TRAINING WITHOUT SCHOOLHOUSES

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ABSTRACT

Technical training in the twenty-first century needs to adapt high technology to instructional methodology. Increased levels of technical skills will be taught in a climate of fewer dollars and with fewer active duty personnel available for instructor duty. This paper reports the results of a preliminary study to improve training in the twenty-first century in this climate.

Some of the alternatives explored include: contracting out entire training centers, life-cycle contractor training of weapons systems and/or selected equipments, and use of future information systems to reduce or eliminate the physical co-location of students and instructors. Areas for further study which have been identified include: identification of required information system capabilities; application of artificial intelligence to course design, development, and delivery; design of low cost generic terminals; and development of an algorithm which aids in the identification of factors essential to successful delivery of remote instruction.

INTRODUCTION

Futurists range from over-pessimistic doomsayers to those who foresee only "streets of gold" in a future Shangri-La. In fact there is a range of possible futures which we can influence by action taken or not taken today. However, rational thought based on reasoned judgment and past experience narrows the range of possibilities considerably. We need to make families of assumptions and determine the research and small scale pilots that need to be conducted now that will aid in making enlightened choices in the future. Two major premises undergird the alternatives explored in this paper. First, the number of technically trainable and recruitable young adults will decrease through the end of this century which will create a dearth of experienced military personnel available for assignment to instructional duties in the early twenty-first century. Second, increased complexity of new weapons systems and an ever increasing ability to change systems already in the fleet will increase the amount of training required, particularly for career personnel.

ALTERNATIVES

Three alternatives which can reduce the number of required military personnel assigned to training are:

1. Contracting out training centers.

2. Life cycle training of selected courses at contractor facilities.

3. Using high technology communications systems in support of selected training without formal schoolhouses.

Obviously each of these alternatives has advantages and disadvantages. The last two alternatives will require additional analysis and research to determine the limits of feasibility and parameters for optimum implementation.

Additionally, other alternatives also need to be explored such as shifting more of the front-end skills into public and private technical schools by such means as providing curriculum at no cost to these institutions and offering incentives to new assessions who have these skills.

CONTRACTED TRAINING CENTERS

The first alternative to compensate for lack of military instructors is to award a "turn-key" contract to run an entire training center. The Navy has contracted out selected maintenance and instruction at a number of training centerns since 1980. Currently over 1,000 contract personnel are teaching Navy courses in Navy run facilities. Depending on geographical area, course content, and experience of potential bidders, there appears to be a 10 to 20% life cycle savings of contractor personnel over a comparable military staff. This results from fewer turnovers, shorter average break-in time, and decreased personnel support requirements. Assuming a stable contractual work-force, costs of such incidentals as security clearances are actually lower compared to a military counterpart because of lower turnover rates.

It is the "military" component, not the "technical training" component of the training process, that will limit the applicability of contract instruction. Obviously recruit training requires "blue suit" examples of military standards of personal excellence. At the other extreme, training for career personnel should emphasize technical content and the choice between contractor or military instructional staff should be primarily economic in the broad sense, i.e., military shore duty billets that provide meaningful shore duty assignments to achieve acceptable sea-shore rotations is part of the economic equation. The value of the sea-shore part of the "equation" shifts the decision toward contracting if future technology increases result in significant increases in length of training for career personnel.

Virtually every function of a training center could be contracted except for quality control, military models of personnel excellence, and where skills are not available in the private sector, e.g., some tactical skills.

This alternative to contract out an entire training center is a low risk option and can be implemented at any time. The Defense Department has extensive experience both in contracting parts of the training function (i.e., instructor contracts and maintenance support contracts) as well as "turn key" contracts such as Vance Air Force Base.

LIFE CYCLE TRAINING AT CONTRACTOR FACILITIES

If one were to compare the cost of training historically conducted at contractor facilities to the average cost of similar training in government facilities, the latter would show a much lower cost per graduate. However, that is due in part to the following:

1. Historically, contract training has been limited to one or two initial cycles of training. Therefore, course start-up costs tend to be spread over those few cycles of training. Economies of scale are not possible under these circumstances.

2. Where unused government facilities exist, the marginal cost of adding additional training appears much lower than expensive initial factory training which includes facility cost.

Additionally, because initial factory training is conducted with unproven curriculum, often with insufficient training equipment, and sometimes with instructors without instructional backgrounds, many people within Navy do not view contractor training as a long term alternative. One example of longer term contractor training is the recent contract for bridge training for officers at Newport.

There are a number of factors that mitigate against more of this type of training:

1. High cost of capital investment.

2. Short length of contracts (five years or less).

3. Government protection as a result of unsatisfactory performance (both monetary and ability to produce a continuous stream of graduates).

4. Extent of military presence needed (new assessions versus career personnel).

These factors are interactive in affecting decisions to opt for life cycle contracting. The higher the start-up costs, the longer the contract life needs to be in order to spread investment costs across the life of the contract. However, as length increases, particularly with capital intensive training equipment, government protection against less than optimum performance decreases, e.g., a contract for a 50 million dollar hot plant in the middle of XYZ Corporation, cannot reasonably be terminated since lead times for construction of replacement facilities would be several years. Laws are needed which allow expeditous judicial decisions to resolve conditions of unsatisfactory performance. The situation is not that different in nature than a ten or more year ship construction effort by a non-government shipyard and would need to be approached in much the same way.

Research

Additional research and analysis would be needed to establish optimum contracting procedures in order to begin life cycle contracting on a large scale. Military training managers, Navy comptroller personnel, contract specialist, and industry should be able to work out reasonable procedures and safeguards.

Another research implication is the development of an algorithm to assist in making decisions on what kind and how much military presence is required during technical training to develop and/or retain the purely military aspects of career development. To repeat a worn but nevertheless true cliche "a sailor first and a technician second". What is the trade-off between such factors as length of service, length of training, type of training, and the ability to "civilianize" the technical training component of personnel development?

A final research question regarding life cycle contracting concerns the size of the contracting effort. Should a contract cover a single course, a series of courses comprising a pipeline, several related pipelines, or a major portion of a warfare area. Economics of scale, synergistic effect of related training, and the sharing of common high value resources would tend to make one decide that large blocks of training should be contracted. Another aspect of size of life cycle contracts is the scope of indirect support and what is termed base operations support at military training centers. Full berthing, messing and recreational provisions could be specified in the contract allowing a wide latitude to achieve the end goals of such support. Civilian "mirror images" of traditional military training installations would be the easiest to define but may not be the best alternative, e.g., integration of training in a vocational-technical school setting (a variation of ROTC) may be a better approach.

Training contracts with full quality

of life support should not be written in traditional contract language of some specified number of man weeks of training or a given number of square feet of living space. Contract language should be developed to specify quantifiable skills or attitudes to be attained from an entry level baseline and some quality of life quotient to be maintained during the student's assignment for training.

TRAINING WITHOUT SCHOOLHOUSES

This option has the highest risk but greatest potential to increase quality of training and decrease cost of training of the alternatives explored herein. The concept should be very compatible with what many project as the information based society of the future. Any future implementation will require research and development in two general areas -- communications and instructional technology. Needed improvements in these two general areas will be discussed first, followed by a description of one possible twenty-first century scenario that reduces the need for schoolhouses at formal training centers.

Low cost communication is a prerequisite to make this alternative practical. An interactive network between two or more training stations would be needed without geographical constraint. Ideally, the interchange would include data, audio, video, and even holographic images. An optimistic view would be that such terminals would be in place in most homes, replacing existing home computers, video recording and playback equipment, tape and record decks, video games, libraries, television sets, and telephones. The effect would be more than replacement but the synergistic effect of totally integrating all of the present day capability. Such a terminal would be very sophisticated and complex yet simple to operate. Input-output modes would include voice, touch, pictures and text just to name a few. With such capabilities, the terminal or station would be capable of generic simulation of many future work stations. Holographic imagery would even create some part task training capability for psychomotor as well as the purely cognitive skills. One could conceivably be able to "touch" locations of analog controls and other physical components on holographic images.

Six instructional technology areas need to be enhanced from present day capability: artificial intelligence (AI) in curriculum development and instructional delivery, competency based evaluation systems, reduction in the amount of hands-on training required on operational equipment in formal training settings, electronic transportability of generic simulations, teleconferencing, and embedded training in operational fleet systems.

Artificial Intelligence

Today attention to format, cut and paste techniques, typing, art work, and other more mundane aspects of curriculum work consume disproportionate amounts of curriculum development resources. Artificially intelligent expert systems of the future, exercising control of future data bases, will enable subject matter experts and instructional experts to make major modifications and minor adjustments to curriculum very easily in almost real time.

One important application of AI is the adaptation of video gaming to instruction. A number of games currently exist that are used in formal Navy courses as well as to maintain and refine skills in the fleet. The Naval Personnel Research and Development Center has developed some gaming based training or assessment tools, e.g., Battle-Management Assessment System (BATMAN) and Raid Originator Bogie Ingress (ROBIN). Other wargames are being developed for specific applications. The long term critical need is to integrate AI based gaming expertise with subject matter expert AI so that these games can be produced and updated quickly and inexpensively.

On the instructional delivery side, yesterday's individualized instruction did not work well because in too many cases instruction consisted of reading paper texts assigned by an inflexible computer managed system that was supported by learning supervisors performing largely clerical functions. Continued growth in expert systems should allow subject matter expertise to be combined with instructor expertise in software of the future that would be cognitively comparable or even better than the average instructor today.

Competency Based Evaluation

Testing practices can be dramatically improved with future technology. Today multiple-choice questions and short answer types of objective tests are prevalent for testing material learned in the classroom. Some retesting of sub-areas on a test is currently practiced in some courses, while few Navy schools provide specific feedback in the form of remedial prescriptions. Performance testing needs to be improved to identify subtle knowledge or skill deficiencies. More complex methods of evaluating an individual's range of competence and assignment of finely tailored remedial instruction is too complex and time intensive today because instructors are needed to do the job; therefore, it is too costly. Again, artificial intelligence can be used to make complex comparisons and quickly generage easy to understand profiles of performance along with individually tailored prescriptions for remediation.

Reduced Hands-On Training

Reducing the amount of hands-on training is not likely to be well received by many trainers. However, there are several reasons why present day objections will be less valid in the future: jobs are becoming more cognitive and less psychomotor in nature, simulation techniques are improving, simulation is easier because more jobs involve interaction with standard display terminals, and finally operational software which will have built-in training modes can be more easily transferred to simulators for part task training. The above factors will enable hands-on training to be concentrated near the end of the course or transferred on board ship.

Electronic Transportability

Computer based lessons will be more easily transportable over communications links. A particularly critical capability needed will be near real time interactive simulation at the various terminals.

Expert human instructors will need to be linked directly with one or more students. Today's teleconferencing and interactive television experience will provide a basis for future systems. Several systems are currently in use. One remote delivery system under test by a DOD training organization provides one way video and two way audio using compressed band-width techniques. Further progress is needed in integrating live camera with stored video. Low cost two way video is needed to further enhance present day systems. Instructor stations which present video from a "class" of students on a master display will recreate much of the present day classroom environment.

Embedded Training

Finally, increased embedded training capability in operational equipment will allow the shift of increased training to the fleet as well as reduced reliance on resident school hands-on training. Ideally the requirement for embedded training will be part of all new weapons systems procurement specifications. As mentioned earlier, subsets of fleet software can be used in generic terminals for individual training and even some team training. The same compatibility of training modes between weapons systems required on board will also allow subsets of training software to interact in a shore-based team training setting.

TRAINING SCENARIO

This scenario will combine various aspects of the three alternatives described above. The year is 20XX. The specific year XX is dependent upon the costs of communications/information systems and instructional technology available.

Recruit training will still need to be conducted by military instructors while most base support functions will be performed under contract. Initial assession general skills training, i.e., class "A" Schools, would vary from training at contractor facilities, contractors teaching at Navy facilities, to USN instructors at Navy facilities and combinations of the above. Computer assistance will be prevalent for remedial instruction, practice, and testing. Also by electronically sharing curriculum and generic simulation, some portion of many entry level schools will be taught in high schools and vocational-technical institutes.

The most radical changes should occur in equipment specific operator and maintenance training. Much of this training will be able to be structured so that the front-end can be supported by generic simulations on low cost terminals. This will result in front-end training being relatively site-independent, i.e., learning could occur on-board ship, at home, in civilian educational/technical institutions, at contractor facilities, or all of these. One typical example would be a young person being assigned to learn a new system via terminal on board ship. During his off-duty hours, he could, if desired, continue the lessons at hime when the ship is in port, or even at a local technical school. Learning the new system could be a temporary duty assignment for a number of weeks at one of these locations.

Training will be more continuous on a systematic basis versus the present prevalent method of front end loading training immediately after initial enlistment in residential schools. This is more flexible method of delivering instruction would allow immediate sea duty assignment after the initial class "A" School and then allow the sailor to continue training on-board through a video linked terminal. Depending on the instruction, the method could be purely computer-assisted (remember that extensive artificial intelligence provides both subject matter expertise as well as instructor expertise) or through communications links providing one-on-one tutorial with a real instructor or multi-station interactive distributed quasi-classrooms, i.e., the instructor at one physical location and various class participants each at separate locations. If hands-on training cannot be accomplished on on-board systems either because of lack of time on equipment, unavailability of supervisory personnel to monitor the student, etc., then a short hands-on capstone segment of training would need to be conducted in formal training laboratories. Again, there would be a variety of ways to provide this capstone training, USN facilities run by the Navy, contractor run Navy facilities, or life-cycle contractor facilities.

Because software and hardware change to systems of the future will be increasingly easier to make, operator and maintenance skills must also change more rapidly. Lumping change into residential school modules and sending each operator and maintainer back for training several times a year is not practical now nor will it be in the future. Remotely delivered instruction is a way to keep the fleet up-to-date.

LONG TERM IMPLICATIONS

The long term implications of such

a scenario would be:

1. No dichotomy of training design and management between most sea and shore training.

2. Reduced military training facilities due to use of terminals in work spaces, homes, and civilian schools as well as increased use of contractor facilities. Berthing, messing and other support capability would be similarly affected.

3. Design of training would more readily accommodate reserve training.

4. Changes to personnel policy which would reward relevant training obtained prior to entry into the Navy as well as on off-duty time.

5. Tactics could be more dynamic because entire battlegroups could receive training in new techniques in almost real time.

6. Refinement of ways to improve team attitudes and skills in light of less traditional classroom groups. The same communications links used to teach can establish teams that could be even less artificially created than a group who traditionally were assigned to begin training on the same day in a course.

NEAR TERM RESEARCH

It is most critical to recognize near term implications as to where research and development must be focused. These are some of the more obvious:

1. Improvements in artificial intelligence based curriculum development and delivery systems.

2. Development of sophisticated learning terminals; preferably for economic reasons these future terminals would be enhancements of common consumer information equipment.

3. Refinement of teaching and learning management techniques relative to remote delivery of instruction. Development of an algorithm which allows the training manager of the future to decide which training setting is most effective for a given training requirement.

4. Small scale tests on the various concepts, i.e., remote instruction, life-cycle contracting of training, and methodology for concentrating hands-on training near the end of the training sequence, etc.

5. Determination of the amount of military presence required at various stages of training in an individual's career. Obviously subject matter, student characteristics, and method of instruction will interact with yet unidentified factors. The initial socialization process of recruit training must necessarily be conducted in a closed military system. However, if follow-on training is conducted in non-military settings, superior performance and lifestyle of military personnel may serve to attract the best and brightest of non-military contemporaries for naval careers.

CONCLUSIONS

There are many possible futures that we can help to create. The future that will actually occur in the year 20XX will depend in large part on the ideas and decisions made today. Besides the research needed in the areas described above, organizations must look to how they need to structure themselves for the future.

In the informational age, traditionally separate organizations will be in close cooperation. The organizations responsible for training at sea and training ashore must function as a single entity since where training is conducted will become less and less a function of location or setting. Policy and directives must become more and more forward looking as acceleration of change increases in the informational age in which the scenario described above occurs.

ABOUT THE AUTHOR

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