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Instructional technology and decision making

by Robert Heinich

It is a cliche in education that it is easier to invent technology than it is to get it into general use. Certainly the major problem of technology is in marketing, but perhaps the opening statement should be modified by saying that **some** technology is easier to invent than to get into general use. The extent to which any technology is welcomed into an economy or an economic subculture depends on whom it affects, how it affects them and whether potential beneficiaries are in a decision-making position. Because the larger system within which we function encourages the development and use of technology, we assume that all its sub-systems do.

The peculiar nature of the educational sub-system is that decisions to use or not to use technology are most frequently made by those who are potentially threatened by the technology and not by those who potentially benefit from the introduction of technology. Because of potential threats to job security, teachers tend to reduce all technology to the status of aids—to the status of tools used at their discretion. If a new or improved technology fits comfortably within the role of tool, then its adoption is much more readily assured. If a new technology does not fit comfortably in the current scheme of things as an aid—a tool (e.g. television)—but rather seems to be powerful enough to pose a threat, the new technology is resisted until it can be reshaped into a tool.

In education we tend to think that the natural client for all instructional technology is the teacher or professor. We tend to see no difference between, for example, the overhead projector and a television system. In reality, introduction of the overhead projector does not change or threaten the power relationships in the classroom. A television system on the other hand has the potential to change power relationships among faculty, students, ad-

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ministrators and public (as represented by legislatures, school boards, etc). Because of this difference, decisions to use overhead projectors are best made at the classroom level; but decisions to install and, more importantly, **use** television systems cannot be left solely with the faculty.

Decisions to **install** television systems **are** generally made at administrative levels, but decisions to use ultimately face faculty veto. We do not fully appreciate the importance of examining innovations in terms of their potential impact on power relationships.

Let me illustrate with an example from industry that is based in the history of technology. Suppose a sales representative from a machine tool maker demonstrates to the manager of a plant that manufactures machine screws a new tool to cut threads. The new tool permits a faster cut, doesn't wear out as quickly and is easier to mount in the lathe. The foreman wastes no time in showing the new tool to the lathe operators who are delighted to try it out. Here is obviously an innovation that has high probability of being accepted by the work force—and the manager is wise to consult them.

Next year the sales representative demonstrates to the manager of the plant a new lathe that **automatically** fashions machine screws. Fewer operators are needed to produce the same volume of screws. The plant manager immediately recognizes an innovation that will have an impact drastically different from the tool he adopted a year ago. Here now is a device that will appeal to the owner of the plant because it will make his company more cost effective. The consumer benefits also because the unit price of machine screws will drop. In the long run, the workers also benefit from the expanded job markets that result. But in the short run the manager knows the lathe operators will not look kindly on a machine that will do their job.

I am **not** suggesting by this analogy that children can be treated like machine screws. The point is that it is important to look at technology from the point of view of how it affects the system and the relationships between and among those working within the system.

Many media delivery systems are inherently capable of assuming the major burden of instruction: television, programmed instruction, computer administered instruction, audio-tutorial techniques, etc. The main question is whether our current instructional management systems encourage their use as mainline sources of instruction or reduce them to supplementary aids. Given the present fiscal problems facing the schools, this is a critical distinction. Any technology reduced to supplementary status becomes an add-on cost that is regarded as a dispensable luxury. A very revealing study would be to give teachers a comprehensive array of technology in a hypothetical situation and observe how they would peel away technologies as budgets are progressively cut. It will never occur to teachers to increase productivity through the technology available to them (that is, reduce the labor intensiveness of instruction, which in the long run is the best approach to making real salary gains). And the most durable technology, the last to go, will be the textbook.

The textbook is worth examining because it has been around so long, has become so much a part of the system, that we tend not to think of it as a product of technology. The textbook endures for two main reasons: cost efficiency and the symbiotic relationship that has developed over a long period of time between teacher and textbook.

Publishers, who make their money through large scale adoptions and who, therefore, must be considered the most successful diffusion specialists, are sensitive to both. When money was in good supply, production values such as pictures, graphs and color were generously incorporated. As money started to dry up, textbooks became leaner, monochromatic and less lavishly illustrated.

Publishers also found out that the symbiotic relationship is disturbed if the book takes over too much of the instructional burden. A text is essentially a course of study between hard covers. It requires the teacher to translate it into effective instruction. If the text translates itself into instruction, as in a programmed text, the symbiotic relationship is disturbed, and the text is rejected. During my brief tenure in the publishing business, I learned that the hard way. The more "pedagogical aids" (in publisher's parlance) provided with the text the better, but there is a very important difference between "pedagogical aids" and self-instruction: the former underscores the need for the teacher. The point is that the adopters are telling publishers that they want something that is supportive, not threatening.

Other delivery systems can be looked at the same way. It is easier to sell and adopt individual film titles than it is a course taught by film—and not just because of cost or research evidence of the lack of effectiveness of the filmed course. (Of course, we should know by now that decisions to adopt technology, or any innovation, are not made on the basis of research evidence.) When the Agency for Instructional Television produces a series of programs for schools, it knows it will sell more programs if each program stands alone rather than articulates closely with the one before and the one after. And so on.

We must become more sophisticated in how we assess the relationship of technological innovations to levels of decision making and then we must pursue adoption at the appropriate level. The adoption process for a programmed text should not follow the process of adopting a textbook. Adoption of a televised course must be handled differently than reception of individual television programs. A complete course on film requires different adoption procedures than purchase of individual titles. Our experience in television and filmed courses teaches us that it is easier to adopt complete courses in subject areas **not** currently taught at all. For example, a course in physics delivered by film can more easily be introduced into a high school that does not have a course in physics.

We are currently going through a shortage of qualified teachers in science and mathematics. Will this mean that our high schools will be more receptive to courses delivered by technological means? Are the administrators in our schools prepared to handle technologically delivered instruction, or will they repeat our experience of the late 1950s and 1960s when televised and filmed courses and programmed textbooks were undermined by the traditional adoption process? We will soon be offered complete courses delivered through computers. How will we handle the decision making process implied by instruction available to the fingertips of students sitting at computer terminals? In order to answer that question we must have a better understanding of how levels of decision making are affected by the nature of the technology involved.