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The Instructor-Free Training Department

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Today's skills will be obsolete in the year 2000. That workforce will require a much higher degree of technical sophistication and adaptability than we have now. Enormous demands will be made of DOE contractor training departments even as federal deficit reduction actions increasingly restrict resources and as the emergence of electronic performance support systems appear to diminish the need for training. True training will still be required but we must, and can, train better, faster, and cheaper. We'll do this by implementing the implications of performance-based training and by focusing on learning instead of on teaching. (Indeed, ability to learn efficiently and rapidly will be the premier talent in the next century AND WE CANNOT TEACH THIS EFFECTIVELY IN A CLASSROOM.) Training Departments must dedicate themselves to changing performance, not to teaching classes. The best training department of the future will have no "instructors." Trainingforce 2000 will look and function much differently.

At the beginning

One of my favorite quotes was spoken by a keynote speaker at a TRADE conference several years ago. "You can't get there from here, but you can get here from there." To decide what we ought to be doing in training today let us imagine the world of 2003.

What will the work environment be like?

..because of increasing international competition, business needs well trained workers more than ever, especially ones that depend on complicated and often confusing technology (THAT's US). Companies must get by with slim staffs, and training can play an essential role in getting the most from the remaining workers.... of today's workers who make it through the year 2000, 75% will need retraining.

Randy Ross reporting in the September 1988 issue of High Technology Business, "Technology Tackles the Training Dilemma"

Changes in the economy will cause a significant restructuring of US occupations. The number of the least skilled jobs will be dissappearing and the number of high skilled jobs will grow rapidily. Most new jobs will demand a higher level of math, language, and reasoning skills.

Workforce 2000, Work and Workers for the 21st Century; US Department of Labor

For the Department of Energy the challenge is formidable. Facilities will be in the midst of massive cleanup efforts. New technology, especially related to environmental protection and restoration, will be increasingly sought, developed, and implemented. Regulations will continue to grow at a steady pace, placing greater burden on employees' time and efforts related to compliance and training. If history is any guide, a vast majority of the new regulatory requirements will be "knowledge related" rather than skill related.

Prediction 1: compared to 1993 the work environment of 2003 will be more complicated, more administratively controlled, and require greater knowledge.

What will the workers be like?

> The workforce in 2000 will have significantly more women, non whites,immigrants and part time workers. For new entrants in the workforce, all categories will be significantly higher except white males which will decrease to only 15%. The median age of the population will increase to 36 years of age.
>
> ... rising skill requirements will affect all but the lowest skill job category. These changes will present especially difficult challenges for black men and hispanics, who are under represented in the fastest growing professions and over represented in the shrinking job categories.
>
> *Workforce 2000, Work and Workers for the 21st Century; US Department of Labor*

So far, then, work will be more complex but entering workers will lack basic skills. Yet, as change accelerates and more training is needed, many workers will need advanced skills simply to get access to useful job training.

Prediction 2: More entrants into the workforce will lack basic skills.

What will the home environment be like?

Astounding advances in interactive communications are taking place in the home.

> Early next year [Time Warner] will launch an interactive service that will provide video and information on demand to 4,000 subscribers in Orlando, Florida.
>
> When the information highway comes to town, channels and nightly schedules will begin to fade away and could eventually disapear. In this postchannel world, more and more of what one wants to see will be delivered on demand by a local supplier from giant computer disks called file servers. These might store hundreds of movies, the current week's broadcast programming and all manner of video publications, catalogs, data files and interactive entertainment.
>
> *Time magazine, April 12, 1993*

Prediction 3: Homes will have access to huge libraries of information and transparent communication tools will facilitate that access.

What will the schools be like?

> The key to success in a knowledge age economy isn't education. It is high tech, ultra customized process that I call hyperlearning(HL). .. anyone plugged into the multimedia network being born from the fusion of cable tv, personal computers, and telephones will have access to more customized information than any school or university can hope to match. The result, hyperlearning, is to classroom education what the M1A1 Abrams tank is to the chariot.
>
> Learning in the multimedia grid will be so much more effective than in schools that it will replace schooling altogether... I'm talking in the next 10 years!
>
> The last three years have seen the rise of the palmtop computer the cellular telephone, and the walkman size multimedia player. As these technologies merge, it will be possible to carry around a portable "knowledge gateway" which offers you learning on demand anywhere, anytime.
>
> *Lewis J. Perelman writing in the September 1993 issue of SUCCESS Magazine*

Prediction 4: In developed countries, schools will play an diminishing role in educating children. National examinations will serve to certify "12th year equivalency." (Such examination results will most certainly mean more than a "high school diploma" does today.)

What will training be like?

Indeed, will training services even be required? When operators and craftspeople carry their personal computers with them, when those computers are linked to central company databases of policies and procedures, when those computers are linked to massive databases of training and educational materials, when users can obtain such training on demand; when that happens, what will be the need for a training organization at all?

Clues to the answer to this can be obtained by reflecting on a more basic question: what is the purpose of training? Then what necessary service does training provide that cannot be supplied "on demand."

At the Ninth Training of Nuclear Facility Personnel symposium in Denver in 1991 Larry Durham, a Tennessee Valley Authority training manager, reminded the audience that problems with the railroads stemmed from the railroads believing they were in the railroad business and forgetting they were in the transportation business. He then remarked that Training needed to remember it is in the behavior change business, not the Training business. And that's what training does: training changes behavior. More precisely, training

enables changes in behavior. Training is meant to supply the knowledge and skill necessary for human beings to perform a task now that they couldn't perform before.

If imparting knowledge and skill is the business of training, can this realistically be delivered on demand? Here is a thought experiment. Take a reasonably intelligent 15 year-old. Hand her a computer with access to all the information in the world. This computer will respond to voice commands. With no other training require this person to drive you in your car across town (for purposes of the experiment you can be the computer). Clearly, such an experiment actually conducted is likely to have disastrous consequences. Missing will be some basic knowledge on fundamentals (reading and interpreting a speedometer, momentum), mandatory training (rules of the road, hazards, protective equipment), and job specific activities (braking, accelerating, etc.). Even if supplied to the operator on demand, not all of these concepts (knowledge) can be absorbed, related, connected, and interpreted when initially encountered. For any moderately complex task training will still be required. But not instructors.

Training in 2003: A Personalized System of Instruction (PSI).

Training's purpose is to *change behavior*. The employer of 2003 cannot afford superfluous training: cannot afford to have employees waste time in a class being exposed to material already mastered. Furthermore, Training fails if the employees cannot safely, effectively, and efficiently perform their duties once their training is completed. Therefore, given an employee beginning a new job assignment the training system of the future will:

1. Thoroughly test the employee to discover and classify both strengths and weaknesses.

2. Provide a detailed recipe of assignments specifically tailored to that employee. These assignments may have the form of completing computer-based training tutorials, viewing videotapes, reading manuals, walking down systems with subject matter experts, practicing with computer-based simulations, answering study questions, etc.

3. Deliver unit tests when requested. Such tests will be immediately graded. Employees close to passing will be offered the opportunity to defend their answers to a subject matter expert who will decide pass/fail.

4. Employees failing unit tests will be directed to continue studying and may be offered alternative training materials.

5. An employee passing a unit test will be directed to specifically tailored training materials for new unit.

6. Employees who have demonstrated mastery of the appropriate units will be permitted to attend lectures demonstrations on the topics, if they wish.

7. Major exams will be administered at the conclusion of substantial portions of study. Exams may be both knowledge-based and include Job Performance Measures.

None of this requires a classroom instructor. Clearly, much of the course of study can be computer-based. Certainly, much of the knowledge testing will be computer delivered, as will practice on simulations. Employees may, however, be assigned counselors. A counselor would be a person knowledgeable about the job who could answer questions, provide helpful hints, discuss the more difficult material, etc. Even more necessary will be the counselor's compliments and encouragement. In 2003 human employees will still need approval and motivation from people they respect and admire.

A personalized system of instruction (PSI) does require, however, a training systems engineer who will select and organize study materials and their modes of delivery, construct tests, help evaluate employee progress, select lectures and demonstrations for employees who have earned the right, arbitrate any disagreements.

Advances in technology contribute to this plan in several ways. First, much of fundamentals training is now commercially available on interactive videodisc. Of course, the training systems engineer will have to select, adapt, and find supplementary material but little should require development from scratch. Similar remarks apply to mandatory training (e.g., Radiation Worker Safety, Confined Space Safety, etc.). Perhaps the most telling achievements come from the ease with which audio and video can now be stored and controlled by a computer. A computer program which can display a system component in one window, a diagram of the system in another, descriptive text in a third, and a video clip of subject matter expert discussing the component in the fourth, such a program can now be constructed in times comparable to that required for development of lectures and would be substantially more effective.

So, then, technology now makes possible a comprehensive PSI. Not exactly. The PSI described above is detailed in *The Keller Plan Handbook* by Fred S. Keller and J. Gilmour Sherman published in 1974. In this book Keller and Sherman relate experiences in implementing PSI beginning in 1963. Further, they recount their astonishment at discovering that similar educational experiments had been conducted in San Francisco about 1910. Naturally, their systems relied more on paper and, therefore, the reading ability and literacy of their students. The fundamental process, however, is there. Perhaps the allure of technology will, this time, install the PSI in our national psyche.

The Keller Plan ,(Essays on a Personalized System of Instruction), Fred S. Keller & J. Gilmour Sherman, W.A. Benjamin Inc. Publishers

Example: Federal Express

Federal Express was the first service company to receive the Malcolm Baldridge National Quality Award in 1990. Their motto "100% Customer Satisfaction".

Fed Ex customer contact organization employees undergo extensive training(3-5 weeks) before they are allowed to have contact with customers, as well as continuing update training. There are approximately 1500 changes per year

which affect training programs. This continuing training is done using 1,225 interactive video systems at 650 locations. The curriculum consists of a set of 25 video disks,which are updated every six weeks to reflect changes in the job curriculum. This is all done without instructors. The training is overseen, not by an instructor but by a key operator at each location who has been given the added responsibility of providing information at that location.

Training and job knowledge testing are linked to pay through employee performance evaluations which are conducted every 6 months. Job knowledge has increased with these programs. For example there has been an improvement in international paper work in terms of service and accuracy. To Fed EX this is a sign the program is reaching its goal; knowledgeable employees offering high quality customer service.

Diane Filipowski writing in the Feb. 1992 issue of Personnel Journal.

Example: Westinghouse Hanford Tank Farms Operator

The training program is divided into 4 broad areas:

* Fundamentals subjects (4-5 weeks in length)

* Mandatory Training (approx 10 courses, 4 hrs-1 week each)

* Plant Specific Training (8 Certification areas)

* Drill Training (Abnormal & Emergency response)

Each certification area consists of classroom and OJT segments. Most classroom segments are less than a week in length, but some last up to 8 weeks. OJT segments may typically be stretched out over a one year period.

Mathematics, using the DOE Fundamentals Mathematics Handbook, is one of the subjects covered in Fundamentals. Table 1 compares the topics in that book to the topics contained in a commercial interactive videodisc course. Such a comparison, together with developing or obtaining additional materials, is the first step in transforming a current training program to a personalized system of instruction. A search is presently underway to identify manadatory training courseware presently in the DOE contractor system (e.g., Respiratory Training available from Fernald) or commercially available. Also, a proposal to provide a prototype for a selected Plant System. The prototype will be used to verify or counter our projection that computer-based training and classroom instruction development times are now commensurable. Finally, while computer courseware may assist in Drill Training, we expect that to require team learning experiences.

Next Steps

For Tank Farms, this project is still in an idea fermentation stage. In addition to prototyping a PSI, a general implementation plan and schedule is being developed. A frame work for a cost-benefit analysis is being constructed together with initial estimates of funding and savings. Once fleshed out, and funding and resources allocated, the project will begin in earnest.

Conclusion

All the elements seem to be in place. The preparation the workforce of the next century will have been accomplished through multimedia technology. That workforce will communicate through multimedia technology. An efficient system of instruction has been developed and refined. Adapting this system to multimedia promises to be the future of training. Training will no longer require instructors, at least not classroom instructors; instead, the Instructor Free Training Department will employ expert instructional designers, computer-based training developers, and learning counselors. We live in a exciting time. The face of training is changing and we are the sculptors.

Table 1.

DOE FUNDAMENTALS MATHEMATICS VS. COMMERCIAL INTERACTIVE VIDEO COURSE		
SUBJECT	**DOE**	**COMML.**
Review of Introductory Math		
Calculator operations	X	
Four basic math operations	X	X
Averages	X	
Fractions	X	X
Decimals	X	X
Signed numbers	X	X
Significant digits	X	
Percentages	X	X (-)
Exponents	X	X (-)
Scientific notation	X	X (-)
Radicals	X	X (-)
MATHEMATICS (ALGEBRA)		
Algebraic laws	X	
Linear equations	X	X
Quadratic equations	X	X
Simultaneous equations	X	
Word problems	X	
Logarithms	X	
Graphing	X	X
Slopes	X	
Interpolation & extrapolation	X	
MATHEMATICS (GEOMETRY)		
Basic concepts of geometry	X	
Shapes & figures of plane geometry	X	
Solid geometric figures	X	
MATHEMATICS (TRIGONOMETRY)		
Pythagorean Thearen	X	
Trigonometric functions	X	
Radians	X	
MATHEMATICS (HIGHER CONCEPTS)		
Statistics	X	
Imaginary & complex numbers	X	
Matrices & determinants	X	

(-) = not 100% match