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ABSTRACT

Management models for cost-effective technological instructional systems must overcome the barriers which the educational superstructure raises to oppose alternative modes of instruction. Under our labor-intensive system, instructional costs rise, but productivity doesn't; the system must either become less labor-intensive, through technology, or increase its revenues enormously. To achieve the former, the only alternative the taxpayer will accept, fiscal regulations must be changed to provide aid on the basis of student needs rather than on the number of teachers and curriculum and instructional decisions must be made, collaboratively, at the design stage, not at the classroom level. Management models must: 1) stop challenging the teacher's authority in the classroom; 2) use interface forms which students, not teachers, favor; 3) make student evaluation a team task; 4) require teacher accountability; 5) provide students with instructional options; 6) promote administrative change to deal with logistical problems; and 7) work with teacher associations to make them realize that differentiated staffing is an unavoidable fact of life, but that within this context teachers' real wages will rise as productivity increases. (PB)

MANAGEMENT MODELS AND INSTRUCTIONAL PRODUCTIVITY

by

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INTRODUCTION

Economists frequently make a distinction between the base of a social system and the superstructure which evolves in support of the base. The base may be, as it is in education, a fundamental premise that defines operational relationships and invests authority. The superstructure is the pattern of institutions, laws, organizations, traditions and habits that support, reinforce and maintain the base. If new developments imply a new base for the system, the superstructure of the existing base acts as the major deterrent to change. When this type of power struggle arises, typical diffusion and adoption practices are of limited use because they are designed to bring about change within a given and accepted set of fundamental relationships.

When formal education evolved in the United States, assurances of quality instruction had to be obtained by relying on the credentials of the person responsible for instruction. For example, the classic Carnegie Unit is defined in terms of hours spent in a classroom with a teacher who has taken a specified number of college credits (defined in a similar manner) in an accredited institution. In other words, the fundamental premise -- the base -- of education is that responsibility and authority for instruction are vested in the person in face-to-face contact with students in a classroom. A superstructure has developed over the years to maintain and support this fundamental premise.

Technologically-based instruction poses a threat to the base of our present system, and the more comprehensive the technology, the greater the threat. Television and programmed instruction are cases in point. In a report to the 1970 convention of the Association for Educational Communications and Technology (AECT), Eleanor Godfrey of the Bureau of Social Science Research cited evidence that teacher resistance to television as direct instruction is causing a decline in use even where that medium has been effective. Because programmed instruction not only purports to be a course of study (as a textbook is) but also claims to complete the instructional act, it disturbs the symbiotic relationship that has developed between teacher and textbook. The teacher may rely heavily on the scope and sequence of the text but feels secure in the knowledge that he still must "dig the instructional ditch." His place in this scheme of things is secure. Therefore, "modular" and remedial programmed instruction may be acceptable, but not completely programmed courses. This last point is an example of why cost-effectiveness studies accepting the present base are futile: technology is an additive cost.

Many more instances of resistance to technologically-based instruction could be cited, but the main point is that management models for cost-effective systems must be based on a different fundamental premise, and we must take into consideration how the present superstructure possibly prevents alternative modes of instruction from competing as options for the student. The wide ranges of instructional choices that technology can make available to curriculum administrators and students are prevented from effectively competing in the educational market place by a superstructure geared to an outmoded fundamental premise.

We do not appreciate the extent to which the superstructure of education inhibits educational technology. Management models that do not take this factor into consideration will likely fail.

The strategy of looking at technology and traditional educational practice as irreconcilable helps throw certain key problems into sharper focus.

THE BAUMOL CRUNCH

Professor Baumol of Princeton University has contended for some years that a number of operations in the public sector of the economy will be subject to pressures to increase productivity (Farmer, 1970). He has maintained that there is a limit to the tolerance of the increasingly more productive segments of society toward those that are less productive. While this has always been true, relatively recent dramatic increases in productivity have thrust the issue into prominence -- so much so that the pressures on the non-productive areas have been given the sobriquet, the Baumol Crunch.

The Baumol Crunch is manifested both through overt attitudinal expressions on the part of the productive sector and through inherent systemic relationships. An example of the former is the usual Chamber of Commerce member's belligerent query, "Why can't they run the schools like a business? We've developed more efficient ways of using resources; why can't the schools?"

However, the systemic relationships are the more critical. If the cost of doing business goes up, and the productivity of the institution stays the same, the Baumol Crunch will start to operate. The only alternatives for an institution like the schools are to charge more for services (in the form of increased taxes) or to seek other sources of funds.

Starting in 1958, the Federal government became a large enough source of funds to soften the Crunch. However, sharp curtailment of Federal monies in the last few years has revealed the extent to which local funds have been out of balance with real costs.

Even in his more pessimistic moments, Baumol did not entertain the unusual situation that now pertains to the schools -- costs going up and productivity going down. Every time a teacher negotiating group forces a change in pupil-teacher ratios, while at the same time negotiating higher salaries, the Crunch is accelerated. For example, a few years ago, the Los Angeles schools had bond issues defeated four straight years, causing a severe financial squeeze. The teachers struck, but finally realizing that the financial situation of the Los Angeles schools prohibited granting their demands, the teachers rejected the offered compromise raise with the request that the money be used to reduce the teacher-pupil ratio -- a stipulation that could only exacerbate the condition the following year! When the current sharp increase in prices influences the next wave of contract negotiations, a collision course between taxpayer revolt, teacher demands and instructional productivity may become unavoidable.

While Baumol's argument was directed at public agencies in general, the schools are a particularly good fit to his conditions. In the private sector, if a company becomes marginal because it cannot increase productivity in the face of rising costs, it closes its doors, or changes product lines (unless, of course, Federal intervention as in the case of Lockheed rescues it). A company that does increase productivity is rewarded. The public schools have no way of dropping the marginal producer except during the probationary period, and even then marginal productivity is probably not an important criterion. Similarly, no formal method exists to reward increased productivity. (For these reasons, diffusion and adoption models from sectors of the economy, such as agriculture, that can drop out the marginal producer and reward productivity, are inapplicable in education.) Increasing productivity, or cost-effectiveness, would seem to be the only way out. But to do so will require management models that permit increased productivity to occur.

MANAGEMENT MODELS

The main purpose of this paper is not to explore specific management models in reference to cost-effectiveness. My position is that unless the basic decision-making process is attended to, management models will tend to operate within what Thomas Kuhn (1962) refers to as "normal science." If the model accepts the paridigm or basic decision-making structure of the system, then it will simply reinforce the basic paradigm by making it seem more efficient. My premise is that the present basic decision-making structure is inherently limiting in reference to cost-effectiveness of the system and must be changed before applying a management model.

Years ago, the semanticists convinced us that the word is not the object, and the map is not the territory, but apparently failed to convince us that the model is not the process. Those of us who have become preoccupied with drawing flow charts of processes, or organizational structures, or of a mix of both, tend to become convinced that those little boxes are people, and when we move the little boxes, the people really move, and when we build in decision points, decisions are really made there. We become convinced, in other words, that our elaborate conjectures are reality.

This is what I am trying to avoid. Instead I will identify certain critical parts of the superstructure of education that must be dealt with before any management model can be devised. As mentioned earlier, the kinds of governing laws, regulations and policies that strengthen present educational practice do not facilitate institutionalization of technologically-based instructional systems. In order to establish an environment that encourages technological solutions to instructional problems, changes in, or at least suspension of certain aspects of the governing structure are essential. If those aspects of the superstructure can be dealt with, then management models should be more readily identifiable and their operating details a matter of try-out and revision.

FISCAL AND BUDGETARY MANAGEMENT

We do not appreciate the extent to which the regulations involving how school districts receive and allocate funds force them to make artificial distinctions between modes of instruction. An economist would say that the financial structure of the schools "biases the mode of production" of the enterprise; it tends to push the schools in the direction of pivoting instruction around the person physically present in the classroom, tending to make educational technology a peripheral and marginal part of the process. The following will serve to illustrate what I mean. This example was constructed to raise a number of problems, and is extreme only in that I collapsed a number of separate real incidents into one case.

Suppose, in a given state, A city district wants to revise its high school physics curriculum. The district discovers that Harvey White is reputed to be an outstanding teacher as well as scholar and hires him to teach physics for one year (as Pittsburgh did some years ago). Now, if White teaches the course in one of A district's high schools, his salary is charged to instruction and state aid is forthcoming (provided, of course, the State Department of Education is willing to issue him a temporary certificate). The district, deciding that it would be wasteful to use White in only one high school, asks him to teach the course by television. In this case, his salary is still charged to instructional salaries, but in some states, state aid for his efforts may be in doubt because of a narrow definition of "teacher." However, in all likelihood the district will manage to get around that one. But then the district decides that one year of White will not be sufficient and videotapes the televised series of programs. The cost of the tapes and other production costs are charged to supplies. When the videotapes are used the following year, state aid will not be forthcoming even though White is still teaching the course! In other words, state aid, when based on a certificated teacher-pupil ratio, is forthcoming if he is physically present in the classroom (or at least in the district) but not if he is instructing through a recorded form of technology.

Nor is the state in a position to issue a certificate to a bunch of videotapes. As mentioned in the introduction, assurances of quality are sought in the credentials of the instructor, not in the instruction itself. Harvey White was chosen deliberately because about 15 years ago his televised course was filmed and districts ran into the problems described.

The ironic aspect of this situation is that A will receive state aid for any certificated teachers used as proctors in the classrooms receiving the videotaped instruction, even though they are not involved instructionally. The state aid formula in Indiana not only cuts off state aid for teachers instructing through technology, but provides state aid for certificated teachers, in ratio with the required number of students, even though those teachers have no instructional responsibility.

The final irony is that if any one of the certificated teachers acting as proctors decides to turn off the television set and teach the class himself, the local teacher association will defend his action even though the program objective of the district is violated. Another way of putting this is that authority resides in the certificated teacher physically present in the classroom, not in the teacher assigned instructional responsibility.

This is what is meant by biasing the mode of production. Technologically-based instruction is obviously not facilitated; classroom teacher-based instruction (aided by technology on an additive basis) is.

Because technologically-based instruction comes in forms that are categorized as supplies and equipment, present economic pressures force them into the expendable category. The percentage of school district budgets devoted to salaries is increasing, leaving less available for supplies and equipment. What is needed is a management model that permits allocation of district funds to instruments of instruction based on measurable units of student achievement, regardless of the form in which they are incorporated. This brings us to state aid.

The extent to which schools depend on state aid varies greatly, but in all cases the percentage is large enough to affect decisions related to personnel. It is commonly believed that the major share of state aid is based solely on a per pupil basis. In actuality, it is frequently based on a ratio of certificated teachers to a specified number of students. The definition of "teacher" varies considerably also. All of these non-relevant stipulations should be eliminated in order to permit state aid to be allocated strictly on the basis of students. Any funded demonstration projects should either take place in a state where aid is allocated by student count only, or in a state willing to suspend restrictive regulations for experimental purposes.

The California code that applies state aid to two-year colleges is one of the best models now on the books. Over a period of years, the code was changed from one that granted state aid only for students directly under the supervision of a certificated teacher to one that grants aid for students under the indirect supervision of a certificated teacher. The code was changed to accommodate instructional management models such as audio-tutorial methods, televised instruction, etc.

Even though the Supreme Court did not concur with the Rodriguez decision, many state supreme courts' rulings, following Sorrano and Rodriguez, will result in higher levels of state support for schools, making the question of how state aid is distributed even more crucial. To my knowledge, restrictive state aid formulas have never been tried in court. A court case came very close in the Gary, Indiana, performance contract battle several years ago. A very real question arose as to whether state aid could be used to support performance contracts because of the restrictive nature of the formula. However, the issue was skirted by the State Department of Public Instruction in bringing pressure to bear on Gary in favor of issues such as adoption of state texts, adherence to state curricula, etc. (Wilson, 1973).

Somewhere along the line, a friend of the court case may have to be instituted in a state with a cost-effectiveness demonstration project in order to clear the way for continuance of the project when the Federal funds phase out. It is obvious that the management model of any cost-effectiveness project cannot be allowed to be vitiated by state regulations that go back into effect when the experimental funding is over. The compatability of state laws and regulations should be looked at very carefully before any demonstration projects are placed in any state.

Very possibly, restraint of trade arguments might be advanced in contesting state aid restrictions. For example, if a private company is denied a performance contract on the grounds that the district would lose state aid as a result, the company could sue on the grounds that the state aid formula is in restraint of trade. The restraint of trade issue was involved in the case of Marjorie Webster Junior College vs. The Middle Atlantic States Accrediting Association, but the Supreme Court reversed the lower courts by ruling in favor of the accrediting association, leaving the question unanswered.

FUNCTION OF FEDERAL AID -- AND AFTER

In general, the basic fiscal regulations governing schools inhibit the schools from using the system that industry does to get large-scale projects underway. The schools are not geared to raising "front-end" or "start-up" money to finance the expensive planning and tooling-up stages necessary for cost-effective production. Nor can they then amortize those costs over a period of years, making the initial investment worthwhile. (Nor do they accept the necessity to institutionalize the product of front-end planning -- this point will be made later.)

A mechanism exists for schools to go into the open market for money for building projects but not for curricular and instructional development. This could be the function of Federal money: to be the market place for financing the demonstration projects contemplated by the planners of this conference, but with one critical stipulation.

Before a school district is awarded a cost-effectiveness demonstration grant, a detailed plan must be presented showing: 1) how the products of the planning stage will be institutionalized; 2) how the continuing operation of the project can be carried on with normal sources of revenue; and 3) how the project will or will not be affected by state and local regulations and agencies when Federal participation is phased out.

I have seen too many projects funded by foundation and Federal money disappear with the termination of funding because the schools involved made no fundamental changes in their usual operating style and, in effect, used the funding to create artificially inflated situations. This is acceptable if the purpose of the project is simply to develop an innovation, but intolerable where the continuance of the project under usual conditions is the raison d'etre of the grant.

Nor do schools often think through the fiscal ramifications of an experimental project if it is successful. In other words, schools do not often gear up for success. For example, a large school district may find it possible to spring loose a hundred thousand dollars or so to set up an experimental CAI program to serve a select group of schools or classrooms. For the usual reasons, the CAI is, in actuality, an additional cost to the standard classroom unit. The experiment is successful, and all classroom units now demand the CAI service. Then the district has to admit that what was

possible as a small experimental situation is impossible on a district-wide basis because it cannot afford to provide the service over and above an accepted classroom unit cost. It would be possible if the CAI was able to share the unit cost but the original project was not structured on that basis.

As mentioned before, no demonstration grant should be awarded if the applicant cannot show how the successful project would be viable throughout the district.

CURRICULAR AND INSTRUCTIONAL PLANNING MANAGEMENT

The structure of traditional curricular and instructional planning and implementation assumes that final decision-making in regard to specific instructional acts takes place in the classroom by the person in face-to-face contact with students. Curricular planning stops short of specifying and developing actual instruction; or if it does, it assumes that teachers at the time of interface may or may not employ the developed products. It is essentially a linear decision-making process. In terms of technological development, it corresponds to a craft pattern where the skill of artisans in their use of tools is emphasized. In this context, technology is additive, serving to aid the teacher when the teacher deems it appropriate.

The nature of curricular and instructional planning, based on the employment of highly developed technologies of instruction, is quite different. As technology becomes more sophisticated, it incorporates more and more operational actions into the design stages, reducing the necessity for ad hoc decisions at the point of use. In sophisticated technology, increases in productivity and variety of product are much more likely in a system that stresses design of comprehensive control systems than in one that relies on successive operation of discrete tools. Instructional technology fits this pattern; traditional instructional planning does not. This means that the linear, discrete decision-making steps typical of traditional instructional planning are replaced by a systems approach to instruction by which interdisciplinary teams cooperatively design curriculum and instruction in parallel operations. In industry, this leads to decision-making by what the economist Galbraith (1967) refers to as the "technostructure" -- a collection of specialists engaged in comprehensive, collaborative planning, who then carry out their respective operational assignments concomitantly. The critical point in reference to instructional management is that operational assignments are specified in the planning process, and while considerable latitude may be permitted in how an operation is carried out, any changes in the basic parameters must be referred back to the planning stage because of repercussions on the other components of the system.

These planning teams would operate primarily on the district level (as do traditional curriculum planning groups) with counterparts on the appropriate building levels. The teams would consist of curriculum specialists, content or grade level specialists (who probably would function as teachers in certain operational phases), instructional developers, instructional product designers, evaluators, students and any others that would be needed. These teams would be responsible for both developing instructional systems and examining, approving, and, if necessary, modifying instructional systems produced outside the school district.

Programmed instruction, televised instruction and audio-tutorial instruction are examples of technologies of instruction that combine curricular and instructional planning and implementation. The IPI program, the University of Akron (or the country of Niger), and the Postlethwait program at Purdue are specific examples that have operationalized each of those technologies successfully. The audio-tutorial approach, which can be considered as programming applied to the language laboratory, has struck a responsive chord in academic circles because it bridges two traditional activities -- lab and lecture -- in a more effective way. Perhaps it is appropriate to mention here that, from the broad view of educational technology, whether any particular course is taught entirely by programmed instruction, television, audio-tutorial methods, or any other comprehensive technology of instruction is less important than the fact that an entire course can be undertaken by technologically-based instruction. The decision to use one or another (or a mixture as in the case of the Open University) may be based more on the particular requirements of interface, delivery and other aspects of the environment than on a question of relative effectiveness -- assuming that whatever presentation and delivery forms are used, they are brought to maximum effectiveness by try-out and revision (formative evaluation).

From a cost-effectiveness point of view, it must be emphasized that the type of planning discussed here is as necessary in a system that provides a variety of instructional components from which a student may assemble his own course of study, as it is in a system that prescribes instruction. It must also be emphasized that this type of planning is essential in order to "recover" teacher time replaced by technology -- certainly a critical factor in cost-effectiveness.

Any demonstration project must have a management model that provides for curricular and instructional planning procedures as outlined above and assures translating the integrity of that planning into operation.

INSTRUCTIONAL MANAGEMENT

The two most critical areas that a management model must deal with are: 1) maintaining the integrity of the planning and development stages through the implementation stages; and 2) institutionalizing the products of curricular and instructional design. The histories of the large-scale science curricular innovations such as Physical Science Study Committee (PSSC) and Biological Sciences Curriculum Study (BSCS) document frustration with this point. Marsh (1964), in his history of PSSC, ruefully comments that while physics teachers admittedly learned much from the PSSC materials, less than half used those materials in their own classrooms. BSCS frustration over this problem led to their proposal of a different diffusion model for a new life science course (BSCS, 1969). The new model was their hope of maintaining the integrity of the program when introduced in the individual schools. The disseminators of Man, A Course of Study, are attempting to maintain the integrity of the package by refusing to sell pieces of it, and by rigorous in-service training requirements.

Many projects carried on within the traditional instructional process fail because teachers will make commitments at the planning or strategy level that, for a variety of reasons, they do not carry out on the operational, or tactical level. We have all witnessed this phenomenon, which is, in my opinion, a major contributing factor to Goodlad's (1970) discouraging report, Behind the Classroom Door. The solution would seem to be to arrange the environment in as effective a way as possible to encourage the concept of shared responsibility between development and implementation groups implicit in the previous section. Churchill once remarked that first we shape our buildings and then our buildings shape us. The systems literature holds many examples of how changes in the environment (used broadly) change behavior. Sociologists and anthropologists, particularly Edward T. Hall, have documented many instances of the same phenomenon. This point is important to keep in mind because in the comments to follow I am not criticizing people but, rather, recognizing that they respond to the forces exerted by environmental conditions and requirements.

The classroom is the territory of the teacher, an inevitable manifestation of the base of the traditional educational system. The authority of the teacher within that context is based on being given a classroom (in the form of grade level or subject) and assigning students to that classroom. If students were never assigned to specific teachers, the nature of professional activity would change as the base of authority changed. The open school, the non-graded school and IPI are moves in this direction.

Let me pick up the other end of the stick and set up a situation that might help illustrate what I mean. Suppose it was possible for students to get all the information and instruction they need at the end of a computer terminal, and, perhaps more importantly, could be evaluated completely at the same computer terminal. What would happen to the character of professional activity? It is always hazardous to attempt to predict the dynamics of a new environmental arrangement from the viewpoint of the present one, but surely one result would be a shift of professional personnel to designing computer programs, and a possible change of what were classroom teachers to floating consulting roles, with a corresponding increase in paraprofessionals directly contacting students. We would also abandon the dogma that the person who is in most frequent physical contact with the student is the best judge of what he needs and how he learns, and a different kind of relationship would evolve between and among program design teams, consulting teachers, paraprofessionals and students. One manifestation would be a sharing of responsibility for student progress, each participant concentrating on those functions that best fulfill the various roles.

I hope this little scenario will serve to orient you toward the remarks to follow. Management models designed to foster cost-effectiveness through technology must facilitate an environment that moves away from the traditional territorial concept inherent in the systems approach. Contrary to what many people think, in a systems design, decision-making and responsibility are shared, not expropriated. Some facilitating changes in this direction that a management model must incorporate are listed below.

1) Don't challenge the authority of the teacher in his own territory.

One of the fatal mistakes schools using technology such as television and filmed courses make is to force the teacher to share his platform with another authority. The teacher is asked to maintain order while someone else takes over his class. It is hardly surprising that teachers resent the non-person role (to use Goffman's term), as reported, for example, in the Wisconsin experiment in using the Harvey White physics course on file (Scott, 1960). Paraprofessionals should be used for this purpose or the environment changed so that students interface with media in a location other than the classroom.

One of the contributing factors to the success of some individually-paced instructional programs such as IPI is that the environmental arrangement minimizes the challenge to the teacher.

2) Use interface forms that students, not teachers, use.

The trend toward cartridges and cassettes should be encouraged because it will tend to weaken the classroom as a territory in the same way that the paperback has tended to break the monopoly of the textbook. Technology designed for group presentation reinforces the traditional pattern (as does the textbook) unless the environment is arranged as stated previously. As media forms become more portable and students can take information and instruction wherever they go, the classroom walls will start to erode, and different options can occur. For example, if BSCS materials were all in these new forms, the student could choose which version to go through, based on his interests and aptitudes, and not have to accept the choice of the teacher in whose class he happened to be.

3) Differentiated staffing.

Differentiated staffing is well known but still controversial. The NEA is schizophrenic on the point; the AFT is simply opposed. Both groups (or the merged group) will have to accept differentiated staffing as a more cost-effective way of fitting the person to the task. Teachers are concerned that differentiation may mean reduction of professional personnel. They may be right, but this is a reality they will have to face. In Banneker School, Gary, Indiana, the number of paraprofessionals increased and the number of professionals decreased during the performance contracting period.

4) Evaluation of students, a "public" process.

Traditionally, evaluation is between teacher and student, but when instructional planning and execution are a collaborative process, then evaluation of student progress must be collaborative. If the various evaluation instruments are an accurate reflection of all the products of curricular and instructional planning, there is far greater likelihood that all components of the instructional system will be used.

5) Accountability.

Closely related to the above is the principle that if instructional efforts are collaborative, then the teachers can be held accountable only for the instructional role assigned to them by the planning process. In other words, they can only be held accountable for those aspects of student performance for which they are given responsibility. Teachers will be more willing to participate in the type of instructional management outlined under this condition.

6) Logistical management.

In the normal course of events, we do not appreciate the extent to which instructional control is surrendered to administrative convenience. By turning over to teachers all administrative chores connected with instruction (e.g., proctoring), the principal of a building may relinquish any instructional control he may wish to exercise. If he recognizes and accepts certain administrative responsibilities, he is in a better position to influence the arrangement of the environment. While the planning team may devise alternative approaches to instruction, it is obviously not in a position to arrange the local environment. The team needs a surrogate to act on its behalf. In a school, the teacher is usually the surrogate, but as mentioned before, he does not want to limit himself to that task. The administrative staff of the school must accept the surrogate role and manage the logistical aspects of whatever the design may call for. There are a number of management models that can help, such as modular scheduling. Certain computer managed instruction projects would also provide useful models.

By "institutionalization," I mean the continuance of all elements of the project, regardless of a temporary cast of characters. Two important stipulations must be built into the management model: 1) new personnel must agree to work within the framework of the project and accept its basic premises; and 2) decisions to accept and continue (or discontinue) any of the products of the system must be based on student performance data.

In regard to the first point, Oakland Community College's innovative program suffered because new faculty were not hired with the explicit understanding of the way in which the institution carried on its instructional program. The management model must provide for the necessary in-service program to train new people.

In regard to the second point, it is critical that adoption of all components of the system is based on data obtained from field trials with samples of the target audience. Just as important, once a product has been accepted on the basis of student performance data, it cannot be replaced without hard data to back up the replacement. Decisions cannot be based on personal preferences

unsubstantiated by data. Unfortunately, virtually all evaluations of instructional materials are now based on "expert" opinion, not student performance data. One of the disenchanting experiences of the programmed instruction movement was educators' disregard of field test data when they were available.

ROLE RESTRUCTURING

Much has been made in professional literature about the necessity of restructuring the role of the teacher because of technological developments. I have touched on this point before. Any project should have a well developed in-service program for this purpose.

However, to me, much more critical is the lesser known necessary restructuring of the administrative staff. They are the key to the success of any comprehensive project. I have implied this in several preceding sections. But administrators are still under the impression that all these new developments are of concern primarily to teachers and not to them. Even when administrators feel they should be concerned, they are reluctant to exercise a role that is professionally uncomfortable. For example, during the performance contract in Banneker School, BRL had to appoint an administrator specifically to manage the project and to exercise the decision-making authority the principal had but was, apparently, reluctant to use. So Banneker had two principals: the official one that acted in the usual hold-the-lid-on capacity, and the unofficial one that functioned as instructional leader.

It probably would be best to recognize this situation and provide for an assistant principal of instructional systems within any management model. In this way, someone with sufficient administrative authority to structure the school environment would be in charge. In secondary schools, department heads would function as intermediate points between assistant principal and teachers.

The central staff of the district must be prepared to take a much more active part in instructional planning and design. Curriculum personnel, in particular, are frequently not prepared for the type of direct instructional involvement required. One of the important requirements of a management model must be evidence of an understanding of, and a readiness for, the kind of hard-nosed involvement by the central staff in the design and execution of the system.

CERTIFICATION AND ACCREDITATION

The June, 1972, issue of Nation's Schools carried this item:

> ...Addison Trail High School in Illinois conducted a typing class using a line teacher with a class in one room and the same teacher over TV for another class in another

> room supervised by a paraprofessional. The local teachers' union (an AFT affiliate) objected and won a ruling prohibiting the TV class. The legal staff of the state department of education said the grounds for ending the TV teaching were that, according to an old Illinois law, a paraprofessional cannot supervise students unless he or she is under the immediate supervision of a certificated professional.

The base of the system is using the superstructure to protect itself.

Any attempts to design cost-effective projects must take into consideration potential certification and accreditation problems. The Illinois case is not an isolated example. The Appalachia Regional Laboratory ran into the same problem in West Virginia, with the same results. In certain states, between certification requirements and state aid formulas, demonstration projects may be impossible, or self-defeating. A thorough investigation of state laws in these matters would seem appropriate, not only because projects would be best placed in states where flexibility exists, but also because final reports of such projects (and of OE and NIE) should make reference to required changes in state laws if cost-effective programs are to be facilitated. At that time, the cooperation of the Education Commission of the States will be essential.

While accreditation practices are a problem in certain areas, and certainly should be explored, the accrediting agencies have relented in varying degrees from the old Carnegie Unit. The North Central Association of Secondary Schools and Colleges has probably progressed more than the others in this regard. However, from personal experience, I know that accreditation teams are more hidebound than the Association. Of course, elementary, middle, and, in most states, junior high schools are not affected. Demonstration projects in junior colleges do face the accreditation problem.

TEACHER ASSOCIATIONS

The organized teaching profession seems to be reliving the history of organized labor, and at this point seems to be about where organized labor was fifty years ago. It seems to be taking a craft union approach, relying on the teaching equivalent of standardizing the four-inch paint brush for protection. Contracts that require strict adherence, classroom by classroom, to set pupil-teacher ratios, make cost-effectiveness impossible. They simply reinforce certification and state aid restrictions. Paul Dawson's (1971) research on the attitude of teacher negotiators toward media reveals a more than casual Luddite approach.

Eventually, the teaching profession will have to come to terms with technology and realize that increased productivity is the best way to real salary increases. It is interesting to note that in several places where teachers have taken out performance contracts, they increase the number of students they are responsible for and they rely more heavily on technologies of instruction. Perhaps these seemingly insignificant instances will point the way to teacher acceptance of productivity increments.

Perhaps the eventual merger of NEA and AFT (as reported in the newspapers after the recent NEA Convention), will hasten a rapprochement between teachers and technology. At least one group will not find it necessary to "out-union" the other group, and experimental situations can be agreed to without risking vulnerability.

However, for the practical present, projects must come to terms with whatever teacher associations are in the districts in consideration. The best demonstration spots might be medium-sized districts operating under flexible state laws with no history of labor problems. But, if successful, the real benefits should be such that the teachers would become advocates. There would be little point in developing cost-effective projects that offer no rewards for the participants.

SYSTEMATIZING FOR STUDENT OPTIONS

I received this assignment shortly before leaving for vacation in southwestern Colorado. As I gazed at the Rockies from our camp, I could not reconcile my assignment with my own choice of untechnologized surroundings. Then the obvious dawned on me. My choice of location would have been impossible without technology. Just as technology served my purposes, so should technology serve the students' purposes. Applying systems technology to instruments of instruction does not mean systematizing the student as well. The objective should always remain to give him a range of choices. Any management model should take into consideration that students accept technology that helps them achieve their ends, but resent our use of technology that serves only our ends. Mechanization of students is not inherent in technology but, rather, in the uses to which it is put.

In this context, open schools might very well lend themselves to cost-effectiveness studies. The concept of the open school certainly makes it technologically dependent -- even though many people assigned to them do not understand that and mentally put walls back in. However, for a cost-effectiveness study, a management model that keeps effective track of the progress of all students is essential. Monitoring and evaluation systems are vital to keep many students from disappearing into the background or losing sight of objectives. A number of open school plans are deficient in this respect. We have taken teacher evaluation of student performance for granted for so long that when we shift to a plan that makes teacher evaluation difficult, we fail to provide an effective substitute. A few years ago, Evanston (Illinois) High School reported that those students who did poorly under the old system did even more poorly under modular scheduling. The acknowledged reason was a failure to devise a collaborative monitoring and evaluation system. A good CMI model should be employed for this purpose in several projects.

CONCLUSION

The obstacles to real cost-effectiveness studies through use of technology are formidable. The present system exerts strong pressure to maintain a floor under the basic unit of cost -- a fixed number of teachers for a given number of students. I am told that in some cities, the percentage of the budget devoted to salaries is approaching 90 percent. Taxpayers probably feel that even if the total budget is increased, the labor intensive nature of education will tend to keep the percentage high. This is part of the Baumol Crunch.

Given the extreme labor intensive situation of education, a district can not make any great cost-effective gains by, say, not cutting the lawn every other week. There are really two choices, it seems to me: make the system less labor intensive, or, from one source or another, increase substantially the amount of money allocated to education.

Perhaps increasing productivity through technology can be accomplished only with institutions created on a technological base, such as the Open University in England; or by letting private industry respond to new ways of awarding degrees, as in the case of Empire State College, Edison State College, etc. But new institutions were not our charge.

A final caveat. New technologies, and particularly systems based on new technologies, are not "proven" or "disproven" by one-shot experiments that may be measuring unimportant comparative features. For example, if educational researchers had been around at the time of Gutenberg, they would have conducted a study comparing learning from print and learning from illuminated manuscripts. They would have found no significant difference, urged the book be scrapped, and would have totally ignored the potential in the real difference between the two. The technology of print broke the monopoly of the church on knowledge. But to do so it needed time, faith and an environment that tolerated its slow early growth and then facilitated its rapid expansion. In addition, longitudinal studies are necessary to overcome the John Henry Effect (Heinrich, 1970, p. 162): the tendency of control group teachers to give maximum rather than typical performance to "beat that steam drill down." In education, we need to create an environment that finds the products of technology both useful and desirable. Without that environment, the products of educational technology will remain the objects of luxury.

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