Distributed Training

Meeting Challenges of the '80s

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Acquiring and maintaining the skills and knowledge required to remain technically current and competitive in an international marketplace is a major business concern of the 1980's. Recent educational policies and strategies prepared individuals with intellectual backgrounds that made them versatile problem solvers in a wide range of situations. In the past, however, businesses did not deal with the information explosion now being experienced as a result of new technology and international competition. With so much more skill and knowledge needed today, businesses find it necessary to narrow the focus of their training activities.

When young people are ready to enter the job market after high school or college, they face a greater number of work options and a more uncertain future than did their parents. In addition, each option often entails specialization of skills and knowledge that cannot be obtained through an academy;only through specific task related training. Thus, the challenge of training goes beyond basic skills; it is a charge to prepare people to work in highly complex and diverse fields of rapidly changing technology.

This challenge of diversity and complexity places heavy demands on businesses to provide effective, continuous education and training experiences for employees. Occupations involving complex technology require more training both in content and proficiency levels; diversity of tasks demands broader, more flexible curricula; and rising training costs require many' students to interleave work and education in their lives. This paper examines centralized and distributed approaches to the training challenge of the 1980's. Advantages and disadvantages of the two training approaches are discussed with some sug-gestions as to how the two might be merged to produce an effective solution to problems of delivering effective training and education.

The Centralized Approach to Training

A commonly cited rationale for centralizing training is that conducting all training in one location achieves economy of shared resources. The assumptions behind this rationale are that all training is conducted either in one building or in buildings within walking distance of one another; all teachers and learning resources are accessible to all students; and all associated physical facilities are co-located in a single, easily managed unit.

The primary *raison d'etre* for centralized training is delivery of instruction. Consequently, the organization, management, and operation of the training center revolves around teachers and teaching. The training, therefore, tends to be "instruction-centered" rather than "learning-centered." An example of instruction-centered training is indicated by scheduled instructional periods. If a student can attend a session at the scheduled time, that is good; if not, that student must either choose another subject or another time the subject is scheduled. In addition, the content of a centralized training curriculum is based in part on staff talents. A subject is not taught if there is not enough demand to warrant hiring an instructor qualified to teach that subject. Consequently, curriculum content can rarely change to meet the needs or desires of individual students. If a subject is not included in the curriculum, students who need or desire it must either find a school whose curriculum includes it or abandon the subject altogether.

In most cases, centralized training locations have a fixed amount of instructional time for any given subject. Student achievement is then measured in terms of the amount learned *from the instruction* within that fixed time. The value of the amount learned (e.g., the grade) is usually a function of a student's position on a "normalized" distribution of achievement scores from past or present students in the curriculum. The "cut off" score between passing and failing may also be adjusted periodically, depending on such factors as the academic aptitudes of the current student population.

Student responsibility in centralized training is usually minimized in terms of what and how to study. Students are in the program to be taught by teachers rather than to learn by themselves. If a student does not respond to this "treatment," he or she is counseled, tutored, remediated, and finally, if all fails, released to pursue some other activity.

Advantages and Disadvantages of Centralized Training

These characteristics of centralized training illustrate a number of advantages, the first of which is that training is easy to manage. All facilities, faculty, and learning resources are nearby and can be easily measured, counted, evaluated, scheduled, and controlled. Students can be observed as they learn, and the training program can be easily adjusted to accommodate change in training direction or policy. The cost of developing materials that form the foundation of instruction is invested primarily in the training staff. Consequently, the costs of developing and delivering instruction are relatively small compared with the cost of operating and maintaining the physical facilities. Finally, centralized training has a strong and revered tradition; almost everyone has experienced it and is comfortable with it as an effective way to train.

In spite of these advantages, there are also some significant disadvantages to centralizing instruction. One disadvantage is the tendency of a central location

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to become isolated from demands of the work place. The jobs people perform and the skills and knowledge they need are often not closely related to the subjects and information presented in a "closed" training system. Frequently, instructors are deeply concerned with *how* they teach and *how* to improve their delivery skills. Because they are teachers, however, they have difficulty measuring the need for or relevance of *what* they are teaching.

Another disadvantage of centralized training is that once a program is completed, students find it difficult to continue training on an "as needed" basis. Graduates find jobs well away from the training location and tend to live in homes more convenient to work than to the training site. Commuting, parking, and time away from the job all interfere with incentives to continue training. The result of this situation is a conflict of interest between going to work and going to school, one if not both of which usually suffer.

Operating a centralized training facility also presents some difficulties. The cost of keeping the facilities in good repair, heated or cooled, and keeping the staff current and adequately paid, amounts to a substantial and continuous outlay of funds. Furthermore, the movement of students through the system must be reasonably constant and predictable. A sudden increase or decrease in numbers of students can cause considerable disruption to orderly training schedules. Enroll too many students, and the facilities, resources, and staff are inadequate to provide quality training. Enroll too few students, and limited funds must be spent on under-used teachers, training facilities, or other resources.

What are the alternatives to training organizations which must operate within these restrictions? One alternative is to distribute the training to various locations where students can access structured education at times and places con-

venient to their lives rather than to that of the centralized training facility.

The Distributed Approach To Learning

The objective of distributed training is to place training in the context of an individual's worklife. This facilitates student access to learning opportunities and reduces the "overhead" of training costs associated with centralized training.

Distributed training can be conducted in several ways. The simplest form is the travelling seminar in which an instructor teaches a course in various places, spending a few days to several weeks conducting intensive lecture/workshop sessions designed to impart specific skills and knowledge. On a more complex level, training can be distributed through large-scale, computer-based training networks that deliver individualized instruction to sites which have a computer terminal. Between these extremes are various self-study correspondence courses, and packaged, paper-based or multi-media individualized training programs using a "programmed" instructional approach.

Characteristically, distributed training focuses strongly on the learner since the approach tends to increase the distance, both physically and intellectually, between instruction developers and instruction consumers. Distributed training developers are therefore required to put much more thought into who the students are, what skills and knowledge they bring to training, and what skills and knowledge they should take away from the experience. Obviously, this situation is far different than that of teachers who see students personally every day.

Effects of distance between an instructor and students are particularly salient when the distributed training is media-based and individualized. In these cases, a student's only contact with the instruction is what an instructional developer has written as prose, drawn as diagrams, or interrogated as questions. If the in-

structional developer fails to anticipate and prepare for student misunderstandings or incorrect interpretaions, some students can be prevented from mastering the required skills and knowledge. Individualized training materials must, therefore, be much more carefully developed for group training settings where error can be corrected on the spot by the instructor.

Using individualized instruction to distribute training also puts more responsibility on students to complete training programs than does centralized training. Since training is not scheduled in structured periods, students must take it upon themselves to set aside time to study. Usually, if students fall behind schedule, there is no one to counsel, tutor, or otherwise motivate them to catch up. When individualized training is used, the incompletion rate for students tends to be higher than in traditionally delivered group programs. Reasons for the increased incompletion rate can lie in training errors that prevent completion, in the lack of extrinsic motivation to finish the training, or both.

Distributed training is concerned primarily with students' abilities to know well-defined facts and principles, develop specific skills, and combine those abilities to perform specific behaviors. The goal of most distributed training, then, is to facilitate learning to a pre-specified level of performance, regardless of how long it takes to reach that level. As a result, achievement is measured in terms of discrete mastery of objectives rather than in the amount of skills and knowledge gained relative to a norm group continuum. Thus, while centralized training tends to keep time constant and allows learning to vary, distributed, individualized training attempts to keep learning constant and allows time to vary.

Finally, distributed training is designed for delivery at almost any location, preferably one close to the student's primary work site. The object of variable delivery is to make training as convenient as possible in order to reduce competition from other activities that make demands on a student's time. The less effort students must make to incorporate training into their everyday worklives, the more likely it is that they will start and finish available training programs.

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Advantages of Distributed Training

When these features are examined more carefully, a number of advantages of distributed training are seen. The first advantage is that students are given much more freedom over what and when they study. Since distributed training is less limited by geographic boundaries, the student population pool can be very large. This large size makes it feasible to prepare a wide variety of different subjects and still have enough demand for each subject to make the development effort worthwhile.

Careful consideration of the skills and knowledge to be taught using distributed training can lead to performance objectives that are directly related to job tasks. This direct job-training connection allows measures of training effectiveness to be obtained that "close the loop" between job performance requirements and training program objectives. If students or their supervisors report dissatisfaction or simply stop using the course, it is obvious that the training is either inadequate or incorrect and needs revision. Consulting with end users helps pinpoint precisely where training is weak and needs improvement. The precision afforded by distributed training gives it a quality of measurability that is important to business managers. Knowing more accurately what skills and knowledge a training program will provide allows managers to make better decisions because they know in advance what they are buying with their training budgets.

Another benefit of distributed training is its responsiveness to fluctuations in demand without much disruption to the program in general. If demand for a course declines temporarily, materials are merely held in stock until demand resumes. Increase in demand can also be accommodated without difficulty as long as required materials are available. Even in the least desirable circumstances, producing more copies of a course is not nearly as expensive as hiring more instructors or building more classrooms. In short, incremental costs per student in distributed training tend to be linear while, with centralized training, incremental costs per student tend to follow a "step" function.

It should also be noted that the continuing costs of distributed training are much lower than those of centralized training. In distributed systems, overhead costs of facilities and instructors are minimized. Since students study on individual schedules, a small learning space can serve a relatively large number of students. Further, the cost per copy of materials produced in large quantities is quite small compared with the cost of retaining an instructor.

Disadvantages of Distributed Training

There are, however, disadvantages to distributing training. Among these disadvantages is the fact that managing training resources can become quite complex, particularly if special equipment, like a computer terminal, is involved. Other complicating factors include keeping track of what courses students have started, how far current students have progressed in their courses of study, and which students have completed specific programs.

When training is distributed, it is usually not possible to exert control over student study behavior. Unless the training organization has access to a fairly sophisticated, computer-managed instruction system, students are at liberty to study a course using any strategy they desire. Because most students grew up experiencing centralized instruction based in schools, they have had little or no opportunity to learn from learner-centered, individualized instruction. Thus, strategies they employ when faced with an individualized course may or may not be appropriate to the task. If the strategy they choose is inappropriate, they may spend more time than necessary working to master the objectives. Lack of access to an instructor means that students may not be able to talk to anyone about how to study a subject. This situation could lead to frustrating obstacles for the student and ultimately might cause him or her to discontinue training.

One of the major disadvantages of distributed training is the complexity and high initial cost of preparing even quality, "user-friendly," individualized instruction. Developing self-instructional materials is a special skill that is acquired only with specialized training and considerable experience. As the distance between the developer and student becomes greater, writing, graphic presentation, and interrogation/feedback skills become more critical. If course materials are not well prepared, maintenance and revision of the materials can become a significant burden on the operation of any training organization.

Regardless of how well a course is prepared, however, content and objectives can change, requiring modification of the course itself. Depending on the delivery mechanism used, such changes can vary greatly in terms of expense. If a video tape must be changed, for example, the cost could be very high. A computer lesson, on the other hand, might involve only some relatively minor adjustments to the software. In any case, maintenance and up-dating of course materials is a constant problem that is considerably more complex to solve in an individualized, distributed environment than in a centralized, group environment.

Although the disadvantages of distributed training are not trivial, too much can be gained from decentralization to discourage adopting this approach. The next section examines the future of distributed training in overcoming disadvantages, and provides alternatives to increasing effectiveness and efficiency of distributed training.

The Future Of Distributed Training

Overcoming the major disadvantages of distributed training should be the primary near-term goal of companies interested in decentralizing training. Loss of student control can be surmounted largely by utilizing a fast, efficient, computer-assisted management system. Record keeping, management of learning resource utilization, and automation of test administration and scoring are all areas that improve control of student

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progress through a training program. Such training management capabilities can play a key role in assuring the success of distributed training where students and training facilities are separated by significant geographic or organizational distances.

Reducing costs of developing individualized materials can be overcome by carefully recruiting developers or vendors who have demonstrated a capability for producing high quality course materials. Careful planning, thorough job analyses, and clear training objectives can do much to minimize costs incurred by rework and revision. A good set of standards and conventions which reduce the number of development decisions that must be made also contribute to reduced course production costs.

Problems of keeping materials current can be reduced by attempting to design instruction in such a way that it can accommodate changes in content or objectives. Normally, presenting course material in a modular manner, where modules can be changed without disturbing other modules, can significantly reduce maintenance costs. Another approach to the problem of keeping materials current is to choose media such as computer-assisted instruction or printed text for unstable (i.e., subject to change) content, and only use expensive media (i.e., AV) for content that is stable and less likely to become obsolete. Finally, maintenance can be simplified if changes can be forecast during course design so materials can be prepared ahead of time for updating rather than trying to retrofit changes after development.

Engaging in efficient strategies for learning from individualized, distributed training is a skill that can be taught. By considering that students need to be taught how to learn from individualized materials, and by utilizing materials designed to teach methods for learning from individualized materials, it is possible to overcome problems of student difficulty with self instruction. Establishing a support staff that answers questions and responds to student needs by telephone can also serve to close the distance between students and those who are responsible for delivering training.

Overcoming the disadvantages of distributing training, then, is not impossible. A creative problem solving approach will eventually lead to an effective, functional distributed training system. The kind of system eventually implemented can depend in part on the general approach taken to training

distribution. To a great extent, the advent of computer-assisted instruction and management has made distributed training practical and cost effective for businesses. There is such a high information load in any training program that, unless the information can be processed at a high speed, the program will not run well. In centralized training, most of the information is close at hand. With distributed training, information can be scattered over a wide area where, without computer assistance, access would be prohibitively slow.

The first caution about adopting a distributed training approach, then, is that a serious attempt at implementing large-scale distributed training should not be attempted without the aid of some type of computer system. A question often asked in this regard is, "Should the computer hardware employed be a collection of stand-alone microcomputers with a central system to handle the management, or a network of terminals connected to a host mainframe that does the entire job?" Each alternative has both advantages and disadvantages.

A system of several stand-alone terminals for distributing training has the most attractive benefits: low hardware costs and absence of continuing communications costs. The disadvantage of stand-alone terminals is that the processing power of microcomputers is quite limited, making them just one step above an electric book. Clerical tasks of ordering and distributing disks containing instructional programs complicate training management. Information on student performance and rate of learning is also more difficult to obtain. Use of the mail for returning disks containing student information is a possible solution, but it takes time to extract the data, and disks can be damaged in transit. Attempting to provide for the possibility of damaged disks means having a backup system that adds still another level of complexity to the management system.

Most of these problems can be overcome with implementation of a computer terminal network connected to a central mainframe. Computer-based lesson material, student data, automated management functions, and all other information is stored in a single, easily reached and maintained central location that can be accessed by any distributed site. Furthermore, input/output speed, CPU power, and memory capacity of a networked mainframe provide a far more versatile training medium than can be achieved within the limitations of stand-alone microcomputers.

The disadvantage of the network solution, however, is the high cost of equipment. Nevertheless, it is not hardware alone that makes an effective distributed training program. One crucial component of successful training is the software programs that support delivery and management of the entire program. The hardware is merely a tool the data processing capabilities of which place boundaries on what services can and cannot be automated. It may well be that to achieve an effective, working distributed training program, a networked mainframe is the only solution. Companies investigating computer uses in a distributed training environment should be careful to evaluate the importance of well controlled, tightly managed training.

Training investments are becoming increasingly expensive and the cost of poor training is a poor return on the training investment. For companies which require high employee productivity, efficient training, and management control, it is critical, first, to look at the training services needed, and second, to find the training system that will provide those services most effectively.

Stand-alone systems are appropriate for small-scale operations where distribution is limited and close supervision is not required or difficult. When distribution becomes widespread and

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close supervision is not practical, the importance of control available through networking becomes increasingly significant.

A third alternative to reducing the disadvantages of both centralized and distributed training is to combine the two approaches. It is well known that some skills are very difficult, if not impossible, to teach in an individualized, media-based approach. Psychomotor skills and affective responses are examples of areas where human instruction and interaction are particularly appropriate.

By combining centralized and distributed training, it is possible to deliver introductory and prerequisite skills and knowledge to the distributed sites. Once the distributed training has been completed, students can be brought to a central site for the intensive training that is best accomplished in a centralized location with an instructor delivering training that cannot be individualized and distributed. In this case, the centralized training instructor serves as a point of contact for students in the individualized portion of training, using the telephone to answer questions and provide explanations or additional details as needed by individuals.

Striking a Balance

Making the decision to centralize or distribute training can be difficult. Usually one mode must be primary with the other serving as an adjunct. To date, centralized training has enjoyed the greatest popularity. But, with information processing becoming more power-ful, more accessible, and less expensive, distributed training is gaining momentum.

Distributed training should be seriously considered in situations when students must travel substantial distances to reach a training facility; when classes are intended primarily for the dissemination of information; or when need for training is unpredictable, required for limited numbers of students at widely spaced times, or required at several different places at the same time.

Centralized training is most advantageous when person-to-person interaction between instructor and student is absolutely necessary to teach the needed skills; when training is a one time need for a fixed number of students in a one-time situation; or when the course content changes so fast that the lesson will be obsolete before the cost of development for individualized media can be recovered.

Combining centralized and distributed training is recommended when neither centralizing or distributing training alone can meet the training needs of an organization. In this case, however, it is crucial that a coherent system of centralized and distributed training be orchestrated to maximize the advantages and minimize the disadvantages of each approach. Too often, the individuals responsible for centralized training compete with individuals responsible for distributed training. The result of this needless competition is wasted resources and lost opportunities for a highly effective mix of group and individualized instruction.

In conclusion, the role of distributed training is just beginning to emerge in the training industry. It is a new frontier and, as such, has its share of hidden problems waiting to be discovered by those who first explore it. But evidence is mounting that traditional, centralized training cannot meet the challenge of productivity now being experienced. Those who will benefit first from distributed training are those who are not presently shackled to large investments in central training facilities with full-time instructors, classrooms, and training equipment. Others to benefit from distributed training are those able to divest themselves of commitments to existing facilities and invest in developing training that can be implemented where the students rather than the instructors are located.