Edgar Dale

Technology Is More Than Tools

HOW systematic should a curriculum be? How can we avoid ritualistic, barren formalism on the one hand, and careless, ineffective, unplanned opportunism on the other? The question has long concerned teachers and supervisors. Indeed, major educational reforms have often aimed to correct the extremes of excessive systematization or a vague and diffuse opportunism.

This issue arises when we discuss educational technology, the use of programed instruction, language laboratories, or new, highly systematic approaches to the teaching of mathematics, biology, physics, and chemistry. Do some of these courses eliminate local curriculum planning, transform the teacher into a mechanical maid to a teaching aid? Will increased systematization discourage innovation, make teachers less creative?

We shall waste time in aimless experimenting and acrimonious debate unless we answer some of these questions by more precise planning of the behaviorial outcomes of education. What do we expect our graduates to do, to be?

In any systematic program of educational development we must know two things—first, the broad and the specific goals of instruction insofar as they can be predicted, and second, the experiences which learners need to undergo to master the stated objectives. Included here, of course, will be the varied instructional materials, e.g., radio, recordings, programed materials, filmstrips, photographs, charts, graphs, maps, and study trips. We need, therefore, a taxonomic approach such as those by Benjamin Bloom, *Taxonomy of Educational Objectives;* Nolan C. Kearney, *Elementary School Objectives;* and Will French, *Behavorial Goals of General Education in High School.*

A shortcoming of current instruction is that it has confined itself chiefly to informational goals involving imitative reaction, rote learning. We have given limited attention to creative interaction —analysis, synthesis and application of principles. Sometimes stated goals are so general that no content can be derived from them. Or they may indeed be so specific that the principles they illustrate are not made clear.

This excessively general approach is illustrated by the colleges which say that their chief aim is to develop the think-

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ing man. Yet a study of their curricula shows that they do not have a carefully planned, continuing program to reach this objective. This is disclosed by the heavy emphasis on rote learning in *all* examinations in college or professional school. Dressel and Mayhew in *General Education: Explorations in Evaluation* (American Council on Education, 1954), say that humanities courses, for example, "were restricted to knowledge of fact with some incidental attention paid to intellectual manipulation of that content. . . ."

Predicting Future Needs

To develop a systematic approach to teaching and learning we must be able to predict the future needs of students. How well can this be done? Certain phases of reading have a highly predictable content. We can predict with 100 per cent accuracy that the letters of the alphabet will all be used every day. We can be certain that some 3,000 predictable words will always make up 95 percent of easy reading and 70 percent of hard reading. We can predict that all pupils will need certain reading-study skills. Similar predictions can be made in arithmetic and other subject-matter fields.

We can also predict that all students will need certain abilities and attitudes in problem solving, critical reading, critical thinking. We can plan for these competencies although they are not routine skills.

However, since we cannot predict all the key problems an individual will face we must systematically help him become a problem-framer and problem-solver. We can systematically plan for this and use technology to present open-ended problems, to develop skills in the framing of hypothesis making and the like. To systematize, therefore, is not necessarily to mechanize. We can carefully plan for creativity, for thinking responses. We can then turn to technology for certain kinds of help.

Just what is a technology anyway? A primitive man who had no tools at all would be living in a non-technological world. But let us suppose that he extends his arm by means of a hammer. He is now developing a technology —a system. Later he may learn to move objects by means other than brute strength. He may learn to store food by preservation and later by domesticating animals. He masters ways of using a microscope, an extension of the eye. He develops a megaphone or a public address system or recordings, extensions of the mouth. He produces systems of transportation, an extension of his legs. He has produced systems for finding out about the world in ways impossible with the natural senses. And technology plays an important part in these systems.

Just as the biological researcher uses an electronic microscope, so, too, there are technological tools for teaching and learning. Obviously we need devices to store and retrieve information to aid the professor and the student. And so we study our libraries and try to invent better ways for storing, retrieving, correlating information. We develop increasingly complex abstracting systems in the sciences and we use modern electronic processing methods in so doing. We Xerox materials so that the student does not take an hour to copy something that he can get in a minute. We store and retrieve information by video tape, by film, by tape or disc recordings.

Inexpensive paperbacks enable us to revolutionize many present ways of teaching. The student can own his book,

write in it, keep it because it has no value at second-hand book stores. But without technology, without mass production, that paperback book would not be possible.

Technology Is Process

But technology is more than tools. It is basically a process by which tools are integrated into a system. Indeed, such a system is needed to produce the tools.

Will this technology "mechanize" education, dehumanize relations between teacher and pupil?

Let us look at some examples of systematized approaches using the best of modern technology and see what we approve or disapprove. Some believe that carefully planned systems will result in a stereotyped, sterile and unchanging teaching and learning process. Not so. We cannot operate without some system, but we must constantly experiment with already developed systems to improve them, to reorganize them.

One example of a systematically programed study was carried on by Paul R. Wendt and Grosvenor Rust of Southern Illinois University and reported in the *Journal of Educational Research* (Vol. 55, No. 9, June-July 1962). The study dealt with teaching library techniques to college freshmen. First of all, they programed by a branching technique and used 2x2 slides in a random access projector. They tried to maximize transfer to the actual situation in the library by means not only of pictorial frames but through performance frames where the students were required to do something.

But these experimenters did not stop after they had developed a systematic method for learning library skills. Next they studied the possibility of using a lecturer to present the materials ordinarily presented in the programed, branching slide material and tested it against a lecture group which had access to all of the slides but presented them in a linear fashion. They also had a bright group who had no program at all.

They found that the lecturer with the carefully prepared slides which had been developed for the program achieved as good results as the programed section. Further, students who were in the top group, the A students, did as well without instruction as the others did with instruction. Obviously they may have had instruction before.

So how does a teacher respond to a proposed system? He does not blindly accept it. He tests it, he retests it, he checks it. And he sees that some students go into the system and others remain outside of it and participate in a subsystem. By the way, it was found that this systematic approach to library guidance enabled the freshmen in six weeks to reach a standard that comparable samples of freshmen, sophomores, juniors and seniors did not ordinarily reach until the end of the sophomore year. Further, there was much greater spread among the ones who picked up the techniques as contrasted with those taking the systematic freshman program.

We can, therefore, make provision within a system for branching, for individualized approaches. For example, sixth and eighth grade pupils in Columbus, Ohio, are participating in a system of programed vocabulary development which a colleague and I developed. Do all children need this year-long program? Yes and no. As improved systems of vocabulary development are provided in

the earlier grades some children reaching the 8th grade may not need this specialized guidance and could omit it from their program.

To those who are rightly concerned about over-systematization may I say that much high school and collegiate education is already over-systematized in the sense that it does not provide varied approaches to fit individual need. The 30 percent of high school dropouts is one proof of this weakness.

The Library as a Teaching-Learning System

What we need in all fields is a curriculum plan whereby certain broad systematic approaches are made, where there is a freedom to move back and forth from individual to group approaches and where specialized, highly systematic materials aid those pupils who either lag behind or want to get ahead. To reach this goal requires a systematic use of all tools of instruction—in short, an educational technology.

So within a broadly planned system, whether it is a curriculum for spelling in the 6th grade or the mathematics curriculum for 12th grade, there can be highly systematized material. Some material can be loosely programed, some very closely and meticulously programed. If children in a particular grade are misspelling the possessive *its* by putting in an apostrophe or if they are misspelling *to, too* and *two,* we can develop a systematic program to eliminate these errors. The issue is not total-system versus no-system, but rather the degree of required systematization.

Another example of the development of a systematic approach to learning is found in better integration of the library into the total learning process. Indeed, if we are aiming to develop the person who has learned how to learn and has developed a taste for learning, we require a quite different kind of library.

The prototype of this library or library function has been developing in the audio-visual field. A long time ago public schools, notably in Los Angeles, Oakland and St. Louis, were seeing the key role that differentiated learning materials could play in effective education. Courses of study listed varied materials to be used in developing major concepts. Book libraries in turn began moving in this direction through major projects of the American Library Association. Film and filmstrip collections were added to their regular collections of material.

Far-seeing librarians realized that ideas were communicated also by means other than books. So modern libraries include recordings, filmstrips, varied pictorial materials, and films in their collections. It is significant that a number of years ago the *Saturday Review of Literature* changed its name to the *Saturday Review* and began including articles and comments on films, television and recordings.

A Learning Center Concept

A later stage in the growth of the integrated, systematic approach to learning which includes the library is exemplified by a program in Shaker Heights, Ohio. Two elementary schools are experimenting with the teaching of study skills making use of school libraries that have shifted to the learning center concept. A technician has been employed to produce materials for overhead projectors, and basic presentations of varied types of study skills are made to groups of 75 to 100 children.

All major types of learning materials are indexed in the library so that if a child needs material on Africa he finds all the varying types in the learning center. He can view films and filmstrips. Facilities are available also for individual and group listening to recordings. All materials are related to a central purpose, the mastery of important study skills.

What will technology do to the role of the teacher? Why is he sometimes reluctant or afraid to use these new media? I do not think it is because he fears the equipment itself. Indeed, new equipment is increasingly easier to operate and the average teacher is managing more complex technology at home than he operates at school. Thus, the teacher fears a diminished role.

Certainly some technology will replace the teacher, as did the textbook—a technological product. But since most textbooks were not self-teaching, the teacher became a translator of complex prose. However, as explanations of subject matter in books or programed materials are sharply improved, become more self-teaching, where does this leave the teacher? Certainly he should not teach what can be taught as well or better by films, recordings, television, programed materials, etc.

The task of the teacher is to do the complicated, artful things that preplanned materials cannot do. The professional teacher will help students plan their work and their lives more effectively, see that they engage in thoughtful, creative interaction as contrasted with the rote learning of imitative reaction. The teacher will become a diagnostician and prescriber for the remedying of weaknesses, and the fortifying of strengths. He will help students correlate, refine, integrate, and interrelate experiences relevant to important learning goals.

The Independent Learner

The teacher will give up some of his or her correcting activities. Indeed the occupational disease of many teachers is a penchant for correcting. The teacher of English, for example, is too often a custodian of a correctional institute. We found in some of our work with programed materials in vocabulary that the teacher felt at a loss when he was not correcting the self-correcting items.

The teacher's significant role is to develop the independent learner. For example, we teach children to read because we want them to be on their own in reading, figure out words for themselves, consult dictionaries and encyclopedias. The teacher must prize the independence of the child and realize that his success lies in changing the child's dependent role to an independent role. We can use our personal relationships to help youngsters become more mature, not to make them more dependent.

The teacher will then take a more integrative role, help youngsters systematize their knowledge. Too often the subjects taught are all down a single subject track, without interconnection, interaction, interweaving. The teacher sees that these interrelationships occur and this is a difficult and complicated task.

In summary, we have no choice as to whether we use advanced technology. The choice is whether we use it intelligently to achieve the objectives we want or use it unintelligently. I see no particular merit in the approach which Frederick Raubinger made about two years ago when he said: "Well, I simply cannot tell the public of New Jersey that the keys to Utopia are at hand; that the

team teaching plan, the dual progress plan, the lay reader plan, are the simple answers to better schools."

Who said it was a simple answer? Who said it was Utopia? I too have lived through a dozen plans—the Morrison Plan, the Gary Plan, the Winnetka Plan, the Dalton Plan, the platoon plan, etc. My answer is, "So what?" I lived through the Morrison Plan and learned a lot from it. I was a part of the Winnetka Plan and learned a lot from it. I lived with and through progressive education and learned a lot from it.

To suggest that these plans do not prove to be utopian evades the basic issue. There will be more and more plans. All of these earlier plans left a residue. Naturally those who were in favor of them were enthusiastic and sometimes overstated their case. "What else?" But was there not a case? Did not these programs and plans have powerful effects on the schools?

I suggest that we not look with jaundiced eye on new plans or innovations, but rather examine them hopefully, knowing full well that they will have inadequacies. But these inadequacies can be detected and changed. Let us not reject them till they are tried. The obligation of the professional person is not to adopt a new method. It is to explore the proposal, to investigate it, to experiment with it, to apply educational theory and sound logic to it. Does it help the student toward increased maturity in thinking through his own problems? Does it set up the conditions under which he can become more sensitive, a more compassionate person? Does it enable the teacher to work at a higher level of instruction than at present?

What mechanizes a mechanized education? Not the machine I assure you. If this were the criterion, every writer would have to use a pointed stick. He could not use such machines as the fountain pen, the typewriter, the dictaphone, or a tape recorder. The real issue is: Does technology enable us to do what is really important?

It is true that communication machines or devices may help people become more alike. But we must be alike before we can be different, otherwise there will be no communication. We are trying to make our students more alike in the sense that we want them to share common concepts in citizenship, mathematics, physics, whatever the field may be. We are being educated when we are being made enough alike so that we can communicate so that we can be different. And we can be creatively alike as well as creatively different. But technology also helps people be different.

All of us in some degree have a nostalgic feeling for a return to a state of nature, a lost state of innocence. But this fancy cannot be indulged very fully in the kind of world we live in. A few may rebel against the use of television or motion pictures or the jet airplane or the automobile or the freeway, but our rebellion is a limited one.

Our responsibility is a simple one. It is to state our objectives clearly and then to use all the means there are to achieve these objectives. The child born today will live half of his life in the 21st century. An 18th or 19th century approach to problems simply will not do. Furthermore, since the one basic thing we can predict about the future is that it is unpredictable, young people must learn how to become independent learners. To do this requires all the brains that we have and all the brains that we can borrow. To do less is to cheat children of their birthright of present and future growth.