

**EDUCATIONAL TECHNOLOGY:
YESTERDAY, TODAY, AND TOMORROW**

Remarks for the Army Extension Training Conference

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by

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In 1973 Isaac Asimov, the famous futurist and science fiction writer, attended a conference on educational technology in upstate New York. At that time TV cassettes were considered the wave of the future, and a number of papers were presented by educators enthralled with the possibilities of storing an extensive trove of information for learning, readily to be retrieved by a student. The TV cassette, it was held, constituted the beginning of a new era in entertainment and could, if educational technologists would but recognize their opportunity, open whole new vistas in teaching. Through some mishap which befell one of the scheduled speakers, Azimov was unexpectedly asked to address the group. In an impromptu talk, he invoked his experience in imagining the future, and invited his audience to accompany him on an intellectual foray into what was to come, so as to follow the TV cassette toward its ultimate destiny.

He began by describing the size, bulk, and expense of the apparatus which had been devised to decode the analog signals recorded magnetically on the cassette tape, to control the flickering beam which stimulated the face of the bulky picture tube, and to evoke synchronous sound from the audio amplifier and speaker system. Obviously, he predicted, the relentless drive of technology, aided and abetted by international economic competition, would assure that this auxiliary equipment became progressively smaller, lighter, more mobile, and more responsive to its users habits and needs. Eventually, he opined, the auxiliary equipment would be eliminated altogether, and combined with the recording medium, the cassette itself.

Azimov then turned to the energy requirements for a 1973 TV cassette system, pointing out that a considerable amount of power was required to convert the tape-recorded signal on the tape into image and sound. Since that 1973 audience was keenly tuned to the implications of America's dangerous dependence upon foreign-supplied fossil fuels, he predicted that our engineers would also systematically reduce the energy requirements for the evolving instructional system to the point that its energy requirements would be virtually negligible.

Hence, he prophesied, we can look forward to a small, light, self-sufficient, eminently portable information source. While it would consume energy and materials in its manufacture, its cunning design would all by eliminate a need for a power supply in use. Moreover, he thought that it would be possible to design the cassette so that system/learner transactions could be completely private, with no possibility of infringing upon the activities of others. It could function anywhere, without the need for wall plugs or batteries. Therefore, it would take learning to wherever the student desired --into the field, into bed, into other environments which in now way resembled a classroom. Individualized instruction on job sites would become a distinct possibility.

But Azimov said, these were by no means the limits on the marvels yet to come. He believed that it would be possible to design the cassette so that it would be activated by brain waves, eliminating the need for switches, knobs, and other mechanical controls. In effect, the cassette would be started at a glance, and stopped whenever the eye or attention was averted. Further, he opined, there was no reason why such a cassette could not be programmed, to provide for random access to any of its frames, conceivably on some sort of index system keyed to the learning

experience, so that very elegant mapping by educational technologists would be feasible, and the learning paced to the absorptive capacity of the student.

How many years would it take to develop such a learning system? How long would technology take, assuming continued strong stimulus from commercial competition in the international market place, to evolve this self-contained, energy independent, mobile, perfectly private, mentally controlled cassette? Azimov's answer was: sooner than we think. He thought that it was possible to give the answer with some precision. His estimate was minus 500 years.

Azimov was describing, of course, a printed book, and timing its development from Johann Gutenberg of Mainz, who in the middle of the 15th century invented movable type. Azimov went on to extol the advantages of the printed page as a medium for teaching, superior, he felt, for most educational purposes to other forms of recording. With a book, the reader's imagination was relatively freer to embellish the printed word with his memory, emotion, or native inventiveness. Azimov did not argue that books could or should replace television and related forms of audio-visual communication. He described reading as an activity then confined to a shrinking minority, a form of communication that, as a matter of fact, had been confined to elites in all societies for all but a fraction of recorded history. He went on to predict that the same elites --which he thought were less than one percent of the world's population-- would remain wedded to the printed word --as he put it, "the ancient and the ultimate."

But, of course, the Army's problem lies surely with the 99% --with the non-elite, to use Azimov's construct. And it is abundantly clear in 1986 that neither traditional school-houses, nor other paper-based instructional systems, will enable the Army to transcend the difficulties it faces with advanced technology and relatively illiterate users and maintainers, with constrained budgets and ever more competition among readiness, sustainability, modernization, and force structure. From the perspective of educational technology, the Army's challenges in these respects are more numerous and demanding than those of the Navy, the Air Force, or the Marine Corps. It is therefore understandable that the Army has led the way with the Electronic Information Delivery System, EIDS, which I understand is now, per the Defense Visual Information Standardization Committee, the DoD videodisc standard.

For me, EIDS is the culmination of a search which began at Fort Monroe in 1974, for it was then, as I recall, that I first showed a videodisc at the TRADOC Commanders' Conference, and talked about the prospective convergence of lowered costs for storing information and for processing it interactively with students. But, just as it took TRADOC twelve years to develop and field the Multiple Integrated Laser Engagement System, MILES, it took us the same period of time to bring EIDS to fielding. Yet MILES is by no means all that has to be done with collective training, and even the most enthusiastic supporter of EIDS will readily understand that it can offer no more than partial answers to all the tough questions facing those who design and direct the Army's individual training.

Let me see if I can enumerate the more important of the pending questions on individual and collective training, for I believe it imperative that any group concerned with the future of educational technology, as is this one, needs to understand them. They have not changed much over the past thirteen years. The incumbent Commander of the Training and Doctrine Command; or his Deputy Chief of Staff for Training; or the Director of Training in ODCSOPS, DA; or any of the other officials whose primary responsibilities include charting the course for Army training, confront problems qualitatively very much like those which TRADOC and the Army faced in 1973. There are at least three fundamental questions:

1. How shall the Army balance readiness in its units with individual training and education in TRADOC institutions?
2. How can the Army optimize its investments in training for readiness so as to afford continuing modernization of its materiel and its force structure?
3. How can the Army define tasks and conditions, and establish standards of performance both horizontally and vertically throughout its ranks?

In the larger sense, these are all strategic problems of educational technology. The choices which today's leaders make concerning how to answer such questions will govern the future of Army training no less than did ours of yesteryear.

Concerning the perennial tension between institutional and unit training, our Army, one of the more robustly conservative institutions within American society, cherishes its heritage of mobilization in time of crisis. But that past is no sure guide for the future. Events in the modern world will probably not as readily delineate peace from war as they have in the past, or allow the nation time to redirect its social energy from peaceful to martial purposes. For the foreseeable future, the Congress and the American electorate are going to have continue large expenditures for defense to maintain in being, and periodically to update, a large standing force capable of deterring war by being demonstrably ready to fight one. But the Army's extensive system of TRADOC schools has been built around our mobilization heritage, designed largely to advance the training or education of individuals, and thereby to increase their potential for larger responsibilities. But an officer or non-com in school is not available in a unit, aiding its readiness. I believe it is true that many of the changes in TRADOC schools over the past two decades have involved hard choices between manning today's force or providing better leaders for tomorrow. But I argue now, as I have over the years, that educational technologists could free the Chief of Staff of having to regard such choices as either-or, and enable him to select instead from alternatives making it possible to train or educate, evaluate and credit as well in units as is now possible in schools. Hence, I see a requirement for overarching training management which can assess need and accomplishment, and deliver training or education to most of the Army's individual leaders, who most of the time serve in operations vice school assignments. I am, of course, over-the-hill and out-of-the-net, but I do

not detect much interest in, or work upon an architecture for Army training which would embrace such a grand design. But in the long run, nothing less will work.

Concerning the tension between readiness and modernization, I have already mentioned one cost: diversion of critical individual manpower from units into the training base. Other important costs must be imputed to unit training, including training ammunition, field exercises, and the related consumption of spare parts and automotive fuels. All these costs have been rising over recent years, and for an Army with a fixed Active Army end-strength, which must plan for a fixed budget (or even a reduced budget) in the years ahead, it is clear that either the Army must find more cost-effective ways to train, or forego some of its planned materiel modernization, or part of its structural upgrades, or both. At the same time, in USAREUR, traditional training methods relying on maneuvers in the countryside and live fire at major training areas are under severe attack from politically potent environmentalists. Again, I suspect that educational technologists could supply remedies, but I am not sure that they have been brought to bear by the Army leadership.

For instance, I have long doubted that firing live ammunition at mono-plane pop-up or track-runner targets continues to make much sense in an era in which most direct fire weapons are equipped with infrared sighting devices, and many have laser range-finders and on-board fire control computers as well. I know that robotic, freely maneuverable, three-dimensional targets are available --e.g., KAMAN's Concept 880-- and that such targets can be engaged realistically via laser with no loss of realism, unless one insists on the environmentally objectionable concussion. You yourselves have seen here a demonstration of vicarious travel via interactive video disc, by means of which large numbers of viewers could get a reasonable impression of what it is like to be on the ground in a given locale without having to go there. And with SIMNET, it is possible to have force-on-force engagements without even having to position elements of a task force on the same continent. However, I detect disconnects between such obviously related projects as EIDS, the Individual Training Management System being fielded at Fort Lewis, the upcoming effort to automate the ARTEP, DARPA's SIMNET project now underway at Fort Knox, the upgrades contemplated at the National Training Center, DARPA's Airland Battle Management project, and ARI's several research undertakings directed at training and evaluating senior leaders or their staffs.

Were I one of the Army's leaders, I would be looking with urgency for a way to pull all that disparate, largely research-oriented effort together, and to focus it on the larger question. I could conceive of an integrated program of individual and collective training in units which rested on EIDS, ITMS, SIMNET and NTC-like field exercises for battalions, coupled at higher echelons with battle simulations and corps-level instrumented TEWTs (Tactical Exercises Without Troops) which permit evaluated, opposed maneuvers over actual terrain in real time. Whether my vision is true or not, somehow the Army --and the Air Force, I might add-- must find a better way to train for Airland Battle without sacrificing needed improvements in its equipment and structure.

Concerning standards of performance, I am aware that the Vice Chief

of Staff of the Army has asked perceptive questions as to whether the Army has adequately defined training missions horizontally across the combat, combat support and combat service support units of the force, and vertically from the theater echelon downward to the lowest functioning units and detachments. But as far as I know, his questions have never been answered. From my own experience I know that historically we have focused our attention, appropriately enough, upon the combat arms and those arms and services directly involved in aiding the former to control land and people. Moreover, the Army has a propensity to drill repeatedly in the performances of units a battalion or lower level, and labors under strong budgetary disincentives for exercises involving brigades, divisions, or larger formations. These budget limitations are not all bad, for I share the heresy of General Ace Collins, who wrote in his book Common Sense Training as follows:

The benefits from a field-training exercise extend to units two levels below the highest headquarters participating. In a company-level exercise, the platoons, squads, tank crews, and gun sections derive the most benefit; a battalion exercise benefits the company and platoon level; a brigade exercise benefits the battalion and company; and so on. If this is a sound rule of thumb, and if the training of individuals and small units is the real key of successful training, then field exercises above battalion do not add much to the quality of training. The larger-unit exercises consume time and resources that could better be used to improve individual and small-unit training, the foundations of unit readiness. Battalion-level exercises should not be held too often; once a year is enough...Some will disagree thoroughly with this outlook on large-unit training, but there are good historical precedents to argue persuasively that full-scale division and brigade-level FTXs are not essential to achieving a fully trained status. For World War II, the Japanese trained a formidable fighting force with no exercises above battalion level. The training of the Wehrmacht emphasized small-unit training and was done for the most part near home kasernes...

While I am quite sure that we should not accept the Japanese or Germans as models --after all, they lost the war-- I do agree that if resources and time are scarce, according priority to performances at lower echelons makes eminent common sense. But the Army has a doctrinal imperative for the proficient exercise of command at higher echelon, derivative of the speed and reach of modern weaponry, and of the ever-increasing interdependence of the Army and the Air Force. It is probably true that a maladroit corps staff can obviate very high proficiency among the corp's battalions. It is surely the case that Airland Battle will be only rhetoric unless there be genuine integration of air and ground operations at the corps level. Training for such integration now relays on simulations driven by computers, using models which are simply not credible to many generals as a measure of how the joint forces might perform under the time-distances stresses of actual operations. I am convinced that the Army must now find a new format for training for Airland Battle, one which would permit, as I have indicated, an opposed TEWT for a corps and its air support against a Soviet-type field army and its air. If the Army can do so, it will be able to validate, or to make more credible, its computer models. More importantly, it will be able to train and evaluate its Corps

commanders and their staffs to realistically high standards, better assuring the President and the Congress that our forces are indeed ready to discharge their wartime responsibilities.

Now I am sure that there are many among you who must at this juncture be somewhat puzzled over what all that I have been talking about has to do with Army Extension Training. Well, I urge you to reflect on what I have said, for I believe that the root problems for extension training are no different from those for the rest of the Total Force. I believe that the educational technology which will provide sound answers to the three questions I raised will work as well in III Corps in CONUS as in V Corps in USAREUR, in Fifth Army or Sixth Army with the Reserve Components as well as in Seventh Army with the Active Component. Moreover, we are in an era when Extension Training may very well come into its own as the primary mechanism for assuring individual readiness throughout the Active and Reserve Components. Certainly today, in the mid '80s, you can do much more for the Total Force via Extension Training than was possible just ten years ago. And I trust this conference has suggested that much more will be possible in the future for AET than we imagine today.

But to find, the Army must search. And there is no outfit in the Army better positioned to lead that search for answers to the questions I have posed than the Army Training Support Center.

Thank you for inviting me again to join you in your work.