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ABSTRACT

In response to a questionnaire from the ERIC Clearinghouse on Educational Media and Technology, 40 leaders in the field gave their opinion of the present and future of instructional technology, both in its broad and narrow (machine aids) sense. Their opinions were then the basis of a panel discussion by an advisory council that met in Washington, D.C. Questions bore upon the accomplishments, the trends, and the effective use of instructional technology. Some of its accomplishments were considered to be the individualization of instruction, the application of the systems approach to education, the development of trained personnel, the establishment of a public service system of broadcasting, and the demonstrated effectiveness of instructional technology. Among trends mentioned were the application of research to the development of large-scale systems, cost-effectiveness and accountability measures, and validated multi-media packages. Measures recommended to achieve effective use of instructional technology include: development of training programs, establishment of experimental and demonstration schools, winning educator acceptance, and expansion of efforts to develop instructional materials. Verbatim responses to the questions are listed with the number of persons making each response specified. (MF)

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Trends in Instructional Technology--1970

TRENDS IN INSTRUCTIONAL TECHNOLOGY–

THE ERIC AT STANFORD 1970 PLANNING REPORT

By William H. Allen
University of Southern California

With Advisory Council Proceedings
Edited by Don H. Coombs

Issued by the ERIC Clearinghouse
on Educational Media and Technology
Stanford, Calif. 94306

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Foreword

This report summarizes a project which benefitted greatly from the participation of

C. Ray Carpenter
University of Georgia

Thomas D. Clemens
U.S. Office of Eduction

Robert T. Filep
Institute for Educational Development
El Segundo, California

Robert C. Gerletti
Los Angeles County Schools

William G. Harley
National Association of Educational Broadcasters

Albert Hickey
Entelek, Inc.

Anna Hyer
Department of Audio-visual Instruction
National Education Association

Andrew R. Molnar
U.S. Office of Education

all of whom convened as a special clearinghouse advisory council in Washington D.C.

Another 40 leaders in the field graciously devoted considerable time and expertise to providing a wide range of views on the present state and future potential of instructional technology.

We make no pretense of having obtained a random sample of opinion. Our strategy was to seek out officers of professional organizations, editors of journals, heads of departments, and other individuals in positions to know what was going on in instructional technology. We feel we succeeded in contacting a good proportion of individuals in "linking roles"—individuals who knew what is happening because they were directly (though perhaps informally) involved in transmitting information about the field. To avoid "old guard, establishment" bias, we asked some of the younger linkers to nominate even younger individuals with innovative records, and then we sought their cooperation.

The project was planned to provide guidance for clearinghouse information analysis activities. Because some of the information developed gave promise of being of wide interest, we are pleased to make this report generally available.

By tactlessly excluding William H. Allen from participation in writing this foreword we are able, tactfully, to go on record as being deeply appreciative of his fine, and timely, efforts on the project.

William J. Paisley
Don H. Coombs
Clearinghouse Co-Directors

Summary

Open-ended responses to a series of questions were sought from a variety of instructional technology leaders, and the results discussed at a Washington, D.C. meeting. Several striking features of the future of instructional technology stand out. In the main, the issues are not unique to instructional technology, but seem to be inherent in the entire range of educational activity. They are briefly summarized below.

Individualization of Instruction

A trend toward greater emphasis on the determination of individual learning requirements—and then the design of learning experiences, environments, materials and procedures that will meet these objectives—is strongly indicated. The important role that instructional technology will play in this movement is obvious. Extensive individualization of instruction requires extensive instrumentation and a mass of instructional materials of all kinds.

"Accountability" for Learning

"Accountability" has been referred to as the big educational catchword of today. Yet the concept of accounting for the learning that results from schooling may be more than a catchword; it may bring about a reexamination of the educational process and put the burden of responsibility on educators to develop quality education of proven value. They may then be forced to discover and employ the most effective techniques of instruction which are available. In the process, instructional technology may come to play a more central role in instruction.

The Systems Approach to Education

The emphasis on the systems approach and its application to the development of integrated large- and small-scale systems of instruction utilizes one of the products of technology. It would appear that instructional media will be more widely employed as courses are redesigned and as the part such media can play in the enhancement of instruction is determined.

Increasing Emphasis on Instructional Materials

There would appear to be at least verbal recognition of the need for more scientifically designed and educationally relevant instructional materials. The trend may well be away from the proliferation of many incompatible devices and toward the production of validated materials to fit the instruments we now have

Need for Demonstrations of Effectiveness and Procedures

Finally, it is apparent that more demonstration projects should be funded, and these may account for a large share of the government's commitment to instructional technology development. The trend will be away from basic research to applied research which is readily transferable to the operational level of education.

Introduction

American education is under such pressure today, and the problems facing it will require such a massive infusion of national responsibility and enlightened action, that every possible solution needs to be investigated. A number of problem areas stand out as needing priority attention, and the solution of each one may be aided by the introduction of some form of the instructional technologies that have been evolving through the years. This report is on the determination of these trends in instructional technology.

To accompilsh the goal several steps were taken. First, media and technology leaders were sent a questionnaire (appended) eliciting open-ended responses relating to trends and problems in instructional technology. Forty respondents completed the questionnaire. Second, the questionnaire responses were studied and tabulated, and the resulting summaries were given to an advisory council which met in Washington, D.C.

This panel, using the questionnaire responses as a point of departure, discussed instructional technology trends, issues and problem solutions. Finally, the responses to the questionnaire and the discussions of the advisory council were used to formulate this report.

Accomplishments of Instructional Technology

One of the first questions that needs to be asked when determining the future of instructional technology relates to accomplishments in the field to date. For the accomplishments of the past may have a direct influence on the future. Both the respondents to the questionnaire and the panel of media and technology leaders provided detailed answers to the question, "Looking at the positive side of instructional technology, what are some developments, products, innovations, systems, etc., that you think the field can be proud of?" A summary of the responses is presented here together with a discussion of their implications.

The Individualization of Instruction

The progress that has been made with the individualization of instruction, particularly as it is exemplified in and encouraged by programed instructional techniques, was considered to be the predominant contribution of instructional technology during the past few years. It was felt that the experimentation in individualized instruction, although not yet fully realized in the educational products that are available, comprised a "residue" of effects that would have significant implications for future education. Among the significant outcomes of this experience is the tendency to establish measurable behavioral objectives or goals, the assessment of results, and the increasing attention being given to the characteristics of the learners as they relate to the strategies of teaching and the forms such teaching and teaching materials take.

The Application of the Systems Approach to Education

Although a number of respondents noted that one of the major accomplishments of instructional technology was the application of the systems approach to education, it appeared that this was more a "promise" than a "reality." The systems approach concept was so broadly applied that it might describe anything from a kit of multi-media materials to a total systems analysis and reorganization of education. Nevertheless, there was an obvious undercurrent of feeling that this was an approach that emerged from the technological sector of society and had the potential to restructure much of the thinking about ways of attacking educational problems.

The Development of Professionally and Technically Trained Personnel

Both the educational preparation programs and the operational experience gained by the practitioners of instructional technology have resulted in a sizeable pool of skilled personnel at all levels. These are people who not only have experience in the more technical aspects of instructional technology—e.g., television production, instructional programming, audiovisual media specialization—but also, to some extent, in the theoretical dimensions of the field as they relate to learning and the learner.

The Establishment of Public Broadcasting

A truly public service system of broadcasting is now emerging and is already reaching 55 percent of all the television households in the country. This development, although in the making for many years, has been dramatically underlined by the success and acceptance of "Sesame Street," a preschool program that was submitted to intensive pre-production validation and which is already being extended into other educational areas. Other projects, such as the American Samoa Project, have demonstrated how the comprehensive application of television may be used in innovating and fostering changes in education.

Demonstrated Effectiveness of Instructional Technology

Despite the predominance of research findings that show no significant differences in effectiveness between classes taught with instructional media and those taught in the conventional ways, the empirical evidence demonstrates a distinct advantage to techniques and strategies that make adequate and creative uses of instructional technology. As was pointed out, it is unreasonable to criticize the instructional media because they do not produce learning results that are "better than" conventional instruction taught under optimum conditions when the calibre of instruction nationwide is so poor that many learners would give anything to get education "as good as " that taught through mediated instructional means. Instructional media were found to be highly effective when adequate resources were made available and when their unique qualities were utilized.

General Conclusions

The tangible accomplishments of instructional technology are difficult to identify and describe explicitly—they seem to be precursors of things to come, rather than demonstrations of hard established gains. Yet the foundation for healthy growth is there, and we can say that a reservoir of techniques, tools, and processes has been formed that could assist in the solution of educational problems. There is a pool of trained professional and technical personnel, there is evidence of the unique capability of instructional technology to bring about improvement in learning, and there are processes inherent in the movement toward individualization of instruction and the applications of the systems approach to education that will have a potent influence on future practice.

"Gadgets or Good Decent Salaries?"

Harley: I guess it was about three years ago, someone in Rochester took a half page ad. I don't remember exactly how it was worded but it was something to this effect: "Mr. Taxpayer. Do you want your tax money to go to pay for gadgets and new fangled things like television, or should it go for good, decent salaries for teachers?" And these huge ads ran there for a week or two.

Accomplishments of Instructional Technology, as Seen By C. Ray Carpenter

"I feel good about the effects the residue of programmed instruction . . . the effects on an increasing number of people of emphasis on the need to specify learning objectives. I don't feel as satisfied by the means to reach that end. And, I'll make two more statements: I feel good about the fact that we're emphasizing individual learning–but we're confusing individualized learning with instructional context. We talk about individualized instruction, and visualize individuals working alone at their own pace, this is leading us down an unsatisfactory track. The increasing recognition that learning is always an *individual* process, but nevertheless learning has a great many *social contingencies*, social requirements, and socially motivating factors–I feel good about that.

"One of the other things that I feel good about is that we're beginning to match, more approximately, means to ends. The quick and dirty solution isn't as often proposed as formerly, nor are we so often proposing a $10,000 investment for a $10,000,000 job. It seems to me that there's a good experience being built up to show that where you have very large numbers of people with such diverse learning requirements, across many levels of education and context fields, that this is a very expensive operation. You don't get by with five and dime store thinking.

"Now, this leads to some things I feel badly about. I think technology has invaded education extensively, but this is not *instructional* technology. It's telephones, computers, architecture, air conditioning, the whole spectrum of technology, and probably the slowest to be adopted is that technology which has a *direct* bearing on instruction."

Accomplishments of Instructional Technology, as Seen By William G. Harley

"Well, from my bias, of course I feel very pleased about the establishment in a very short time of what appears to be a truly public broadcasting system in this country. It looks as though we will get an appropriation for the Corporation for Public Broadcasting . . . I don't know what it will start out as. But the prognosis is that we may have between 40 to 50 million dollars going into this thing in the next two or three years. Ultimately, perhaps 100 million dollars. So we can finally bring into a position of parity with the commercial system a truly public service broadcasting activity in this country.

"The impact that we've begun to make in terms of recognition and appreciation on the part of the public, and the Congress and so on, is very heartening. And so are the surveys indicating that we now are reaching, on a regular basis, about 55% of all the TV households in the country.

"The NAEB Television stations (which have frankly not always been most interested in the instructional aspect of their operation even though they've devoted 50% of their time to it) have now begun to show quite a different attitude. I guess the best indication of this is that they have voted to dedicate their entire dues increase in the association toward the instructional area, beginning next year. Coupled with this is what I consider to be rather a revolutionary enlightenment: their perception that they can no longer just be broadcast stations–that they are going to have to revise their role in terms of the changing technology, and devote a good deal of their talents and energies to becoming curriculum design and production centers providing materials that can be disseminated through whatever is the appropriate channel, whether it be broadcast or ITFS or closed circuit or EVR's or whatever.

"So there is a perception on the part of our people, which is very heartening to me, that they're no longer going to be wedded to a particular piece of transmitter hardware–that they are moving into a new role.

"One of the other achievements I think that we brought off was the Samoa demonstration of the comprehensive application of television, and what it could do in terms of innovation and fostering changes that were more effective and efficient, demonstrating what television can make possible, or bring about, that could not be achieved through conventional means in terms of the deployment of human and nonhuman resources and the achievement of true team teaching.

"And the final thing I would remark about is that the new era of accountability makes it difficult for us, but I think also provides a tremendous opportunity–if we can now really demonstrate the kind of efficiencies and relative savings that can be achieved through the appropriate application of technology. We've got a great chance here, finer than we've ever had, in terms of this tremendous concern about getting return for the taxpayers' money. These kinds of questions are tough–we don't have the kind of hard answers perhaps that we ought to have–but I still feel that there is an opportunity here if we are alive to it that can greatly foster the development of instructional technology."

Innovation and Perversion

Clemens: Look into Dick Carlson's book, "The Adoption of Educational Innovations," in which he uses the rural sociology model for studying innovation in a lot of different schools. And then after he has found out about adopting units in a classic Everett Rogers way, his last chapter is called "Some Unanticipated Consequences of the Adoption of Programed Instruction."

The unanticipated consequence was that every adaptation teachers made was contraindicated by the intent of programed instruction. And principals changed their supervisory behavior of teachers in the presence of programed instruction in one of two ways. Either they supervised on completely irrelevant things, like whether the programs were put back on the shelves right or whether the kids said they enjoyed it, or else they gave up supervising entirely. It is a beautiful example of what Rogers says about an innovation having to be consistent with the norm of the cultural group in which you try to implant it, or else the innovation gets perverted.

Accomplishments of Instructional Technology, as Seen By Andrew R. Molnar

"I think probably the greatest contribution so far has been the lack of federal funds. I think before we can get innovation, before we can get change, we have to have a crisis.... That's when change comes about. I think innovation comes about when nothing exists or it comes about where you've tried everything and it all fails. When businesses adopted computers they found that they were doing just as well as they were before, except it was costing them more. Then they questioned, "Why does it cost more?" The computer people came back and said "It's because you have a lousy system. You've got to redesign the system." The second phase comes when they optimize the system. I think right now at first we can't afford these systems, they're too expensive.

"The second thing is that it's been said that necessity is the mother of invention. Now, invention is the mother of necessity. There was evidence in the computing industry that there was no need for time-sharing systems. After time sharing was developed we found all sorts of uses for it. I think this is true with television, and with computers in education. Give people the equipment and let them use it. They will find things to do with it. I'm convinced of that. And I think we're going to have to provide it without cost/effectiveness judgments.

"We have a telephone for every man, woman, and child in the country and nobody asks if it's cost effective. Teenagers jibber over it. There is no concern of cost effectiveness because it's a necessity. And I think it's going to be a necessity to have computers, it's going to be a necessity to have television, and what we do with it will emerge after we get it. I think this is good.

"I am appalled by people who knock instructional technology. Based upon the educational research that we have, Schramm summarizes some 200 studies, and there are at least 500 studies, that show that television is as effective as any conventional system. Again, I cringe when people say, 'Aha, not *better than*, therefore you shouldn't use it.'

"Many people are receiving a poor education, or even no education at all. They would do almost anything to get a system which is as good as a conventional classroom teacher. Programed instruction, I don't know how many studies have shown that it's effective, but it's in the hundreds. Computer-assisted instruction, there are not quite as many, but they are at least in the 30s now. 30s or 40s.

"...My feeling is that engineers design bridges to withstand a certain stress, and if you exceed that stress, the bridge will collapse. If you take a teacher, give her 40 students with heterogeneous backgrounds, and don't give her sufficient facilities or sufficient equipment, and pay her less than you pay a babysitter—you might ask if that's not enough stress to destroy the system. If we were to reverse that, to 40 teachers and one student, give them good facilities, and some support, with that kind of situation we've demonstrated that we can teach the mentally retarded, we've demonstrated that we can teach the disadvantaged. A more pertinent question is how far can we extend the resources in order to develop a low cost, efficient and effective system. We're really dealing in that marginal area where the bridge is likely to collapse.

"...Educators used to work in a closed system, where they were the only ones in a town or a village that had access to 10 years of education. They were the sole repositories of information, and were the sole place that people in the village

Sesame Street: Lots of Questions?

Gerletti: Regarding Sesame Street, I have good and bad reactions. I'm a little bit worried about some of it from some of the reactions we get from teachers. But we are getting reactions, which we need.

Carpenter: Could I ask you another question? Are you concerned about it becoming known as THE answer?

Gerletti: Not so much that. We have some feedback—and again, we don't know just how valid these reactions are—that some of the techniques may lead to some phoney conceptualization on the part of kids. And this is what we're getting from some of our sharp teachers.

Carpenter: I don't think we've ever had a success that more urgently needs external and impartial analysis than this.

Unidentified: I quite agree.

Unidentified: By somebody that isn't paid by the Sesame Street organization. A real look at this thing and the various considerations as to where you go next.

Harley: We have the same concern. But it's been a fantastic thing from the standpoint of drawing attention. Talk about an Open Sesame, I've been to four congressional hearings within a two-week period, and everybody had heard about Sesame Street. All the congressmen knew about it and it was "love and roses" everywhere, because this had made such an impact.

Now, we also know that, though it was designed for the underprivileged kids in urban centers, that the kids who are watching it are largely the white middle class. And, much of the popular reaction is on the part of parents, and adults. So there are lots of answers. When it gets into the transition from the pre-school to the formal school experience, what happens then? There are lots of questions still to be answered, but it sure as hell has created attention and awareness as nothing we've ever done in public broadcasting.

could go to get knowledge. Educators have lost that place in the system, and now we're in an open system where people get more information through their TV sets, and just about everybody knows how to read and write. We're dealing with open systems, and to ask educational researchers to demonstrate that we can do things significantly better in an open system is an impossibility. I think we're becoming aware that we can't do that. We can't demonstrate statistically significant results in an open system.

"Another good thing is cost-effectiveness. But cost-effectiveness is an ineffective term. Clearly defined, it asks, probably, the wrong question, and it's probably inappropriately applied to education. On the other hand, I think by asking that question, you'll see how poorly we do everything else. And by comparison, technology will look better."

Accomplishments of Instructional Technology, as Seen By Albert Hickey

"I feel good about the so-called programed instruction residue. I think we're looking at it ten years later now, and I think ten years from now we may relish it even more, as a significant educational landmark. The first step in individualizing instruction. And I feel good that educational technology seems to be forcing rigor on the teaching-learning theory. Having toddled through the learning theory routine, you know, some fifteen or twenty years ago, I'm much more turned on now by current developments than I was then.

"Perhaps a new point of view is that educational technology is drawing into educational concern, or concern with education, a new class of people that weren't particularly involved with it before except as users and that is of course industry or the military industrial complex or whatever you want to call it. And I think they have introduced some new concepts, systems is certainly one that is popular, and I think we have to acknowledge that the original concept of system was acquired from the notion of physical and engineering systems. And then more recently things like turnkey, cost effectiveness and that sort of thing, I think they are all concepts which help us to look at education from different angles.

"... Technology seems to be tying education and training together, where before education was something done in the little red schoolhouse, and training was something that was done in the shipyard. Now we're beginning to look at it from the point of view of instructional technique.

"And finally, the thing I feel good about as a personal gain is the introduction of the computer as a workbench for working out the details of the instructional process. One thing I'm concerned about and don't feel too good about is that I still think we have an interface between education and the private sector, which really now is a chasm ... lots of things are falling in the crack there, such as development and packaging—who takes responsibility for it in a system such as we have? The English have the National Training Act and other mechanisms which tend to close or bridge that gap. I haven't seen any evidence of our developing any such mechanisms."

The Growing Concern for Accountability

Harley: One of the things that I was thinking about as you were talking, Anna, was that another element of conflict here, between teachers and technology and the educational establishment, would be this growing concern for accountability. And when technology tries to answer those questions about productivity, and the return for the money, and so on, we are inevitably going to clash with problems that the teachers have never wanted to face up to—that is, "productivity" is a dirty word to many teachers.

Hyer: Of course teachers either will move toward instructional accountability or they will be forced to move in that direction, but technology can move that direction faster. If technology can demonstrate that it can be accountable better than the teacher-dominated system, to that degree it is definitely going to have an edge with the public and the taxpayers. And this is what industry knows, the reason it is moving so fast into the performance contracting field, and showing a willingness to lose money currently while it learns. If industry can demonstrate accountability it is going to get government funds.

Molnar: I think we must make a distinction here between types of responsibility. One type of responsibility refers to "who you blame," and another form is concerned with how to obtain value-added. The concept of value-added is very important in terms of cost because it is pretty obvious now that we want at least a minimal level of education in this country for all. We won't tolerate groups receiving no education—mobile groups like migrants and remote groups like Indians. We are spending extremely large amounts of money for the disadvantaged and with very little result to show for it. We are willing to do this as a nation, so money is really not the major factor any more.

Now as it affects education and technology, it seems to me another trend is that local school districts are failing because of insufficient funds. And in Maryland and other states, there are proposals for the statewide funding of education. I think that many school districts have failed because we have been dependent upon local funding. Current large scale CAI systems can't be purchased by major cities. No major city can afford to buy one. If we go to statewide funding, instructional technology systems can be financed. In the long run I doubt that even states can afford educating everybody to some minimal level. That's an exorbitant expense, therefore unless we change the financial mechanisms of education we can never move away from a labor-intensive system to a system that uses technology. If the John L. Lewis model of Technology in the coal industry teaches us anything, it is that we'll have to pay teachers significantly more if we are to encourage them to use technology.

Accomplishments of Instructional Technology, as Seen By Robert C. Gerletti

"I feel that more people are aware of instructional technology, as Tom has indicated and, apparently, more people are working on despite the frustrations of it. We find a lot of interest. I think one of the healthy things is that librarians are vitally interested in this field now, where they weren't before. You get a good deal more cooperation, and I think we're ending up with instructional teams as contrasted to individual approaches.

"There is a significant development of media centers at building level, which indicates a kind of decentralization that we haven't had before. The more of that that happens, the closer that we get the materials to the teachers, the more effective instruction can be. That will allow us, then, to do the broader kind of thing like television, and things which need a broader financial base.

"We see a great variety of approaches being used that we haven't seen before. We are aware now, I think, that the solutions to some of the computer problems are going to mean that we're going to have to have a wide-scale financial base. I think this is also true of television, that the base may have to be state-wide. And with computers we probably will have to go region, or nation-wide, in order to get the financial base in order to make it reasonable. Experimentation has helped to put problems into perspective. We've been given options through these experiments, funded through USOE, that we would not have recognized had we not had the experimentation.

"Another healthy thing is that we apparently are making a strong enough impact as the unions are very much aware now of the contributions of media. It shows up in negotiations."

Accomplishments of Instructional Technology, as Seen By Thomas D. Clemens

"At the very narrow level, even the atomistic level, one thing I, as an old audiovisual type--I've been one for about 25 years--feel very good about is that it's now possible, any day, to go into just about any school, and see at least one teacher making imaginative and effective use of instructional media resources. In an effective and imaginative way. And that's a kind of unconscious efficiency, it's no longer that "Look, Ma, I'm dancing" bit that we used to go through, in 1945 or even 1955, about the classic way to use the film, or whatever. We're building a base of competency, wired right into the fiber of the teacher, I believe, with modules of the system, that is awfully good.

"A second kind of a trend that I personally feel good about struck me after hearing some of the others talking this morning, that, again, looking in perspective since the post-World War II period, the locus of initiative with regard to instructional technology decisions has changed. No longer is the initiative with the instructional media man or whoever, the locus of initiative of decisions appears to be at the top levels of decision-making in the organization. The superintendents and the school boards, and so forth. This seems to me to be extremely salutory, because we, and others like us, no longer need to be in the position of being advocates, but of being helpers and facilitators in making instruction better through media resources--a great step forward.

"The good things that I can see, I guess, are sort of impacts of instructional technology on education in general, rather than impacts that are specific to instruction. First of all, it seems to me that more than any other area in education, the instructional technology field has spread throughout the educational profession; for example, commitment to the idea that instruction is as subject to empirical verification as efforts in other fields. The fact that teaching isn't a matter of doing what comes naturally, intuitively, and then defining it as good. Instructional technology has turned us more toward a science base than just an experience base, if I can make that distinction.

"Similarly, I believe that the instructional technology field has led to a kind of *operational* concern for learner variability. We've always talked about each child being different, but perhaps educational technology research and development efforts have spread more concern throughout the educational profession for what this variability means in terms of how one teaches. Another trend that I think is very important is that the field has led the way toward iterative development of instructional procedures. And it really was this field that gave meaning to the idea of formative evaluation, evaluation to make the product better, rather than summative evaluation which said, after the fact, that the product was or was not good."

Accomplishments of Instructional Technology, as Seen By Robert T. Filep

"I feel pretty good about the fact that there is a process or an attempt to implement a process which came out of the whole development of the systematic approach to instruction, whereby we began to be concerned with the wide range of individual differences in youngsters. I think that as that technology emerged, and we began to specify goals in instructional objectives, this was helpful. There was a strong commitment to evaluation to see how well the instruction was operating, and I think that that, in a sense, has given a platform to the accountability issue. Here was at least a basis to talk about how you might go about assessing how well you're doing.

"I also feel good about a commitment to looking at what you are doing toward revising and improving the instructional process. I feel that this is something that has come out of the work in the field of educational technology. If you recall that about five years after the Title VII studies were underway, after some of this started to get in place, ESEA comes into the picture and you have a strong commitment to special education, compensatory education, people saying, you know, we've got a lot of different kids to worry about.

"Suddenly you have pieces of a technology in place which can be employed to work with special education, with diagnosing individual differences, prescribing instruction. There was something there at about the time of the major thrust under ESEA, when programs began to develop and deal with large blocks of minority groups, such as kids in Head Start. It would appear that the process has taken hold.

"I feel pretty good about the fact that the efforts in the goals and objectives area have given us an indirect fallout in terms of curriculum development. Let me put it this way: We are currently working with a project with a number of California schools where the districts have to define their goals and objectives. This is a task not solely for the classroom teacher or the administrators; it requires involving the community in discussing and developing the goals of education for each district. The work in the area of instructional technology has given us

some tools to deal with this problem. People have said 'All right, we now have at least a vehicle whereby the community, all the sectors in the community, can interact to determine what they feel public education should be for their youngsters and their school district.'

"I feel terribly good about Sesame Street. Because if you look at the ten years of open broadcasts or closed circuit broadcasts, I don't think there was any single activity that really pulled together the output of the research and application projects in television. Certainly, we had statewide systems in the Carolinas, but suddenly now there's something that's in place, and it's on open broadcast, it's reaching a lot of kids, not only the ones that are sitting in the suburbs. This program couldn't have happened unless there was a lot of experience that was built up with the ten years of television or the twenty years of television.

"I feel good about the fact that Sesame Street is out there, is an open broadcast activity, people can turn on the set if they so choose, they're not committed to getting involved, it's a resource that's there for everyone, without going into the formal school structure.

"I also feel good that technology has identified some alternate systems, or the potential for alternate systems, *vis a vis* the public school system. Performance contracting, for one.

"I feel good about the stress on inexpensive equipment. This may be an intuitive feeling, but I like the idea of showing how sets which are relatively inexpensive can be used for a number of instructional settings–that we can use auto-tutorial, or slide tape presentation and maybe we don't need a big computer. I think I'm starting to feel good about that. That we've identified ways to do things without a large investment of hardware. This trend is intuitive and would be difficult to document, but I feel good about it.

"We've planted seeds for things like 1) tutoring of younger children by older children, 2) systematic approaches to analyzing instruction, and 3) alternate ways of going about instruction. I feel good about these types of spinoffs which are not equipment oriented, they are people-oriented, they're process, they're systems-oriented, and again we're saying, well we can do things in different ways without large investments of money and still be effective."

Cheap But Expensive

Molnar: Unfortunately, we think cheap is inexpensive. It isn't. For a case in point, take computers. The National Bureau of Standards predicts that in ten years 25% of our gross national product will be involved in computers. The Organization of Economic Cooperation and Development predicts 50% of our budget for the next ten years will be involved in computers. Nowhere in the federal government can you find any major programs in computing going on. Nowhere in the school systems can you find people being trained for all the potential jobs that will be opening up. Nowhere can you find any direction to the countless small efforts that are being attempted at the local level. And that's cheap, but not inexpensive.

We're not putting any money into computers. But most of the school districts are, and most of the universities are going out and buying their own equipment, finding out that they can't pay for it and either going out of business and losing the equipment, or seeking other means of support, indirectly from the federal government. We are all, as taxpayers, paying for those mistakes because we have no Federal policy, we have no instructional guidance, we have no system for supporting computers in education.

We frequently give people a television network, we will even in some cases give people a computer system, but we won't provide legal means by which they can support that system. Stanford provided services to Mississippi, but there was no way of making a profit from those services to pay off the purchase of a computer. So consequently, there is really no strong incentive for Stanford to continue the service.

Our Title III projects on computers are limited to three years. I think any computer project needs 5 years to survive. So we've supported some 67 million dollars worth of computer research, and you can't find any of them that are operational. That's cheap, but expensive.

Trends in Instructional Technology

What are the major trends in the conceptualizations, approaches, and applications of instructional technology that will influence future education? This is one of the major problems addressed by the questionnaire respondents and leadership panel. Although there was much overlap in the responses, the trends are treated here under six different classifications:

Research and Development
Evaluation
Commercial Production
School Adoption
Legislation and Other Government Activity
Other Trends.

Trends in Research and Development

Applied research and development with large-scale systems. The belief was widely held that research in instructional technology would change emphasis from the more carefully controlled and circumscribed basic experimental studies to the larger-scale applied and developmental projects. These projects would tend to be directed toward the solution of problems of a social rather than a theoretical nature in such high commitment areas as the disadvantaged, reading, and exceptional children. There would be more emphasis on research and development teams than on the lone researcher, projects would produce generalizations and products of immediate usefulness that could be applied in both large and small instructional systems. A concomitant of this developmental effort would be increasing attention given to "accounting for" the instructional strategies employed and doing it in some kind of cost-effectiveness terms.

The individualization of instruction. The trend toward increasing research and development attention for factors related to the individualization of instruction was evident. Not only was this apparent in much of the discussion of systems applications, in the attention given to computer-assisted and computer-managed instruction, and in the concern for the simplification and use of uncomplicated simple-to-use devices, but also in the trend toward considering all facets of instructional media in relation to the educational objectives being served and the characteristics of the learners.

The application of learning theory to instructional technology. There seemed to be an emerging trend for research and development projects that take more fully into account the developing theories and strategies of learning and teaching. Such a direction was also subsumed under the facilitation of large-scale system research, such theoretical considerations being a necessary ingredient of any kind of effective system analysis.

Development of instructional products. It was evident from the responses that a more systematic approach to the development of instructional materials, or "software," would be taken in the future, and that these efforts would be more closely related to research evidence and empirical product testing. The inadequacy of presently available materials was frequently pointed out, and the need for their more careful design noted. These design principles are not yet known and can only be determined through systematic research and development.

Development of a variety of technological devices and information delivery systems. Although there has been much criticism of the instructional technologist's preoccupation with equipment and devices—the "hardware" of instructional technology—and a subsequent refocussing of attention on a wider and more learning-centered approach to the concept, there nevertheless exists a strong indication of a trend to continue research and development with such equipment and media forms. There was particular recognition of the trend to simplify and standardize equipment and delivery systems. In addition, there was evidence that research might be conducted on the use of such new forms as lasers, holography, and response and retrieval systems.

Trends in Evaluation

Cost-effectiveness and accountability measures. The dominant trend in evaluation identified by the respondents was determination of the effectiveness of education in relation to its costs. The focus here was on *proven* results, and the movement was toward increased efficiency in instruction. From the viewpoint of the instructional technologists, the evaluation will center around the question of whether or not the use of the components of instructional technology makes a difference. This could be a difference in the level of learning per dollar of cost or in the reduction of costs of instruction while maintaining an equal level of learning. Such determinations, difficult though they may be, characterize the nature of this trend, and it is toward the development of instruments and procedures that will adequately measure these factors that future attention will be given.

Evaluation of instructional systems. There was considerable support for the notion that the future would see more evaluation of the functional results and operations of the total instructional system. This evaluation would include, not only such cost-effectiveness factors as mentioned above, but also the development of appropriate performance measures, the investigation of areas that now defy adequate evaluation, and measures of individual learning as related to specific educational objectives. The emphasis will be on the evaluation of these elements as a whole rather than the more fragmented evaluation of the single parts.

The increasing role of the computer in evaluation. It was evident that the respondents thought the computer would play a more important role in the evaluation process. In particular, there would be an increase in so-called computer-managed instruction, in which cumulative and current performance profiles of individual learner behavior and achievement would be made available to teachers, counselors, and instructional managers. The computer would also be used for in-depth analyses of learning problems and the evaluation of achievement as these relate to learning objectives.

Instructional materials and equipment development, tryout, revision, and measurement. Increasing attention will be given to product validation and equipment evaluation. This will take the form of pre-production testing and revision based on

criterion-reference achievement measures and the increasing amount of data available on the effectiveness of different media and the characteristics of the learners.

Evaluative techniques will be more rigorous. As the range of evaluation is expanded and more sophisticated psychometric devices and techniques are developed, there will be a tendency to apply greater rigor to the evaluation of learning performance.

Trends in Commercial Production

Validated multi-media packages. Almost half of the respondents felt that there would be a trend toward development of validated multi-media packages of instructional materials. These packages of materials would be designed to meet specific instructional objectives and performance criteria in carefully designed curriculum areas and in many cases would be tailored to the characteristics of specific learner groups. They might be designed as individual instructional units, perhaps in modular formats.

Design of learning systems. Related to the trend toward multi-media packages was the emphasis again placed on the utilization of the systems approach in the design of large-scale learning systems. In fact, the packaging of materials into instructional kits was but one phase in the implementation of the systems approach and could be considered to be a component of it.

Entry of large corporations into the educational market. It has been evident for some time that large corporations would enter the educational market as it expanded and offered the possibility of profit. This trend will probably continue. The newer emphasis, however, would appear to be away from the manufacture of single devices and limited materials to the production and manufacture of a wider range of educational materials and systems. We will probably see complete curriculum packages, although several respondents felt that the high cost of this development and production would limit this unless there was considerable subsidy by the federal government. Related also to the role that the private section will be playing in education is the emergence of contract specified learning in which commercial organizations contract with school systems to perform certain instructional tasks, an activity that often includes the development of special instructional materials and delivery systems.

Industry-school cooperation in materials production. As the large corporations enter the educational market they tend to draw upon the knowledge of educators. This cooperation not only includes the consultation that teachers give producers, but also fairly large-scale cooperative efforts in which the school systems themselves are used for tryout of materials and teaching strategies over extended periods of time.

Increased emphasis on the production of instructional materials. Whereas the development of equipment and media delivery systems has received the most emphasis in the past, and the production of instructional materials has followed no systematic plan, the emphasis may now be changing. Throughout the responses to the questionnaire, frequent mention was made of the importance of the production of validated teaching materials, particularly for individual programed instruction. Specific suggestions called for more open-ended materials, the developing of materials for existing equipment, new forms and formats, and more materials of a social action type and for the urban, rural, and poor child.

Development of new equipment forms. Several types of equipment have emerged during the past few years, and it was

Autonomy, Privacy and IT

Molnar: I don't want to belabor the point I've been making continually, but I think it's almost obvious that we as a society must restructure and re-evaluate our educational values. Frankly, the major value in conflict with respect to technology, as I see it, is the concept in education that autonomy is good. We as teachers feel that we should be the only ones to decide what we teach and how we teach. Frequently it is easier for a college president to commit millions of dollars of the university's resources to innovation than it is for him to get a professor to teach in a more effective way. The same situation exists in the public school system. We've got research galore that shows effective ways to teach, but to get people to use them, that's another problem. I think we've reached a point where the value of autonomy is in conflict with the value of innovation.

Schools and colleges cannot use instructional systems without giving up a degree of autonomy. And you cannot gain any savings from doing everything by yourself, by constructing your own TV programs, writing your own computer programs, or if you do, you know by the law of differentiation of function that it's going to cost you a fortune, and you don't have enough human lifetimes to do it.

So we have a value conflict: "Sure I'd like TV, sure I'd like CAI, but I want to control my classroom. I want to run my classroom the way I want to run it, I want 10 students that I can talk to, and I don't want to be distracted by using technology." Now, how do you solve a value conflict? I think it's a matter of stress and time and eventually a new value emerges. Cost-effective arguments have little effect upon values.

Clemens: There's likely to be another revolution, conflict. We see that many people believe the concept of instructional systems, of individualization of instruction, is the direction in which we'll go. And I think at least most of us around this table, maybe not all of the instructional technology types, but all of the people around this table say that it is desirable to provide for human kinds of learning experiences, the humanized kind of learning which is in the interest of the students. Yet these systems, if they are to work, if they are to be humanized, require kinds of data banks about individual learners which in time are likely to be very threatening to the idea of personal privacy.

We're hearing some of this in Washington today—"How much right does the system have to learn about individuals in that system, even to do good for them?" It is very possible that unless the people in instructional technology can face that question, we'll end up with a kind of benevolent despotism of instructional systems in which the operation will be highly successful but the patient—the dignity and worth of the individual—will die.

Molnar: But Tom, these are not myths, these are beliefs. First of all we don't have the privacy we think we have. Anybody that has a credit card has more information about him in the credit system than in any agency in the Federal government. There are techniques to overcome the invasion of privacy. You can decentralize the educational information among a variety of

data banks so that no one individual can get it without meeting certain accepted requirements.

Hyer: . . . I think we have to be careful not to rule out developments because we don't know how to control them. At one time we had the same issue, for example, with the data from a psychiatrist, or a doctor, or a priest. It was confidential and not allowed in court. That was our way of solving the problem of information storage in those days. Now what we have is on a tremendously greater scale.

I think we have to point out the value problems that are going to affect this field and others, rather than just view the dangers. These are things to find solutions for. If we're not careful we are going to have people condemning and voting against certain things that may be desirable, merely because society does not know the answers as yet.

. . . Followed by Failure

Molnar: We brought the systems concept from the military without realizing that our organizational structure and procedures are different. In a military missile system, you check on human behavior routinely, realizing that human behavior can deteriorate and the missile will not work properly unless everyone does his job well.

The military try to build in feedback mechanisms to give signs of any system deterioration.

In education, I think, all too frequently innovation is a one-shot deal. We develop one Sesame TV program and no more. Or we introduce IPI and stop. Now I think what we have got to do is think in terms of systems reliability or we are going to go through phases of innovation followed by failure.

predicted that there would be a trend toward their extended development and use. Particular attention was given to the tape cassette, the new electronic video recording (EVR) system, videotape recordings, different forms of telecommunication systems, the 8-mm film format, dial-access retrieval systems, the mini-computer, and holography. Surprisingly, computer-assisted instruction was not mentioned frequently.

Reduction in costs of equipment and materials. There seemed to be a trend toward the development of more simple types of materials and devices that were less expensive. At the very least, there were efforts to reduce costs. Such cost reduction efforts might emerge from the move toward more standardization and simplification of equipment.

Trends in School Adoption

The trends seen by the respondents were less clear in this category than in most of the others, and there was a tendency toward more negative reaction in this category.

Little change will occur. The most common response was that little change can be expected in the schools in their adoption of instructional technology, that such adoption that did occur would be random and ill-defined, and that there might even be retrenchment in the adoption of innovative techniques because of lack of financial support.

Schools will be completely redesigned using technology. A contrary view was also expressed, holding forth a promise of a complete reconstitution of our schools in the next five years. One of the key factors contributing to this change would be the pressure for learning results brought about by economic pressures on the budget and the growing concern for cost-benefit accountability. There seemed to be an implicit assumption that, when accountability measures are applied to the products of our schools, instructional technology will find increasing support and subsequent adoption.

More individualized instruction. The respondents saw a move toward the adoption of more individualized instructional procedures in the schools. This individualized instruction might take different forms, but there was little support for any large-scale adoption of computer-assisted instruction.

Trends in Legislation and Other Government Activity

As was the case in school adoption, the respondents indicated no strong trends in legislation and governmental activity related to instructional technology. Actually, the responses were contradictory, one group believing that there would be little or no positive change for the next two to five years, and the other group contending that government interest would increase, but with a changed emphasis.

Little change will occur. One-third of the respondents held out little hope for change from the current attitude of the government toward instructional technology. They cited the negative governmental attitude resulting in decreasing funds for research and development and for educational programs as a whole.

Increase in governmental interest. A substantial group of respondents felt that there would be increased governmental interest in and funding for instructional technology. This interest would result partially from a weakening of the current excessive preoccupation with holding down taxes and a turning toward the solution of existing social problems. A positive reaction to the Commission on Instructional Technology's Report to the President and the Congress was predicted. The assumption seemed to be that, in any major governmental attacks on crucial

educational problems, technological solutions would play an important role.

Where the funding will go. There was considerable support for the notion that the bulk of future government support would be turned toward large-scale solutions of problems with national priorities such as those related to pressing social needs and the remediation of educational deficiencies. This suggested the support of fewer heavily-financed demonstration and development projects, with each one to receive a larger sum of money than now is the case. There was evidence also that future legislation would tend to support programs showing increased effectiveness and efficiency with cost-benefit emphasis. More attention might also be given to professional training programs for instructional technologists. Finally, it appeared that an increasing amount of federal funding would be given to the states for their discretionary use in the support of research, facilities, and equipment financing.

Other Trends

Some attention was given to trends toward increased military spending for instructional technology, establishment of equipment and materials standards, support of contract specified learning, increased support for public television, and the possible passage of some form of the Educational Technology Act.

With Technologists, Some Grave Reservations

Molnar: When I speak to non-instructional people, I usually advocate technology. But when I am with Technologists I express some grave reservations, and I think this is something that ERIC should attend to. I am shocked, you know, at what I see IPI doing in certain communities. In one city they surveyed most of the parents in their system and found they didn't even know their children were getting IPI. Second, when I talked to a number of teachers in the system, they said, "Yes, we use IPI, but we also teach regular classes on the side, because we don't really believe in the Technique."

The teacher realizes that kids take exams, and that each one does progress. However, you don't know where he is unless you really have contact with him, and talk to him in a group, in a class.

In so doing they tend to destroy the individual part of the process and are really doing group instruction again. The converse is also true: Some teachers have corrupted the concept of individualization to mean learning by yourself, rather than tailoring materials to meet student needs. Another corruption is usually found in large classes where the teacher has little or no contact with the student. If the student does little or no work he is given the grade of "pass" in the class. And when I inquired about such a student, the teacher said, "This is individualization, he's going at his own pace. Because he didn't do anything in the course doesn't mean that he couldn't have done anything, so we are passing him."

In other words some Teachers are using the IPI crutch for failure. If the kid fails to work, you don't say he is unmotivated; you say that he is progressing at his own pace. These corruptions of the method of instruction should be cataloged. The resistance to innovation can be as important as the innovation.

Unidentified: If the kid fails to work, he's too individual.

Unidentified: No, he's going at his own rate and we don't want to discourage him.

Unidentified: It'll take him another year.

Molnar: We'll give him a passing grade, so he moves on through the system. But the point is we are imposing concepts on teachers without finding out whether the teachers are willing to accept them, whether they are interested in them. Consequently the clichés and the rhetoric are carried through the system, but little changes. Like the "Great Leap Forward" in China, we're going to find out after it's adopted that it doesn't work. We must concern ourselves with system reliability in education. Because an innovation worked during the research phase does not mean that it will necessarily work after it has been introduced into the school system.

Achieving Effective Use of Instructional Technology

Responses were made on the questionnaire and a discussion was held by the leadership panel members on the question, "If you had a significant amount of money (say 50 million dollars) to spend to achieve widespread effective use of instructional technology, what specific projects or programs would you undertake?" The replies were detailed, varied, and complex, and their assignment to specific categories fails to do justice to their richness of content. However, some main themes could be determined, and these themes form the basis for this discussion.

Development of Training Programs in Instructional Technology

One of the primary problems in instructional technology is that of training personnel of all levels. This problem exists through the entire range of educational activity, with the instructional materials producer as well as the school administrator, and with the classroom teacher as well as the professional instructional technologist. Solution of the problem through the organization of varied training programs, in-service education, and professional development programs was the most commonly cited way to achieve effective use of instructional technology. Such programs assumed several different forms:

Workshops and "on-the-job" training for teachers. The crucial training need appeared to be for the in-service training of teachers in the applications of instructional technology. This should be conducted on a systematic basis in the teachers' own school environments. Some kind of reward system for successful participation in these programs might be feasible.

In-service training for school administrators and key decision-makers. Similar training programs should be set up for school administrators and those individuals who are in key educational decision-making positions. Local and regional workshops and summer institutes are channels through which such training could be conducted.

Training of instructional technologists. The training of instructional technologists, both professional and para-professional, was strongly supported. Such education and training might occur in workshops or in institutions of higher learning under expanded EPDA-type governmental support programs leading to higher degrees in instructional technology.

Implementation of training programs. Suggestions were given for the implementation of training programs. For example, a semi-private or governmental agency for innovation might be organized to assist schools, curriculum planners, and teachers as "helpers," and play a role somewhat similar to that of agricultural extension agents. Similarly, a broad program of automated individualized training or large-scale discussion groups on broadcast television might be organized.

Demonstration and Experimental Schools and Centers

A significant number of respondents stressed the need for demonstration of the potentialities of instructional technology if it were to be applied to all phases of education. These demonstration projects assumed three different forms, all focussing on the experimentation, demonstration, and training aspects of the field.

Experimental schools in states or regions. It was proposed that experimental schools having complete media implementation be established in each state or geographical area, perhaps with matching funds from the state and school districts. These schools would experiment with techniques of instruction, demonstrate teaching procedures using media, and generally serve as lighthouse examples of innovative and creative instructional practices. They would be amply funded for the conduct of dissemination activities.

Model demonstration centers. A series of model demonstration centers, perhaps set up geographically, could be established to demonstrate the effectiveness, and the techniques, of instructional technology. These centers might be structured to demonstrate different aspects of media application–e.g., individualized instruction, media use with the urban disadvantaged, television applications such as the Samoa Project–and might incorporate training, media production, and dissemination of information activities.

A statewide demonstration. A suggestion was made that a state, such as California because it is considering something of the kind now, be extensively funded to develop a statewide system that develops and puts into operation a systematic approach to instruction. This system would spell out its goals, develop instructional objectives, perhaps establish a program planning budgeting system, incorporate criterion-referenced testing, and implement an information retrieval system. The state would create a model of the system and develop instructional products that would be transferable to other states.

Establishment of Programs to Gain Educator Acceptance of Instructional Technology

The need to change the attitude of resistance to the application of instructional technology and innovation by educators at all levels to an attitude of acceptance, or at least open-mindedness, was viewed as a critical problem. Despite this recognition, few practical operational suggestions were made. Rather, the suggestions dealt with general approaches, several of which are described below.

Plan a national effort to gain acceptance. This endeavor would try to establish within the education system a tolerance for planned change. It would be necessary to bring instructional technology and learning into a cause-effect relationship by

The Cost-Effective Xerox?

Molnar: I think the element here is how we account for what we're buying and what we pay for. If we were here today saying "How can we provide Xerox facilities for everyone in the country?" and we have 50 million dollars to do it, that's the wrong question. We put a Xerox machine in the library, and for 5c you can get a sheet of paper and Xerox it. Nobody questions as to whether it's good, bad, or cost-effective. We're indifferent to it. There is a built-in financing system.

mounting and funding programs that demonstrated their cohesiveness. The hope would be that, if change were recognized as a norm in education, the role conflict between technology and education could be resolved.

Reward innovative educational practices. One way of encouraging innovation and change was by means of incentive systems that would reward in tangible ways those individuals and groups who became innovators and adopters.

Confirm the values of instructional technology. Suggestions were made that educators might accept instructional technology if it could be dramatically demonstrated that it was effective in bringing about improved learning and motivation to learn. This might be accomplished by discovering if the claims made by those interested in behavioral objectives, systems analysis, and behavioral modification do in fact create the optimum environment for such learning. It was further suggested that one or more subject matter areas that are difficult to teach could be chosen, and a program created that demonstrated the effectiveness of a total, or at least optimum, technological approach.

Development: No Funds?

Hyer: I was surprised . . . I would have thought that the "instructional development" category of the questionnaire would have received more attention. I was extremely surprised that only two people mentioned it.

Molnar: It doesn't surprise me, because there are no funds for development in education [illegible]lopment concepts are not accepted. . . .

Hyer: That may be true, but in some of the other places where it could have shown as a trend, it didn't. I felt it might emerge because it seemed to me that it is a place where we need funds.

Molnar: I've noticed two things. First, over the last four years R&D funds for technology are decreasing and the number of projects in R&D are fewer. Second, the dollars per project have gone up. So I think your qualitative judgments correspond to what available data there are about USOE projects in this area. There are very, very few development projects, most are "bootstrapped" somehow. I examined Department of Defense R&D figures and found that they spend something like $4 for development for every $1 for research. We just can't find anything like that in education.

Paisley: Is there a corollary trend in the allocation of state funds, foundation funds?

Molnar: I can't really tell, because these figures are hard to come by. For the last four years I've been trying to get gross figures for spending in instructional technology–from articles, publications, people who do special surveys. We found that all their figures were "guestimates" and were not really based on much hard information. Our figures were based upon what the Office of Education said it spent. While these are not necessarily hard figures either, they are as close as I can come.

Paisley: If I could pursue this point one question further: I know that you did an extensive survey on the use of computers in education. How much value is there in knowing exactly how many projects there have been, and how much money has been spent?

Molnar: Well, it depends on how you look at the future. If you make a straight line projection, computers are like this [gestures down]. Next year the Office, the National Center, will spend $15,000 on computers. I think from the trendline, it's obvious what's happening–we're going out of the computer business. From a project-line projection, I think you can see that the average cost of projects is going up. We are attacking broader problems. As money gets scarce, we are less likely to fund the small projects, and more likely to fund big projects. But any figure provided by the government can only be considered an estimate.

We've sat around for the last three years trying to come up with program planning descriptors and taxonomies. I've come to the conclusion that no matter what taxonomy you come up with, you can only account for about 40% of the effects. After that, everything is unique and must be treated separately. Because if you group them you're just going to get distorted data.

Filep: Is there a correlation here between the dollars spent and the trends that have been set in motion? If I had read this question and responded to it, I'd be concerned about the main directions, as contrasted to the dollars that are available for particular kinds of projects. Did some of those earlier projects plant some very important seeds, and have people been sensitized to the need for the increase of applied research and development?

Failed and Failed and Why?

Gerletti: It's always nice to have sage, elderly advisors. We have some, and my understanding is that the incentive thing is not new. This is about the third time around since 1920, I guess. We failed then and failed in the past. I don't know why someone hasn't gone back to find out why it failed, or where it could have succeeded. The other one is behavioral objectives, this is the third time around for it, too.

Expansion of Efforts to Develop Instructional Materials

A large number of the respondents stressed the need for an ansion of efforts in the development of instructional erials, the "software," and the design of courses in which such lia play a significant role.

Centers for instructional materials development and ribution. One possible solution to the problem was blishing regional centers or a national institute with the onsibility to search for, locate, reproduce, and package for ribution those instructional materials already available. The lers also might design and produce needed materials. Each er might have responsibility in a specific area, and active arch on the problem would precede the system-oriented lia development or acquisition. Such materials would bably be made available under contract to commercial nizations, with royalties from the sale of the materials going a central federal fund to provide ongoing self-sustaining vities and support for the program. Experience of the lonal Science Foundation with it Project Physics has shown such development projects can be self-supporting after they operational, and can even recover developmental costs.

Development of materials for the culturally different. A d was expressed for the funding of development and duction of instructional materials that were specifically gned to deal with such questions as the linguistic problems, ceptual bases, cultural backgrounds, value systems, conceptual ities, and levels of motivation of culturally different segments he population. Similarly, there was some interest expressed in development of instructional materials related to moral es, and the affective domains of educational responsibility.

Start from Zero, Make Mistakes

Filep: One of the real gaps in information when a school district attempts to utilize educational technology is a central source where they can turn and get documentation, a brief documentation of the use and experience of other districts. Our work with some of the junior colleges in California is a good example. They want to use auto-tutorial, and other things. They don't want a report out of a journal. They want vignettes of use experiences from other institutions.

So we got on the phone and called around the country. We put together a ten-page document with little short things, not very different from the kind of thing you are doing now, but identified the institution and the person to contact. This thing is going like hot cakes! You know, "We can go out there and there's an institution that looks like ours." Why doesn't somebody put this kind of thing together in other areas? And I think about the other side of the coin: someone doing this on a continuing basis who could respond to these requests and provide information about these kinds of experiences.

Gerletti: There's not enough evidence as to what happens when you put instructional technology into a school system. Administrators really are ready to move, but they're worried about not having enough evidence as to "How does this process really affect my school system?" We do not have models we can replicate or transport.

Molnar: We have no innovative mechanisms in education. What we do is observe an innovative project for a week and then go home and try to duplicate it. In the process we make all the mistakes that they made in their start. I surveyed all of the computer projects that the Office of Education supported. Someone dialed up everyone of those people and asked for their materials or their programs. Not one program was available, from several hundred studies. None of the materials developed were transportable to another location.

If you look at the ESEA Title III projects, you find they follow a pattern: First year, learning; second year, developing materials; third year, just getting it to work; fourth year, out-of-business. After three years, the innovation stops. Innovation by Title III definition is three years. In CAI, I think it takes five years to develop a system before you can run the equipment rather than have the equipment run you. In these projects everyone begins from point zero, goes three years, and stops. Innovation does not spread because there is no incentive. Now in business, there is a dollar incentive, a salesman goes from door to door. He is the transmitter of information. In instructional technology we begin from zero and make the same mistakes over and over and over.

Achieving Effective Use of Instructional Technology, By Thomas D. Clemens

"I would spread my dollars in the first year—and I would change the spread through the years—over five different kinds of functions. First of all, I'd put money into the generation of new knowledge, research if you will. Secondly, into the engineering of that knowledge into materials, practices and resources—that is, into development. Third, I would spend it on facilitating the trial, adaptation and adoption of instructional technology systems by operating educational agencies of all sorts. Fourth, I would support training. And finally, I would put money into maintaining what is usable in the system now.

"Now how would I spread the money? Well, starting with the assumption that perhaps the maintenance of what we have now can be improved, even if there isn't all that much to maintain, I'd put perhaps 10% of my dollars into maintenance functions. This would include increasing the access (both intellectual and physical access), to resources like instructional materials and so forth—into monitoring the system, allowing for interchanges. For providing incentives, incentives to industry, for example, to exploit those things which are already available, incentives to educators to take risks, and so on. This would be, as I say, at about a 10% level and this would have to grow through the five year period as the state of the art improved.

"Secondly, I would put perhaps 15% of my money in the area of research. The great bulk of [illegible] would go into applied research and particularly applied research *in situ*, in which we are looking at what actually occurs when there are instructional resources which can be used in a systemic way in education. I think we've had enough studies of how a classroom teacher uses a movie or a television receiver or whatever, in a self-contained classroom. But how to begin to use instructional media as a system and where the teacher changes her role to behave in a different way, given certain changes in instructional materials and equipment, this is something we have badly neglected in our research. I think that we in the Office of Education have been derelict in not force-feeding this type of study for five years or more.

"I would also, though, reserve some of this 15% of the money for basic research. Since I think that much inquiry-oriented (as opposed to decision-oriented) research can be carried on at a less expensive level, at least at our present state of knowledge, I would put more money into the naturalistic, applied, *in situ* type of thing, but I would make sure that the basic researcher was protected, not expecting him to have any significant impact on the field in the near future, but allowing him to go ahead and develop our knowledge base.

"I'd put perhaps one fourth of my resources into the area of development, since we need systems of instructional materials, empirically verified, a terribly expensive business, and recognize that it is going to have to stay at this level, perhaps four or five years. And this would involve the kind of iterative development that both Bob and Andy have talked about. It would involve not just iterative development in laboratory settings, but field tests as well.

"Installation, I feel, is extremely important because one of the reasons we are not making use of what is now available to us is that educational budgets simply have no room for risk capital. When roughly 80% of your budget is tied up in instructional salaries, and the remainder goes for fixed charges, for construction, and other static categories, there just is not that much money for the local administrator to use in attempting anything new. He does not have budgetary flexibility and fiscal flexibility is one of the most powerful predictors of adoption of innovations in education, according to some of the most recent information. Therefore, on a competitive basis, I would have 20% of my money available for institutions which could give evidence that they had seriously explored what was available in terms of resources, had worked on some kind of a definition of their instructional problem, and could provide a work plan for adapting and (if successful) installing an instructional system or some other change. They also would have to give some commitment of their own resources, from the beginning—hard commitment, not just words—for them to get this money.

"The other 25% of the money that I'd have left, I would put (and this would decrease as time went on, but over a period of perhaps two to three years I would put as much as 25% and decline from there) into training. First of all, in-service training would not be for getting teachers who have just come into the schools to know how to use a television series or films or a self-instructional program, or whatever. The training would orient them toward more systemic uses or materials, toward the idea that the classroom teacher is not alone, that she need not be in a self-contained classroom. Also, I'd put a substantial amount of training money into attempting to generate developers of instructional resources. We can do pretty well using the researchers we have now. They'll propagate themselves, but the educational developer, the educational engineer is a different kind of animal, and we're not doing a very good job on him.

"I would also try to provide some kind of training to give this field the surge of leadership which it needs. It seems to me that our leadership is getting old. I don't see a lot of young people moving in behind us oldsters. It seems to me that we have to do some force feeding to get some of the young people in their 20's and early 30's, moving at least to the middle management level."

Business: Looking, Leaping?

Molnar: I think that is the most pertinent question—who the audience is. There is an article by Theodore Levitt in the Harvard Business Review in which he says about educational technology that [illegible] is a demand, people want it, people know about it, but there is no market. We've spent 2.5 billions of dollars, in the last four years, through the Office of Education, but there is no customer. Nobody can afford it. No school district is large enough to spend 8 million dollars for Project Physics; 10 million dollars for a U.S. Naval Academy project or 8 million dollars for 26 weeks of Sesame Street. There are, literally, no customers. And his advice to business people was to look before they leap or stay out of that area. And I think that is supported by the IBM withdrawal from CAI, and the tough sledding that all of the knowledge industry people are having in selling technology.

Levitt concludes that there is only one customer large enough to procure systems and that's the federal government. And frankly, that's where we're at right now. We're going to go back to the small audiovisual packages that school districts can buy, and I think that's where the market is. And the big systems are just not going to be purchased without federal support.

Achieving Effective Use of Instructional Technology, By C. Ray Carpenter

"Let us say you've got 50 units of funds to spend in some way. Obviously if we can find a base of ongoing operations to begin with, rather than create something new, then we're ahead of the game. And in spite of all the pros and cons about the R & D Centers and the Regional Educational Laboratories, I think that these are organisms in place that need to be doubled or tripled in size and scope as rapidly as possible. They need to be restaffed to a certain extent, to take advantage of the technology that exists. The people who already staff the laboratories aren't, in most instances, instructional or communications technology sensitive. In some instances they are. But every one of these labs and centers is working on the question of producing instructional materials, trying out models, trying to get something going, in some instances in a rather primitive manner.

"I suppose if you are dealing in units I would put about 10 of my 50 units into the R & D Centers and Labs. More of them ought to be built to cover the spectrum of education from public schools on through college, university and into continuing adult education. Obviously the leadership on the federal level is going to have to be greatly improved and expanded. . . .

"We need media libraries that function as search, find, modify, transform, and make ready for use operations, not just storage. And when you come to the more conventional function of the library, what we see in the country is that the media material is moving into more specialty libraries, away from the main traditional libraries. We haven't yet solved the problem of adequate library services for media materials other than print. And maybe 10 more of my 50 units ought to go to the building of new kinds of media libraries.

"The other great untapped resource that I see is in the private sector. We just haven't worked out a way, in spite of ARISTOTLE and all the other DOD efforts, and the Media Council, of defining for the private sector proper roles so that they can function effectively in order to meet the needs that the government agencies aren't going to be able to meet.

"This problem has bearing on your Media Council, which needs to be expanded. The whole business should involve the making of partnerships to get the kinds of learning stuff produced and tested, and properly distributed. I think that this is one job that we can do relatively cheaply. The energy is there. Particularly if we can get out of a war economy, and swing our efforts into another kind of a critical area. So I don't know how to put a figure on that, but I think that 5 of my units would go a long way down the line toward beginning to open up the potentials of government-industry cooperation.

"I'm convinced that we already know a great deal about the learning processes, but I think that a sustained effort in basic research has to be continued. I think the information springs are going to dry up if we get off on the pure application theme and stay there, and I think the disregard for basic research, the low prestige that it has, the low prestige of university research operations, is a modern disaster. All of this is going to make it extremely important for us to try to sustain some kind of basic research all the way through pure theory and particularly communication theory and learning theory.

"Now my final investment, and I think I'd put about 10 of my units on this, is the training of leadership in this field, broadly, not just in technology, but having presidents and provosts and deans who know the score in terms of running a complicated educational system or institution. And unless I miss my guess, we have a serious deficit here. Particularly in this area where it's assumed that leadership development is somebody else's business. Even good university presidents have not really understood instructional technology and how to build it into their institutions."

Motivation or Neurosis?

Clemens: We are pretty well convinced, from all the evidence we have, that although you may expect certain kinds of scholars and others to read basic research documents, they are not going to be read by most practitioner groups. It doesn't help very much if, for example, a superintendent says, "Tell me about the effectiveness of instructional television," and blahhhhh, you throw out 450 separate comparative effectiveness studies. Even if he were so motivated as to read them—and I wouldn't consider that motivation, I'd consider it neurosis—he wouldn't have time to, if he had the competence to really filter out all the technical jargon and so on.

We have become convinced from some evidence, and from some education by Don, Bill, and others, that it is essential to find ways to begin putting increasing amounts of money into the transformation of the documents, collections of documents, and of practical and practice information into interpretations and syntheses tailored to the decision-making and decision-implementing process in the schools.

Systems and Little Bits and Pieces

Molnar: We fractionate our federal programs. There are 15 different Acts and Subtitles allowing for planning, research, development, training, facilities, equipment, materials, dissemination, and networks. Programs administered by six bureaus at different levels of organization. The law provides for grants, contracts, provisions for outright grants, up to 55% sharing, administered at the federal level, Office of Education, administered through state departments, administered through local educational agencies, institutions of higher education, state boards, vocational education, research labs, research and development centers, laboratories, U.S. regional offices.

Now, you can't build a system with that many people. Especially if you split it up equally over 23,000 school districts and 2300 universities. We've fractionated all of our legislation to the point that it makes no sense at all. You know, you can't do business that way when you're talking about systems. Systems don't come in little bits and pieces. They come as wholes.

Business Not As Usual

Carpenter: What are we doing with instructional technology to make it useful in this situation [the state of conflict present in schools and colleges today]? One way or another—is instructional technology operating adversely? I don't want this to be a distraction, but I think my main point is that business is NOT as usual at Penn State and Georgia and Maryland and a dozen other places. It's not likely to be "business as usual."

An Educational Moon Shot?

Molnar: I think we know enough, I think that Sesame is a demonstration that we do have the empirical methods to put together programs that will work. I just did a paper on computers and instruction, and the same thing is crystal clear in computers, while researchers can't tell you explicitly how to design a program, they can design an effective program through an iterative method. Secondly, since there are no customers, there are no systems. There are attempts at some hardware developments, but we're a bunch of amateurs when it comes to systems. I hate to think what would happen if NASA had turned over the moon program to the educators.

Clemens: We'd have the biggest damn slingshots in the world. . . .

Molnar: We would. And we would have 50 of them, or 23,000. Frankly, I think Alaska will have the first satellite system, and they will be using the Canadian satellite, not the U.S. satellite. . .

Achieving Effective Use of Instructional Technology, By William G. Harley

"Let me indicate some of the things that concern me about depending upon federal support. The facilities program for public broadcasting is continually in very bad straits. The administration is now advocating five million dollars for a program where we already have on file well over 30 million dollars in requests for matching grants! This program has been spectacularly successful in terms of the federal yield. Returning, at a level of about 16 to 1, non-federal money that is generated from the multiplier effects upon local and state sources.

"One of our concerns is filling in white spaces; about 25% of the American population is still outside the reach of the educational television signal. And it's even worse in educational radio. But we're more concerned at the moment with the deterioration of the existing system, which is the kind of thing we forget about as we keep thinking about new systems. But we shouldn't let what we have established fall by the wayside.

"Our stations and our transmitters are ten to fifteen years old, about 50% of them are not utilizing the full power for which they're licensed, and their towers are lower than the commercial stations around them. We've only got about 10% of them with color production capability. And only about 50% with color transmitting ability. If educational television on public broadcasting is really going to achieve anything in this country, I think it has to have a technical capacity that's on a par with the commercial systems. The matching principle has been established for the facilities program, and has worked well, but the program ought to be properly supported. It may improve, but at the moment it's in really desperate straits. It's been so undernourished for the last two years that it's almost a disaster. So that's a major concern.

"I don't happen to agree with Andy that we can't do something with demonstration centers. But, then again, it's a bias that grows out of my Samoan experience. I brought nine major city school superintendents down to Samoa to look at a system in actual operation, and the impact was just tremendous with those guys. I don't mean that they went back immediately and embraced the whole system in their own city, but I was tremendously impressed by the difference between talking about it or sending literature and so on and having them see an operation . . . a comprehensive application of television to a total school system.

"I still think that it would be tremendously useful as a compelling demonstration and a convincer to people if we could have a few domestic Samoa situations constructed. I know that you can't transfer the whole thing because we had a special environmental situation there where we had a good deal more control than you have in a complex educational situation in this country. But I think something approximating that could be done in two or three places. I think that nothing is so convincing as that kind of on-site demonstration of a real working operation. I would hope that some money could be put into that kind of activity.

"One other thing, quickly: There should be established a public communications policy planning office within HEW, because HEW has tremendous responsibilities in communications and has no one in charge of that area. Now the division over in the U.S. Office, the new one, in Libraries and Educational Technology, is better than we had before, but I still don't think that this takes the place of an office at a higher level, closer to the seats of power."

The Role of Research Studies

Carpenter: Let me raise a question, and we can drop it as soon as I raise it if you wish. When you listen to a hundred people talking for an average of six hours on what are the factors which affect the quality of instructional materials, and almost nobody ever refers to research literature–although in another context, the same people would play the role of researchers–what does this mean?

Paisley: Is this an actual content analysis of the meetings?

Carpenter: No. There were 12 seminars that lasted from half-a-day to two days, a total of 117 hours, and they all worked on the level of opinion, with little or no specific reference to research. What does this mean, in terms of the role of research studies in educational decisions? What does it mean in terms of how people think about practical media problems? What does it mean in terms of how to get information to people that would be useful to them on a certain semantic level of generalization? This is an issue that really disturbs me, and I don't know what the answer is to the question of how to disseminate the results of research.

Interaction and Maladaptations

Clemens: The problem is that any adaptation of the thing as created by Bob Glaser, or any other first-class scholar, necessarily has to be transplanted and inplanted that way in 17,000 school districts. Well, I happen to agree with Ron Lippitt. When he says that most social changes and almost all educational changes go through a process of adaptation, rather than wooden-headed adoption like planting hybrid seed.

The important thing is that both research and practice have to contribute to make sure that they're adaptations rather than maladaptations. And I don't think that you can do this just with one-way communication media–be they print, film, or whatever. This requires some kind of two-way interaction between the earlier and the later adopters.

Achieving Effective Use of Instructional Technology, By Andrew R. Molnar

"Frankly, I think Sesame Street succeeded because it didn't go into the educational system, and didn't compete with it. We didn't get superintendents from 23,000 school districts to decide what the curriculum would be. We didn't worry that the curriculum might be determined by a handful of people. We didn't worry that it might have some ill effects as well as good effects. We just went ahead and did it.

"I don't think that 50 million dollars, no matter how well spent conceptually, will make one iota of difference unless we look to the multiplier programs."

Achieving Effective Use of Instructional Technology, By Robert C. Gerletti

"What I get concerned about is that we get going down a good path and so often, as you've indicated, instead of running five years you run three and you don't know what would have happened in two more. I didn't allocate dollar amounts, because you fellows have already done that. But a couple of things I'd like to get developed out of this: I'd like to have some replicable, transportable models, that will work in the real world. Whatever that takes to get, five to ten years.

"If you only have 50 million dollars, priorities are going to have to be established to see how you spend it. Some of the things that you've suggested are going to take a lot more than that to maintain. And you know, if they phase out, where are you? I'd like to see, for example, how the federal, state and local levels could really work on something–on CAI, for example. I'd like to work out a model as to how you would interface those three levels.

"And then I'd like to have some investment in validated uses of materials. Right now, you've got four groups looking at the media field, and you've got three working on bibliographic kinds of things, maybe more than that. Piecemeal, too small, nothing is going to happen from any of them. They're all going to phase out in about three years and you know, we will end up with a system that's not going to be of any great value to any of us."

Achieving Effective Use of Instructional Technology, By Robert T. Filep

"Unaccustomed as I am to spending 50 million dollars, I'll take it on as a task, and make the assumption that we may have a National Institute of Education, and also that we are concerned with not "make it new," but rather with "make it work." A real stress on research, development, application, feedback cycle–the RDAF model–is required. About 9 million or 10 million dollars on basic research and development with a good stress on programatic efforts. I think that if I've learned anything out of the Title VII study it's that a programatic approach to funding research is important. There are institutions out there that ought to keep doing it. I think Title III, the R & D centers ought to have a mandate, but this doesn't exclude industry. I think the DOD has benefited from the fact that it's had both the public and private sectors involved in its research and development efforts. And I think we ought to enable industry groups, ones with the capability, to be involved in this program.

"I think we need a development model, and I would suggest, and this is not nepotism or chauvinistic, but I think California is on its way to developing a statewide system that looks at the components of a systematic approach to instruction and I'd like to give 10 million dollars to the state to develop that statewide effort. But design it to involve all components of the society, including the legislature. There's Senate Bill No. 1 that states that school districts will have their goals spelled out by 1972, and then move to the instructional objectives. There's also legislation that deals with the program planning budgeting system, there's one that says all right, let's get criterion reference testing in place so that we can diagnose the kids as they go along, and provide additional appropriate instruction.

"I could see a massive infusion of funds to set up an information retrieval model, a statewide model, with the commitment that the products that come out of that, the software and everything else, are readily available to any other state or school district that wants to use them.

"In the development and application area, one of the problems is that I haven't seen a pre-service program that inculcates the kind of systematic approach to instruction that we talk about. Somehow it's getting done in a haphazard way, but the new teachers–when we look at what their in-service needs are–they almost have to start from scratch. They've come out of a traditional program. I'd like to see 10 million dollars allocated to set up maybe 10 new schools of education that would be developed from the standpoint of a systematic approach. And I think all of us would admit that any department of educational technology that's up and operating is having a difficult time interfacing with the rest of the departments in the school of education, not necessarily the others in the university.

"Any department of educational technology, I don't care if it's Indiana, if it's USC, if it's brilliant, it may not be as rich as Indiana but any, you name it, it's having difficulty interfacing with other departments in the school of education. And I wouldn't say that it's a campuswide problem, it's more within the restrictions of the school of education. Title VII demonstrated that a lot of people came into the field from other disciplines, this is really what made educational technology, we had engineers, we had psychologists, we had operations people, we had communication research people–and these new schools of education should have that kind of flavor. They should be multi-discipline, even drawing on the sociology department to look at the cultural factors and come up with some new models for a total pre-service package. So I'd invest 10 million dollars there, and of course the corollary would be that you'd get a capability to provide excellent in-service training for administrators and teachers in the classroom.

"I'd spend a little money on the feedback-use center, I feel that's a critical need. We don't have the information as to what's working, how well it's working, in what place. Whether it goes to an expanded ERIC or what have you, I feel those kinds of data have to be pulled together in a form that's usable, where somebody can enter the system, interact with it, get information back that's unique to their particular needs as they go about applying the technology.

"And then last but not least, I'd save one million dollars to get at the interface between educational technology and the social problems that I mentioned this morning. If we don't, it's a new ballgame and there are new assumptions and we damn well better deal with them. We violate our own perceptive code of a systematic approach to instruction because we're not dealing with the environment in which the instruction has to operate."

Computers and Attendance

Molnar: Somebody pointed out that if they put CAI into some city school systems its attraction could increase attendance to 70 or 80%–from the present 50%–and increased state payment for daily attendance would amortize the cost of the computer. You wouldn't have to worry about the effectiveness.

Researchers and 10 Questions

Molnar: A business friend of mine talking about researchers said if he has a question, he never goes to researchers. I asked why not. He said, "Well, if you give the question to a researcher, he'll come back with ten more questions. What I do is hire a consultant because he'll give me an answer. He doesn't know any more than the researcher, probably less, but at least he'll give me an answer and I know what to do then."

Achieving Effective Use of Instructional Technology, By Albert Hickey

"I was interested in flipping through the responses that the people who answered the questionnaire made to that question. One struck me which may not be too relevant to how you spend 50 million dollars, but one chap asked, "What does society expect from education?" And I think that's a very critical question right now. Another thing that I'm not sure tells us much about how to spend 50 million dollars is this business of getting a more straightforward relationship between the federal concern for education and the private sector and so forth. That might be accomplished for virtually nothing, just by a legislative study to try to clean up the connections between the two. And this might be a proper function for some activity within Health, Education and Welfare too. Either try to clean up the existing legislation, so the people who are operative in the field can understand it and go ahead, or propose something new to substitute. . . .

"I don't know how many seminars or symposia there have been in the last couple years involving publishers and people from USOE, and my feeling is that they've come away just having not cut through anything. So I think that it's not a matter for a symposium, but somebody has to decide whether the thing can be cleaned up or not. The companies who are the logical people to package and disseminate and so on, don't know what their rights are, don't know what their risks are at this stage of the game."

Systems Approaches, But No Common System?

Molnar: We said, all right, if we're to provide information, you've got to be able to ask the right questions, and you ought to look at it using a systems approach, and you have to look at it from the decision-maker's point of view. So we initiated a study. We set up a hypothetical decision-maker and outlined all the proper questions and used systems concepts liberally.

Then, we asked, why not take the model out and try it on about 50 universities, and see how well they do. The researchers came back pulling their hair out and they said, "Well, you know, no university has the same decision process. Every system is different. There is no uniformity. One system, the president can buy; the next system, it's the controller; the next system it's the department head, the purchasing head, on and on and on." So, you know, we came to the conclusion that while systems concepts may be of assistance, there isn't any common system to apply them to. Unfortunately that's our prime user, that's who we're trying to assist.

Verbatim Responses to "What Major Trends do You Foresee in the Following Areas? That is, What Concepts, Approaches, Arrangements Will be Dominant?"

In Research and Development:

Increase in applied research and development (15)*
Large scale systems and system planning (14)
Media relationships to educational objectives and task analysis (8)
Accountability and cost-benefit factors (7)
Individualization of instruction (7)
Easy-to-use low-cost individual devices (6)
Media relationships to learner characteristics and learning strategies (4)
Media use with disadvantaged and lower SES groups (4)
A more systematic approach to developing instructional materials (4)
Application of learning theory to instructional technology (IT) (4)
Simplification of equipment (4)
Multi-media use and integration (3)
More "team" research (3)
Computer-managed instruction (3)
Computer-assisted instruction (3)
Implementation models for various media (3)
Application of management models to curriculum design and teaching (2)
Instruction development (2)
Innovative approaches (2)
Extension of R & D Centers (2)
Poor national climate for research now (2)
Lasers and holography (2)
Response systems (2)
How to reduce resistance to technology
Application to teacher education
More community involvement
Emphasis on micro-systems of learner interaction with small units of curriculum
Model building and development of system simulation
Curriculum development in the health sciences
Behavior tracing studies
Greater emphasis on process than on content variables
Early childhood programs
Techniques of research management
Problems of social importance
Reading
Exceptional children
More concern with mechanical equipment
More concern with increasing profits of industry
Application of electronic devices for teaching reading
Two-way multi-channel cable interconnections among schools and universities
Compressed storage of data for rapid selection and retrieval
Integration of research findings into a few basic generalizations for precise prediction
Increased attention to humanistic goals in program development
Instructional materials centers
Analysis of factors which affect conditions of learning in relationship to all phases of IT
Modular small units of curriculum
Refinement and application of current hardware to learning situations
R & D effort to stabilize the present incompatible and redundant hardware systems
Documentation of case studies to serve as models for replication
Enriching environment as related to CAI use
Spatial diagramming of stimulus information
Emphasis on instructional strategies and their variates
Increase in synergistic approaches
Application of programed instruction to subject matter areas
Development and implementation of learning theory in early childhood education
Learning systems using incentive components as elements in anti-dropout programs
Action programs will replace research and development
Increased emphasis on classroom use of media and its deterrents
Forecasting and innovation research
User (student) oriented research designs
VTR
CCTV and CATV
More home instruction
Less emphasis on contribution of speical media types
Tape recorders
Continued proliferation of mechanical aids as supplements
Continue to support outdated curriculum
Development of a number of new devices, most of which cannot be used in the schools

In Evaluation:

Cost-effectiveness and accountability measures (18)
Product development, tryout, revision, and measurement (8)
Evaluation of entire systems (7)
Application of more rigorous evaluative techniques (6)
Equipment evaluation efforts (6)
Maintenance of the status quo (4)
Investigation of areas that defy effective evaluation (3)
Measure of individual learning as related to defined objectives (3)
In-depth analyses by computer (3)
Computer evaluation of achievement related to learning objectives (3)
Evaluation of materials by teachers toward meeting objectives (3)
Criterion-referenced criterion measures (3)
Computer-managed instruction; cumulative performance profiles of individual learning (3)
Computer analysis of learning problems (2)
More positive data on effectiveness of all media (2)
More toward performance measures (2)
Diagnostic and prescriptive evaluation (2)
Concern with practical and useful information
Critical thinking, problem solving, etc.
Setting criteria and guidelines for evaluation of different classes of IT
How to establish feedback on effectiveness
Translation of learning principles into design principles
Relationship of media to individual characteristics
Development protocol materials for teacher training
More contracts to private industry to evaluate
More emphasis toward student-time required to meet objective
Self-evaluation
Electronic and chemical evaluating instruments
Evaluation a continuous process
Emergence of evaluation teams
Continued evaluation on a behavioristic basis
Those using evaluating to serve a given device or process will have trouble
Only limited evaluation on short term effectiveness
Reduced emphasis on objective tests
"Sequential testing"
"Confidence testing"
Use of latency as a measure of learning
Programing of pace and content toward established learning goals
"Soft" evaluation as opposed to "hard" evaluation
Long-term research for follow-up evaluative studies
More independent testing by outside agencies
Development of precise evaluation instruments
Systems of instructional objectives will be developed and disseminated
Need learning validation studies in CAI
More differentiated tests with flexibility built in
Evaluation of interrelated contributions of media to learners, different disciplines, and unique school situations
Media evaluation in specific contexts as part of the system
Continued publication of non-tested materials
Mechanical aids will come under attack
EPIE continuation
Continued studies in CAI of cost per hour, number of terminals, response time, etc.

In Commercial Production:

Validated multi-media packages (18)
Systems approach and design of learning systems (13)
Large corporations enter the educational market (11)
More commercial cooperation with schools in materials production (9)
Individualized systems (6)
EVR (6)
More telecommunication systems (6)
Efforts to reduce cost; more low-cost products (5)
VTR (5)
Increased software emphasis (5)
Tape cassette (5)
Establishment of general media standards and selection (4)
Validation of effects on particular audiences through pre-production testing (4)
Maximization of student performance (3)
More concerned with statement of specific educational objectives (3)
Unit and modular formats (3)
Commercial producers will fit software to hardware (3)
Hardware development will precede software (3)
Super 8 film format (3)
Better utilization of computers (2)

*This means that 15 different respondents made essentially this answer.

Manipulation of educators by commercial interests (2)
Companies hesitant about full-scale entrance into the market (2)
Complete education in the home (K-grad school via TV and self-instruction (2)
Mini-computers (2)
New equipment for individual study (2)
More diverse equipment (2)
Retrieval systems (2)
Targeted to population
Increased accessibility of materials
More social action materials
Evaluation of published materials
More commercial linkage with R & D agencies
More open-ended material
Large-scale computer-managed instruction
More self-instruction in new learning environment-centers (industry, community)
More material for the urban child, rural and poor child
More emphasis on learner effects
Better quality
Continued release of "poor" materials ("Junk" programs)
Better utilization of visual display system
"Hard sell" by commercial interests
Initiative will have to come from school systems, not industry
New forms and formats
Dial-access
Cost reduction efforts
Central multi-media library banks
Films for TV in local systems
Increasing competition for hardware people
Advantage to those who can offer software with hardware
EVR will fade as users realize software problem still exists
CAI slower in being accepted
Conventional media produced in greater quality and variety
More material for individual use
Industry takes lead
Developing software for existing hardware
Materials designed as modular components within instructional process
Less commercial production because of need for government subsidy
Holography
Reduce CAI costs
Contract specified learning will increase
No movement toward needed standardization
More materials with no motivation treatment but of the same kind
Follow trends in entertainment field: multiple images, faster pace, etc.

In School Adoption:

Little change will occur (7)
Schools will be completely redesigned using technology (6)
Change will be brought about by economic pressures on budget and pressure for results (5)
Adoption will be random and ill-defined (5)
Retrenchment because of financial squeeze (5)
Of programed instruction (4)
More toward systems applications (4)
Cost-benefit accountability procedures will determine change (3)
More individualized instruction (3)
More need for money (3)
Develop model procedures for adoption of IT (3)
Adoption of larger systems rather than packages (3)
Development of standards will stimulate adoption (3)
Purchase of equipment without clear idea of use (2)
More total courses teaching (2)
Television adoption (2)
More use of tape cassettes (2)
Television adoption (2)
Directly related to assistance from manufacturer to the school (2)
Greater teacher involvement (2)
Closer school-industry relationships (2)
Purchase of packages designed to specific objectives (2)
Schools will show they are not resistant to change (2)
Need a big "breakthrough" in demonstrating effectiveness (?)
Development of contractual arrangement with other agencies (2)
Practitioners become researchers, applying technology to design
Emphasis on teacher differences
IT incorporated in team teaching
Less emphasis on textbooks and more on media
State and federal pressure will bring change
Centralization of school systems
Change will be function of number of workshops held
Teacher major cause of delayed acceptance
More emphasis on implementation as opposed to development
Total community as a learning environment
Greater use of systems that have minimal requirements for teacher
Less formal textbook adoption
Subject areas will integrate more
More flexible scheduling, redeployment of teachers, team teaching
More acquiescence to adoption without considering negative implications
Easier adoption of small units than major concepts
More sophisticated school purchases
Growth in non-public schools
Less priority to enrichment materials
Empirical testing prior to adoption
Instructional materials centers in buildings
Emphasizing of individual learning needs
Fear of IT will diminish
Programed single concept material
More emphasis on teacher-prepared material
More use of radio
More use of print
Some reduction in book orientation
Extension of school year and day
Gaming and simulation
Large computers for central facilities; small for department and classrooms
Increasing learner use of media production materials and equipment
More learning centers
More flexible scheduling
More regional and county cooperation
Learning carrels
Cartridge loading projectors
Limited introduction of EVR
IPI increase that is achievement-oriented
Hardware ahead of software
Innovation and experimentation programs that have no effect on direction of educational change
CAI many years away
Growing disenchantment with VTR
Schools increasingly cautious because of bad past hardware experience
Reduced use of films, TV, and group presentations
Concern about equipment obsolescence

In Legislation and Other Government Activity

Little or no positive change for two to five years (13)
Legislation will support programs showing increased effectiveness and efficiency with cost-benefit emphasis (9)
Increase of development funding for systems (6)
Positive reaction to Committee on Instructional Technology report (6)
Turn toward large-scale solution of problems with national priorities (5)
More money for public TV and non-systematic educational programs (5)
Increasing state support for research and equipment (5)
Decrease of research funds (3)
More support for professional training programs (3)
Less support for acquisition of equipment (3)
Emphasis on standards (2)
Copyright legislation will have influence on copiers and computer storage and retrieval (2)
More simulators and training aids for military use (2)
Equipment purchases to continue (2)
Passage of some form of Education Technology Act (2)
More support for research that is "practical" and shows results (2)
More vocational education (2)
Consolidation of related overlapping programs (2)
Education given more priority if military spending slows
More adult education
Develop organization for equal access to resources
Provision for experimental and innovative schools
Team teaching and differentiated staffing in use of IT
Research on significant role of IT in education
Continued matching grants
Limited introduction of EVR
More for private schools
More for the disadvantaged
More money for commercial development
More money for "Sesame Street" and "Texarkana" type projects
More programs directed toward social and cultural problems
More active government role in seeing superior materials gets disseminated
Trend toward certification of IT specialist, further widening gap between the specialist and the teacher
Educators will cooperate with each other more and more
Too much money will be given for hardware for the sake of hardware
More money for encouraging adoption of IT without considering effects of technology on man

Love of gadget will triumph
More ineffectual but politically oriented programs
Regional media clearinghouses
Software purchases to continue
More money for VTR
More money for direct instructional use to produce measurable instructional improvement
Merging of library and media functions for evaluation
Development of a few large-scale pilot projects
Establishment of regional and national centers for design and production of materials
Foreign country use of CAI
Effort to broaden tax base
Support will shift more to commercial companies
ITV support
Software development
Funds granted on less permissive basis, as adjuncts to on-going programs, with little thought to program analysis or systems planning
Declining CAI support
Legislative pressure to "cure" educational ills before the causes are carefully diagnosed
Diminishing local support

Verbatim Responses to "What are Some Developments, Products, Innovations, Systems, etc. that You Think the Field can be Proud of? If We Wanted to Show Our Present Strengths to Congress and the Public, What Would We Talk About?"

Broad Developments

Individualized instruction (15)*
Development of leadership and professional competence in IT (7)
Application of the systems approach or design of education as a totality (6)
Application of behavioral objectives and task analysis concept (5)
Entire instructional job can be done by media (3)
Can show only bits and pieces, but no significant practice (3)
Demonstration of effectiveness of IT applications on learning, attitudes, etc. (3)
Emphasis on product accountability (3)
Shift in emphasis from teaching to learning (3)
Establishment of public TV and radio systems and stations (3)
Instructional materials center concept (3)
Potential of TV in the home (2)
Potential of IT in making education relevant for different types of learners (2)
Some effective innovative programs that have influenced experimentation
Systems for reinforcement contingency management
Establishment of R & D Centers and Regional Laboratories
Has reduced the traditional 50 year time lag in the application of educational reform
Student interest developed in using, working with, and developing media
Increasing instructor interest in replanning instruction for media use
Research has shown how to produce more learning-effective materials
Concept of empirical tryout and revision of materials
Public awareness of professionalism in the field
Armed Forces and industrial training applications
The most creative thinking today is by instructional technologists
Potential of international information networks
Use of technology in newer schools
Response to inquiry and discovery approaches
Beginning to realize complexity of education's problem and to realize there are not simple solutions

Product Developments:

Hardware (3)
8mm film loop (3)
Cassette tape (2)
Development of simulation and games (2)
Nothing to be proud of; too concerned with gadgetry (2)
Combination slide-tape devices
Accumulation of resources of AV materials for later retrieval
Vast amount of equipment in schools through federal programs
Increased standardization of equipment
Some "good" programs on the market
Stress on inexpensive equipment
Product design at Southwest Regional Laboratory

Special Programs:

"Sesame Street" (9)
ERIC system and similar information retrieval systems (2)
Postelwait's Audio-Tutorial system (2)
Pittsburgh's IPI program (2)
American Samoa TV Project (2)
Oregon's Teacher Training Simulation Project
Borg's minicourses for microteaching
Allen Bush's microteaching system
Bruner's "Man, a Course of Study"
SRA's Inquiry Development Program
Wisconsin's R & D Center on Individually Guided instruction
The Open Schools
Plato at Illinois
Buchanan's Programed Reading
Sullivan programed instruction materials
EPDA
Suppes CAI system
Improvement Institute Program at Michigan State
Captioned films for the deaf
Regional Laboratories
Case studies under Edling's IPI Study
The many exemplary programs

*This means that 15 different respondents made essentially this answer.

Verbatim Responses to "If You had a Significant Amount of Money (Say 50 Million Dollars) to Achieve Widespread Effective Use of Instructional Technology, What Specific Projects or Programs Would You Undertake? In Other Words, What *Are* the Major Problems, and How Would You Proceed Against Them?"

In-service education and training programs at all levels and for all types of personnel (15)*

Instructional materials and course development (11)

Demonstration and experimental centers and schools (9)

Build in a reward system for technological application (6)

Use of TV and radio on a broad scale for dissemination, training, and direct instruction (6)

Analyze educational objectives and find means of implementing; redesign of education; new patterns of organization (5)

Change schools toward individualization of instruction (5)

Focus on the learner, matching instruction and curriculum to his characteristics (4)

Set up R & D Centers to research specific problems and then develop instructional materials (4)

Use the systems approach to design optimum educational systems (3)

Use a group of the best minds in the country to come up with possible solutions to the problems (2)

Develop a system of contracted educational services (2)

Develop computer networks regionally so can contract for different curricular materials

Provide mechanism for self-sustaining efforts that return money to treasury from produced materials and services

Expend funds on efforts that have a multiplier effect

Develop programs to restructure role conflict between IT and educational system by bringing IT and learning into accord

*This means that 15 different respondents made essentially this answer.

STANFORD UNIVERSITY

STANFORD, CALIFORNIA 94305

ERIC Clearinghouse on Educational Media and Technology
The Institute for Communication Research
Cypress Hall
Telephone (415) 321-2300 Ext. 3345

ERIC Information Analysis Planning Project

Panel Questionnaire

This questionnaire deals with the future of:

A. Instructional technology in the broader sense. That is, scientifically designed and evaluated systems of instruction. These systems always involve people. They sometimes also involve...

B. Instructional technology in the narrower sense. That is, mechanical aids to instruction, ranging in sophistication from the phonograph record to the computer.

The questionnaire also asks your advice on future activities of the ERIC Clearinghouse on Educational Media and Technology. As the federallly supported information center "responsible for" instructional technology, we want to use our limited resources for publications, special projects, etc., in ways that will be most beneficial to the field.

If you need additional room to write responses, please feel free to use the back of the sheets.

In answering the following questions, please think of the next five years of...

- research and development
- evaluation
- commercial production
- adoption in schools
- legislation and other government activity
- etc.

... in instructional technology.

[Note: The remainder of the questionnaire has been condensed, for inclusion in the report, by deleting the spaces provided for answers.]

1. Taking instructional technology in the broader sense (systems of instruction), what major trends do you foresee in the following areas? That is, what concepts, approaches, arrangements, etc., will be dominant?

   In research and development?

   In evaluation?

   In commercial production?

   In school adoption?

   In legislation and other government activity?

   In other trends not covered above?

2. Taking instructional technology in the narrower sense (mechanical aids to instruction), what major trends do you foresee in the following areas? That is, what devices, programs, use concepts, arrangements, configurations, etc., will be dominant?

   In research and development?

   In evaluation?

   In commercial production?

   In school adoption?

   In legislation and other government activity?

   In other trends not covered above?

3. The report of the Commission on Instructional Technology mentions many deterrents to the effective use of instructional technology (with emphasis on mechanical aids, but with the acknowledgment that instructional technology is "a systematic way of designing, carrying out and evaluating the total process of learning and teaching in terms of specific objectives").

   If you had a significant amount of money (say 50 million dollars) to achieve widespread effective use of instructional technology, what specific projects or programs would you undertake? In other words, what are the major problems, and how would you proceed against them?

4. Looking at the positive side of instructional technology, what are some developments, products, innovations, systems, etc., that you think the field can be proud of? If we wanted to show our present strengths (or near-future potential) to Congress and the public, what would we talk about?

5. If you have other general comments about the state of instructional technology, would you write them here?

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