realization that this process of implementation and mutual change is not automatic but must be consciously directed and monitored. For example, General Meyer (1980), the Chief of Staff of the Army has written,

> Over the decade the Army will invest several billion dollars in research, development, and procurement of training devices. These

devices . . . must be integrated aggressively into training programs lest they become themselves wasteful expenditures.

For the training devices or programs to be integrated aggressively into the user's organization, a systematic approach is required. Such an approach is being developed for Army training programs and is called the Life Cycle Evaluation concept. In this paper I discuss why a systematic approach is required, the MILES-TES training system on which the approach has been applied, what the Life Cycle approach is and how it has been used to evaluate the implementation and use MILES-TES.

Better Mousetrap or Alligator Farm? Obstacles to Implementation

The training community is a victim of the "BETTER MOUSETRAP FALLACY." We have built, invented, or bought better training programs and have expected the world (user) to beat a path to our door. When the world has not obliged, we have either been too busy working on the next project to notice, or have put the blame on the world for being too stupid to appreciate the wonderful things we have done for it.

For the world or user, any given training program is more likely to be perceived as an alligator to be fought off than as a golden opportunity to improve training. For the user there is no "empty niche" for a new training development to fit into. All of his time, resources, and personnel are already committed. To accommodate new developments, the user must make changes in existing procedures, priorities, and management.

For these reasons and others, the users motivation to use the new training development may not be high. For example, the user may not see

a need for the change, or the new development may not be perceived as satisfying the needs that exist. Finally, use of the training development may not be rewarded or may even be punished. (Salinger, 1973).

The root cause of this "better mousetrap versus alligator" dilemma is that the requirements for planning, supporting, and evaluating the implementation process have not been understood. For example, while the Army has the Life Cycle System Management Model which prescribes development actions, there is little or no guidance for implementation. (For a recent exception, see T. Gray, Roberts-Gray, & W. Gray, 1983).

Identity Crisis or the Name is Familiar but I Can't Place the Face

If a training program survives implementation and is used routinely, maximum return on the investment is still not assured. The problem is that the program as used is seldom, and maybe never, identical to the program that was developed. If the only information on the effectiveness of a program comes from the research and development stage, then very little is known about the effectiveness of the program as used by an organization. For a new program to be implemented, either the organization must change its behavior to better fit the program or the program must be changed to better fit the organization.

Most program developers assume that it will be the organization which changes to accommodate the program and not vice versa. This assumption is unrealistic. A recent Rand project which looked at the implementation of 293 educational programs found NO cases in which the

program was implemented unchanged (Berman, 1978). All 293 projects were either not implemented at all, or if implemented had been changed somehow to better fit the user.

To summarize, developers and users of training programs must be convinced of two things. First, new training programs do not just get used. They must be integrated aggressively into the user organization. Second, an implemented program is always different from the program the training developer produced.

Anticipating that there would be problems in the implementation and use of MILES-TES, the program manager took the unprecedented step of asking the Army Research Institute (ARI) to come up with a scheme to monitor and evaluate this program. The result is the Life Cycle approach to training system evaluation. The Life Cycle approach is intended to monitor the implementation and evaluate the use of Army training programs. To illustrate this approach, I will first briefly describe the MILES-TES system and then discuss some of the issues involved in its Life Cycle Evaluation.

MILES-TES

MILES-TES stands for Multiple Integrated Laser Engagement System--Tactical Engagement Simulation. The system provides a realistic simulation of combat for Armor and Infantry units up to the battalion level. It consists of two components--a training methodology which maximizes the team training value of each exercise without interfering with the realism, and a hardware system for weapons simulation and casualty assessment.

All direct fire Infantry and Armor weapons are equipped with laser transmitters and all targets, both men and weapon systems, are equipped with laser detectors (see Figure 1). The system is "smart" in two ways. First, it can detect a hit or near miss and provide differential feedback to the target. Second, it can determine which weapon system is firing at it. Thus, a tank will ignore firings from an M16 rifle.

The MILES hardware is expensive. As of July 1982, research, development, procurement, and fielding costs have exceeded $146 million dollars. This includes the cost of procuring enough hardware so that every Division in the U.S. Army can conduct battalion-level exercises in which every soldier, anti-tank weapon, tank, and armored personnel carrier is outfitted with MILES.

The expense and the glamor of the lasers and computer technology tends to lead users to perceive MILES-TES as a hardware system with software (training methodology) support. To the contrary, MILES-TES is a software system, Tactical Engagement Simulation, with hardware support. The training methods and procedures which constitute Tactical Engagement Simulation use the information provided by the hardware to provide realistic two-sided, free-play training exercises in which all direct-fire Infantry and Armor weapons are played. The system can be used for routine tactical team training at the home-station for every echelon up to Battalion, and for Battalions at the National Training Center in Fort Irwin, California.

The Life-Cycle Evaluation of MILES-TES

In developing the Life Cycle Evaluation, we shared the belief

expressed by Cronback (1980) that, "A theory of evaluation must be as much a theory of political interaction as it is a theory of how knowledge is constructed." Hence, while some or all of the Life Cycle concept may be applied to other organizations, it was tailored for the constraints and structure, that is, the political interactions of the Army training community. An activist orientation is adopted. The emphasis is not on judging how good a program is but on how the program can be made better or used more effectively.

Life Cycle Evaluation organizes the life of a training development into three sets of issues: research and development, implementation, and use (see Figure 2). Life Cycle Evaluation begins where research and development ends, hence, the R&D issues are taken as a given and are addressed only as they influence evaluations of implementation and use issues.

Research & Development Issues

Figure 2 shows four classes of issues under research and development. First is the condition analysis. The condition analysis which preceded the development of MILES-TES was conducted by the Army Board for Dynamic Training in the early 70's. Out of the condition analysis came a problem statement. The Board concluded that small-unit tactical training was in need of improvement. At this point, the training research community was called upon to develop a solution concept. To improve small-unit tactical training, a two-part solution was sought. One, develop a new team training methodology; two, develop a weapons and casuality effects simulator. This two-part concept was

turned over to the developers for solution development. The solution here was Tactical Engagement Simulation as the new training methodology and lasers or MILES for the weapons and casualty effects simulation. The developed solution was then measured against the concept in the Army's development test/operational test (DT/OT) cycle. For most training innovations, involvement of the R&D community ends at this point and the innovation is turned over to the user to do with as he pleases. This did not happen with MILES-TES and will n happen whenever an approach like the Life Cycle Evaluation is used.

Implementation Issues

For the Life Cycle approach, implementation issues are those plans and actions required to aggressively integrate the new program into the operational environment. Three categories of issues are considered: planning, fielding, and sustainment and support (see Figure 2).

Planning an implementation involves the coordination of many complex intra- and inter-agency issues, including deciding which agency is responsible for what actions during fielding, and sustainment and support. Fielding refers to orienting the users, the delivery of the program, an initial issue of any special items of support required to use the program, and training the trainers. Fielding involves an approximately even mix of user and developer responsibilities. Sustainment and support issues are those changes in organizational, individual and program procedures which must be resolved if the program is to be regularly and permanently used. Sustainment and support issues are primarily handled by the user.

The questions for evaluation vary with the category of issues. For planning issues, the questions are whether each element of the plan is necessary and whether all elements will be sufficient to implement the innovation. For fielding, and sustainment and support issues the questions are whether and how faithfully each plan element is executed and, if executed, whether the element has its intended effect upon the implementation process.

Obstacles to Effective Use of MILES-TES

At this time (July of 1982) the Life Cycle Evaluation of MILES-TES is ending its focus on Implementation Issues and beginning to focus on Use Issues. Much of the information we have obtained has been fed back to the developer and other agencies in the form of short reports, both oral and written, with recommendations for immediate action. Going beyond such nitty-gritty details as which plan element is not being executed and why, several broader and more general obstacles to effective use of MILES have emerged.

- o Users do not percieve a need for a new methodology for tactical team training.
- o The MILES hardware is regarded as easy to break and to lose. Some units have instituted such rigid accountability procedures that our fear is that the devices may seldom be taken out of the box.
- o MILES-TES requires more resources, more advanced planning, and more advanced training than previous methods of tactical training.

o The hardware may be used without the training methodology. This means that the laser equipment can and is used for other than tactical team training. This becomes a problem only to the extent that the equipment is diverted from use in tactical team training. The seriousness of this problem is not yet known.

o The realism of the system inclines the users to substitute the goals of combat for the goals of training. Combat emphasizes tactical outcomes while training emphasizes tactical processes. In combat, the main concern is to inflict maximum damage upon the enemy and to seize the objective at minimum damage to oneself. In training, the goal is to improve those tactical skills on which the team is weakest. Users who substitute the goals of combat for the goals of training tend to have a checklist approach to training. The mission is either accomplished or not accomplished. In either case, little analysis of tactical weaknesses occurs and the unit is quickly shuffled on to the next mission.

I have given you the highlights, a sort of "WORST OF" the obstacles to effective use of MILES-TES. These are issues which have emerged from our monitoring of the implementation process and which we intend to examine closely as we become more involved with actual use of the system. However, the important point is not that MILES-TES has certain obstacles to its effective use, but that all training developments face some real-world obstacles to their effective use.

Life-Cycle Evaluation of Use Issues

We know that the program as used is seldom identical to the program

that was developed, and we know that MILES-TES already appears to have run into certain obstacles to its effective use. In Life Cycle Evaluation, these concerns are organized into the categories of fidelity, sufficiency, and effectiveness. Each category of use issues is related to a category of R&D issues (see Figure 2) as well as being interrelated with the other use issues.

Fidelity

Fidelity evaluation (Fullan & Pomfret, 1977) is procedure oriented. It is a comparison of the user's procedures against the developer's ideal. The goals of the fidelity evaluation are to determine what parts of the program are actually used and to describe variations in use among units. The data from the fidelity evaluation provides feedback to the developers on how well their product is used and feedback to the implementors on what actions or local conditions lead to the most complete implementation. Results of the fidelity evaluation may lead implementors to launch a second, revised effort at implementation.

Sufficiency

The sufficiency evaluation is function oriented. That is, it compares a user's practice against a meta-model of "how-to-train" or a theory of team training. (The area of sufficiency evaluation has been referred to by Leinhart (1980) as Domain-of-Instruction.) We assume that in the solution concept stage of research and development, the researchers had an implicit theory of what functions the trainer must

perform to conduct good tactical training (such as that provided for teacher functions by Fisher, et al 1981). Each function was then instantiated during solution development to form the exact procedures which define tactical engagement simulation. For example, one set of procedures from Tactical Engagement Simulation is called the After Action Review. These procedures describe (in great detail) the steps a trainer must take in order to provide feedback to the trainees. The function of the After Action Review is to provide feedback to the trainees. However, if the exact procedures specified in the After Action Review are not followed, feedback may still be provided by some other procedures. Hence, we could find the case where excellent feedback is being provided but none of the After Action Review procedures *are followed*. *That is*, the function is being filled, but the procedures are not followed. (Note that the After Action Review fulfills the functions of a post-exercise briefing (Boguslaw & Porter, 1961) and these involve more than just providing feedback; however, the point of the example is to make a distinction between functions and procedures.)

Why is sufficiency evaluation important? First, the importance assigned to any given procedure can only be determined based upon what function that procedure serves. Second, if the innovation is changed to better fit the organization, then the organization may have substituted procedures of its own which fill the same function as the procedures invented by the developer. If this were the case, we would probably not want to waste time and effort on getting the users to do it "our" way.

Effectiveness

The effectiveness evaluation proposed by the Life Cycle approach is a "unit oriented" comparison of the current state of training with the pre-fielding state (see Figure 2). It is not an experiment. At least not a classic experiment. The purpose is not to assess the "maximum" or "design" effectiveness of the system. Presumably this sort of effectiveness was assessed in the R&D stage. Rather, its purpose is to assess the actual effectiveness of the innovation as it is used by real units with all the constraints and problems real units have.

For the Effectiveness evaluation of MILES-TES, there are two major questions. The first relates back to the original problem statement; namely, has the state of small-unit tactical training improved? Second, by combining the information from the effectiveness evaluation with information from the sufficiency and fidelity evaluation we try to ask how a unit's current state of training is related to their training policies and procedures. We hope that answers to this second question will lead to recommendations for training policy as well as to ideas for new training developments.

Conclusion

It seems safe to assume that in todays military, all users are already working at 100% and all are overburdened. A new training develoment, no matter how promising, is perceived as just another task to be dealt with. Many of us are used to systems analysis and systems thinking. Life Cycle Evaluation represents an attempt to look at the user's system and try to anticipate the multiple ways which any new

device, methodology, or whatever, impinges upon that system. Life Cycle Evaluation goes a step further by viewing the innovation as a living entity which changes as it matures and can survive only by adapting to its environment. Hence, the nature of the evaluation is tied to the life cycle of the innovation.

So far, the Life Cycle Evaluation concept has been applied to the implementation of MILES-TES and its findings and recommendations have been welcomed by the developer and the user MACOMS. At present, the Life Cycle Evaluation is being extended to the actual use of MILES-TES. We expect that this part of the effort will be just as successful but that it will affect primarily longer-term policy and R&D issues. Something like the Life Cycle Evaluation concept is required to ensure that training developments are, in General Meyer's (1980) words, "integrated aggressively into training programs" so that the military gets more than a twenty percent return on its R&D investment.

Footnote

1. For a more detailed discussion of the issues and framework for implementation monitoring see:

Gray, W.D. (1984). Implementation Monitoring: A Role for Evaluators in Helping Innovations Succeed (ARI Technical Report--in press). Alexandria, VA: Army Research Institute.

This Technical Report provides a slightly different framework, and a much more technical discussion than is provided here.

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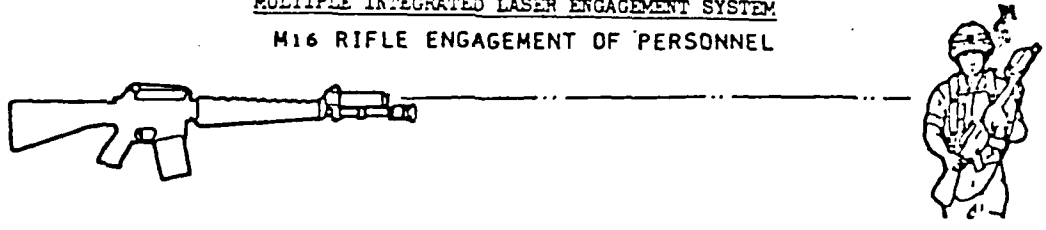
Figures

MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM

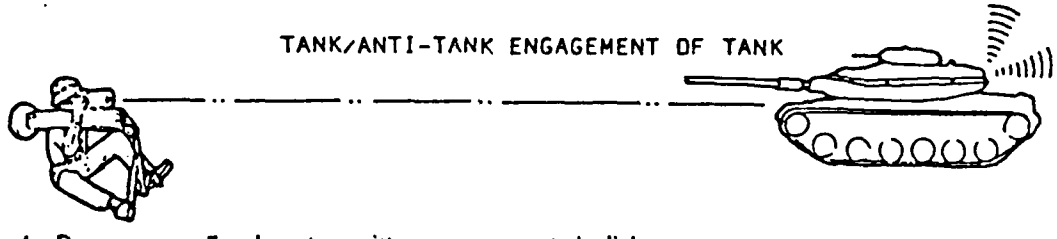
M16 RIFLE ENGAGEMENT OF PERSONNEL



1. Firing a blank causes laser to fire. (M16 rifle shown for illustration purposes only. Transmitter can be adapted to other rifles.)
2. Detector senses *kill* or *near miss*.
3. a. If *near miss*, beep-beep sound comes from buzzer. Soldier takes appropriate evasive action to prevent being *killed*.

   b. If *killed*, buzzer sounds continous tone. Soldier removes weapon key from M16 transmitter (M16 disabled) and inserts key in harness slot to silence buzzer.
4. Controller may reactivate M16 rifle transmitter and restore basic ammunition load with special Controller Key.

TANK/ANTI-TANK ENGAGEMENT OF TANK



1. Dragon gunner fires laser transmitter.
2. Gunner tracks target for 6 seconds.
3. Detector senses *hit, near miss, or kill*.
4. If *hit* or *near miss*, alarm sounds intermittently.
5. If *killed*, alarm sounds continuously and strobe light comes on.
6. Heavy gun transmitters are automatically disabled on receipt of *kill* signal.
7. Vehicle commander may reactivate tank and restore basic ammunition loads with special Controller Key.

LIFE CYCLE EVALUATION FOR ARMY TRAINING DEVELOPMENTS