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ABSTRACT

Various predictions are being made about the future of library technology, but many of these are "paper dragons"--exciting and plausible, but made without real consideration of need or of the possibility of implementation. A review of many such forecasts makes it possible to develop criteria for a logical and credible prediction: technical feasibility, practicality, social feasibility, economic feasibility, and moderation in statement. This is not to say that forecasts should not be made, especially where technical feasibility is concerned, for the past twenty years has shown just how fast technology can progress. Predictions can be made in such areas as the solution of the photocopy/copyright problem, standardization of bibliographic control and improved microform usage. The technology for these advances already exists, the needed developments are sociological, involving cooperation, user acceptance, and the designing of new procedures. Indeed, the greatest advances in library/information technology during the next twenty years may not come from new technologies at all, but from better applications of the technologies that already exist. (SL)

FORECAST FOR LIBRARY/INFORMATION SERVICE TECHNOLOGY

by

Philip Leslie*

Text of a talk given at Symposium IV,
the 2nd ASIS mid-year regional conference
at Bloomington, Minnesota, April 27, 1973

Have you heard that some day all kids will be carrying microform readers instead of school books? Have you heard that lending libraries will be replaced by issuing centers set up to dispense inexpensive photocopies? Have you heard that whenever you borrow a book drom the library of the future your universal plastic borrower's card will be used to record

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the transaction in a big national data bank?

If you haven't heard these particular predictions, certainly you've heard a dozen like them. Such predictions are exciting. They come from the minds of imaginative, creative people. But they're really paper-dragon predictions.

A paper dragon, as you may know, is the fiction writer's counterpart of a paper tiger. It's a story that attracts attention, seems to be plausible, starts out with a big flourish and then doesn't go anywhere. The paper-dragon prediction does much the same thing. It attracts attention by suggesting an imaginative technique for accomplishing something. It seems plausible because it addresses technology that's either already in existence or apparently within reach. But it falls short of being an honest-to-genuine prediction because it fails to cover little essentials like what it would take to implement it and whether people really want it.

For example, let's take another look at that prediction about microform readers. Certainly the rapidly

growing microform industry can be expected to bring us dramatically efficient portable readers and huge numbers of things to read on them. Certainly we can expect the student with a portable microform reader to become a common sight. But the idea that microforms will make ordinary books totally obsolete just doesn't evoke a great deal of credulity. For one thing, there are too many bibliophiles in the world. For another, if a user has a choice he'll invariably select hard copy over microform because it's simply more convenient.

TURTLE

Then there's another aspect to this. If you have many opportunities to watch what happens to the mechanical toys owned by the average junior citizen you can picture this with me. Can't you just visualize some of the things a grade school student might do to his portable microform reader? Like spill milk on it? Or in it? Gook up the knobs with peanut butter and jelly? Drop it on the sidewalk to see it it will bounce? Try Daddy's hammer on the plastic viewing screen to see if it's really unbreakable? Go to the bedreoom and take it apart to see where the light comes from? Run out to show Mommy where the light comes from and trip over the dog in the hallway? Nobody's hurt; but the reader bounces nicely on the stairs this time. So do the parts that come off

on the way down. No. I just can't see the school book disappearing entirely.

Well. It's not nice to poke fun at somebody else's serious predictions. My only excuse is that I needed an easy-going introduction to the subject of forecasting. I never gave much thought to the techniques of forecasting until I started to work on this paper. Just as most of you would do, I began with a literature search on prophecies about technology for libraries and information science. As I read through the various papers I was surprised at how many paper-dragon predictions there were. After a while I began to see that certain specific defects were appearing over and over again, and I soon found it possible to develop a list of criteria for a logical and credible prediction. Although I made the list for my own guidance, it occurred to me that you might like to know what was in it. Forecasting is an important function, especially in a rapidly growing field such as ours; and it's probable that every one of you has to practice it in one form or another. As far as library/information technology is concerned, then, I offer you this as a

suggested list of characteristics for a forecast:

1. Technical feasibility. Whatever you predict should involve an application of existing technology, a logical extension of existing tehcnology or a plausible assumption of new technological developments that could be achieved by research. This is the easiest requirement to meet and is often the only one met by a paper-dragon prediction.

2. Practicality. Your scheme should be based on a careful analysis of what it might take to implement it and whether it would really work. For example, suppose the credit-card idea appealed to you and you envisioned a design for a universal library borrower's card, maybe using each borrower's name and social security number for basic identification. Would you propose to establish a computer facitily somewhere in the Midwest and a network with an online terminal in each of the nation's many libraries? Would time-zone problems affect your maintenance schedules? Would queuing during peak hours cause unacceptable delays and breakdowns? Would you be

able to overcome transmission line problems? Would the sheer volume of traffic make the whole thing worth doing? Would you like me to stop asking obvious questions?

3. Social feasibility. This is a catchall requirement for all sorts of nontechnological considerations: legal constraints, financing, intergroup cooperation, standardization, etc. Proposals for the development of centers for the wholesale distribution of photocopies lack social feasibility if they don't speak realistically to the current furor over the copyright law. So do a host of suggestions that mention respected things like optical scanning, MARC compatibility, holography, lasers, telefacsimile, interactive systems and online terminals without actually proposing anything truly implementable.

4. Economic feasibility. Those of you who make marketing calls in the information industry all know the kind of customer who has a million documents he wants entered into an online retrieval system and hasn't the foggiest notion how much it would cost to analyze the data elements and

convert them to machine-readable form. Usually this customer has some hazy notion that optical scanning will eliminate input keying costs or an even hazier notion that he can avoid system development costs by shopping for a proprietary system that will somehow get his documents "into the computer" at a small cost. Surprisingly enough, a lot of people who should know better have predicted grandiose uses of nonexistent data banks without regard for how much it would cost to build and maintain them nor who would pay the bills.

5. Moderation. The most believable predictions avoid absolute statements and absolute words like all or none. The one about the kids and their school books is a typical example, but there are lots more like it.

Now that we've looked at these five characteristics, do they seem to be obvious? Do they seem to be basic? They are. And yet, on the basis of our literature, I submit to you that at least one of them is apt to be lacking in the typical prediction for library/information science.

When I insist that they be taken into account, though, I don't mean to imply that you shouldn't be bold about your own predictions, especially where technical feasibility is concerned. If you have any doubts at all about how fast technology might progress in the next twenty years, just remind yourself how many things have happened in the last twenty years.

Twenty years ago, in 1953, we were still trying to develop Vannevar Bush's Memex and in that year Ralph Shaw patented his Rapid Selector. We've long since given up the concept of a single-purpose information machine and made tremendous advances in the use of large multipurpose computers. To be sure, the use of multipurpose equipment was already being advocated then by such people as Garfield, Gull, Kent, Perry, Taube and Vickery; and Eugene Garfield had done some solid work on the use of the IBM 101 statistical machine for preparing indexes on punched cards.

However, progress was impeded then by the absence of suitable data processing equipment. The current IBM computer was the 650, and the 701 was only introduced that year. The 1401, 7090, 360 and 370 belonged to generations not born yet. UNIVAC I was a new baby; the first Honeywell computer was still a few years away. Honeywell and

Raytheon were yet to form a joint venture called Datamatic Corporation from which the D-1000 would be created, and the first D-1000 system wasn't destined to be installed until 1957. Computers have indeed come a long way since then.

Today we take it for granted that library book catalogs, directories and other list products can be produced from machine files by computer-driven photocomposition. Yet in 1953 Photon Incorporated had just produced the first book by means of photocomposition and donated it to MIT.

In our own circles, the term information retrieval was only three years old. ASIS was ADI with a small two-day annual meeting on topics like editing of reports literature, document reproduction, and organization of documentary material. Mortimer Taube had just formed Doc Inc. and was trying to sell librarians on the virtues of coordinate indexing. And the typical librarian was proclaiming loudly that it would be impossible to mechanize processes which were essentially intellectual in nature.

Have we made much progress in the last twenty years? I think you'll agree that our progress has been phenomenal.

I think you'll agree also that we can expect equally impressive progress during the next twenty years.

Certainly we can ask for almost any reasonable technical capability and expect to get it. For example, how would you like to have a computer small enough to fit in a corner of your office and yet designed to have at least ten times the storage capacity of today's largest computer system? You'll probably get that and a lot more. It's really not too much to ask when you look at the transistor radios, electronic calculators and hearing aids of today in comparison to their counterparts of twenty years ago.

How about microform readers? Do you want one about the size of Webster's Collegiate Dictionary with a brilliant viewing screen, a battery power source and a dozen other special characteristics? Work it into a forecast. You'll probably get it. As a matter of fact, you may be closer to getting it than you think.

We could go on and on with things like this. Extend computer output microfiche (COM) technology to achieve the reciprocal, microfiche input to computer (MIC)? Transmit microimages by telefacsimile? Make instant copies of

microforms as easily as you make Xerox copies of full-size pages? Make instant copies of CRT displays? More things too numerous to mention and too fuzzy to describe? Stick around. Technology has lots of goodies in store for us.

So now we've dismissed technological developments and only hinted at a few of the things the future may have in store for us. I'm sure you're beginning to wonder if I'll ever get around to making any forecasts myself. I'm getting around to it. Right now.

For no particular reason, suppose we start with interlibrary lending. With the increasing availability of good copying equipment we've seen a strong trend toward the provision of photocopies of journal articles and other short documents. The copyright dilemma has made some people reluctant to predict just how the whole copying problem will be solved. Nevertheless it seems that a satisfactory solution is inevitable.

The most likely possibility is a system where organizations will be licensed to make photocopies, much as night clubs and broadcasting stations are licensed to sponsor performances of musical compositions. There are

several ways licensing might work. Publishers might issue licenses directly to copying centers or they might depend on a common agency similar to ASCAP -- maybe even ASCAP itself. Licenses might be issued to libraries or they might be issued to clearinghouses of one sort or another. A library might get one kind of license (say a Class B license) to copy things for its own users and another kind (say a Class A license) to copy things for other libraries. A clearinghouse might negotiate licenses with various publishers and then assess charges for its photocopying services. ISI has been doing something like this for about six or seven years now, routinely negotiating licenses with various publishers so that photocopies can be supplied to its customers when original tear sheets are no longer available.

At any rate, we can be sure that something will be worked out so that libraries can protect their collections, library users can continue to get photocopies, and publishers can get some sort of reimbursement. Certainly any copyright legislation imposing an absolute ban on photocopying seems highly unlikely. It wouldn't prevent people from making copies any more than Prohibition kept people from drinking booze.

The growth of photocopying traffic has brought with it a new form of an old lament. Remember how the larger libraries have always complained about the cost of postage and handling for all the requests they receive from countless smaller libraries with little to offer in return? Well, now that photocopying expenses have been added to the burden, the annual costs are big enough in many libraries to have genuine budgetary significance. And they're bound to get bigger.

Still, the overall costs are the sum total of separate page charges in transactions of a few dollars each. When you stop to think that a bill for two dollars can be harder to process than one for two hundred dollars, you begin to see a need for better accumulative accounting. It seems inevitable that the practice of sending a statement of charges for each individual photocopy request will give way to a practice of accumulating charges and credits, perhaps quarterly or annually. With data processing capability becoming more readily available to libraries, this doesn't sound as formidable as it might have sounded a few years back.

However, we may need -- and get -- one more device

that will make it easier to keep track of such things. With the standard book number firmly established and the standard serial number soon to be a reality, it seems logical to expect a standard library number as the next development. Although some people abhor the proliferation of numbers in our society, I'm afraid we'll have to get used to them. In the long run they're going to simplify a great many things for us.

The whole question of standardization is due for more attention, and it seems inevitable that all of us will be concerned about it in one way or another during the next ten years or so. For example, to carry this standard number concept a little further, just think how many banks of machine-readable bibliographic data are being built now or planned for the near future. If we're to engage in inter-bank traffic with any efficiency at all, it will be a lot easier to use identification numbers instead of complete descriptions to communicate. But which numbers? Not every document has an LC card number. Not every document has an ISBN. Many items have neither one. So it seems to me that we should be thinking about some Z39-type effort to standardize the standardization of numbers. Maybe we could agree on a priority system, using the LC card number

if that exists, the ISBN if it doesn't, any of several clearinghouse numbers if neither of the first two exists, and a procedure of some sort to assign and register a number if none at all is available. One thing is clear, though. It will take a lot of committee work, a lot of publicity and a lot of cooperation to devise and implement any scheme at all.

Another thing that should come in the not-too-distant future is more standardization in microform technology. In spite of the accomplishments of COSATI and other organizations, the microform industry is facing a situation much like the one the phonograph-record industry faced a few years ago when the 16-33-1/3-45-78 controversy was raging. From nice simple problems like 35mm. vs. 16mm. and roll film vs. fiche we've progressed to multiple problems involving various reduction ratios, various fiche sizes and various kinds of ultramicrofiche. The outcome of the phonograph squabble was the three-speed record player. At the present rate of unprogress, the outcome of the microform controversy may be either a collection of single-purpose readers or a multipurpose device that doesn't serve any one purpose with true satisfaction. Neither alternative will help us achieve the desired goals of economy and portability.

Since user resistance to microform is anything but negligible, it seems logical that the micropublishers will soon be forced to get together for a little cooperative soul-searching.

You'll notice that these things we're talking about right now aren't really technological developments at all. They're what might be termed sociological developments. I think the distinction is significant because the greatest advances in library/information technology during the next twenty years may not come from new technologies at all but rather from better applications of technologies we already have.

To illustrate this, let's speculate a bit about a possible use of optical scanning. Probably the most common delusion among uninitiated people who suggest the use of OCR equipment is the belief that optical scanning is faster and cheaper because it eliminates input keying. The second most common delusion is the belief that there are virtually no limits to scanning applications because now we have scanners that can read nearly anything printed or typed and can even read handwriting.

Where are the fallacies here? Not in the scanners, certainly. They really can do these things -- under the right conditions. Let's remember that a scanner is no brighter than a camera. A camera can take a picture of almost any scene, but it can't write a caption. A scanner can record anything on the title page of a book but it can't tell a title from an author.

Now suppose we predicted that some day optical scanning would be used instead of input keying to get book cataloging data into computer systems. Would that be a paper-dragon prediction? As I just stated it, yes. Under present conditions the simplest method -- and the method most commonly used so far -- would be to transcribe the data elements from the appropriate pages of the book by typing them on a sheet of paper and assigning the necessary field tags or delimiters in the process. Then the sheets could be fed to the scanner, which would build an input transaction tape containing not only the data elements but the field tags that would identify them. Would it work? Certainly it would work. I've done it myself and so have some of you. But let's examine the process more carefully. It may or may not eliminate coding; it depends on the skill and knowledge of the typist in the matter

of assigning field tags. It wouldn't eliminate input keying; it would substitute typing for it. It wouldn't eliminate machine conversion; it would substitute scanning for some other function such as card conversion or tape code conversion. How about comparative costs? Well, obviously we'd have to know exact costs for given configurations to reach any firm conclusions. Nevertheless if we do a quick assessment we can see that typing labor and other keying labor are roughly equivalent, that a typewriter could be purchased for a little less than a year's rental on sometning like a keypunch, that the rental on a scanner would be an additional cost not present in a nonscanning system, that update costs on the computer would be about the same, and so on. In other words, unless we could eliminate the step of typing the sheets for the scanner to read, our overall operating costs might be just about the same.

Suppose, though, that we made a different prediction by combining the present state of the scanning art with an existing development in printing technique. Have you ever seen a Canadian or an East German patent? On the title page of one of these patents there are little circles

with numbers in them. The circles are scanning targets and the numbers are data-element identification numbers. Each scanning target is placed just to the left of the patent number, or title, or whatever it applies to. The composer of the title page has complete freedom in such things as printing format, length of the title, number of patentees, etc. In other words, the title page of the patent is the counterpart of a variable-length machine record. Now, in the light of those two developments, what if we changed our prediction? What if we predicted that some day many patents, government reports, journals, books and other documents would be printed with techniques that would facilitate direct data capture by optical scanning?

Would that be a paper-dragon prediction? It might not be. For one thing, you'll notice that new prediction hedges by using the word many instead of the word all. For another, the idea might appeal to some publishers for certain promotional purposes; and that might get the ball rolling.

However, I didn't digress into this long discussion of optical scanning just to force a prediction. I did it -- and you'll see the loop close now -- to provide an illustration base for my earlier remark that our greatest advances may come from sociological rather than from technological developments. In the case of the scanning-target gimmick, implementation would have to be based on a whole complex of achievements

in legislative reform, standardization, intergroup cooperation and other sociological areas.

An idea like this wouldn't appeal to publishers unless they could see some sort of profit motivation in it, however indirect. When you remember that some publishers include information storage and retrieval systems among the prohibitions in their copyright notices, you realize we have a long way to go before we can make this or any other prediction along the same lines come true. If we get copyright laws and photocopying practices straightened out so that licensing or other facilitation can promise publishers additional income after initial publication, if we can achieve standardization on things like I.D. numbers for scanning targets and inclusion of all data elements on title pages, if we can get library catalogers to back off from some of their esoteric ideas about titles and entries, if we can develop some reasonable concurrence on how much is necessary and sufficient for bibliographic lookup and display, maybe we can think more seriously about proposals along these lines.

With regard to library cataloging in general, again the greatest progress in the coming years is apt to come from nontechnological developments. As a matter of fact, we've barely begun to take advantage of the many technologies already available to us. The systems that have been implemented

so far suggest that the future will see trends developing toward such things as these:

- Increased access to data processing capability for libraries of all types through either network arrangements with other libraries or integration of needs with sponsoring institutions or simply the availability of smaller and cheaper computers.

- More integration of library acquisitions functions into the automated accounting systems of the companies, universities or political jurisdictions sponsoring them.

- Greater use, for cataloging purposes, of the bibliographic data captured for acquisitions purposes.

- Tendency for selection, acquisitions, cataloging, processing and retrieval in a library to be accommodated simultaneously by a single data base and an integrated system .

- Wider acceptance of standardized cataloging with less concern for custom cataloging at the local level.

- Less preoccupation with the concept of the main entry as librarians begin to think less about the physical

layouts of catalog cards and more about classes of data elements (e.g., less about corporate author entries in card catalogs and more about corporate names as retrieval tags).

- Less bibliographic embroidery in cataloging and more simplification in cataloging records.

- More use of machine systems for serials management and less dependence on card records for check-in and holdings information.

- More use of online access for catalogers and acquisitions personnel even though the library where they work may have a card catalog or book-form catalogs.

- Development of more networks, both cooperative and commercial, for the development of common data banks and the provision of access to cataloging data through catalog cards, book catalogs and remote terminals.

This list could be expanded almost indefinitely and subjected to enough discussion to fill an eight-hour lecture or a full-length book, neither of which is appropriate to our needs at the moment. I'd like to make one observation

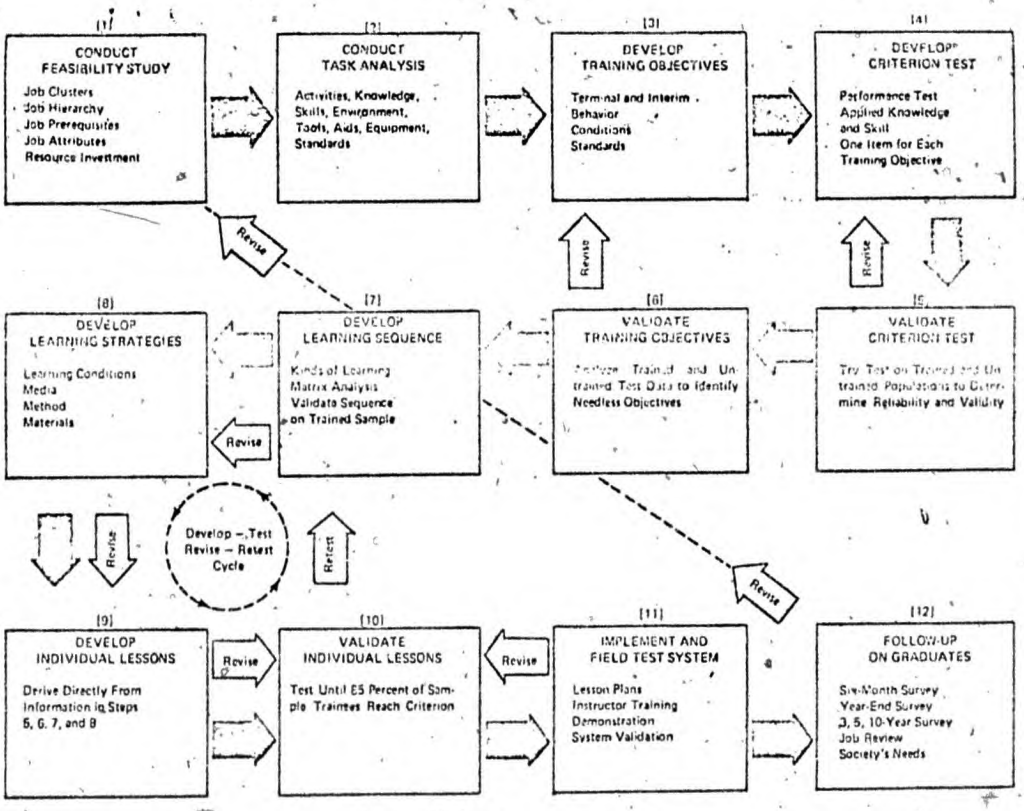
about it, though. You'll notice that I didn't predict that book catalogs and online systems would replace card catalogs. I think it would be just as foolish to predict the demise of the card catalog as it would be to predict the demise of the school book.

Because this paper is getting long we'll have to cheat a little and try to cover a few more topics in broad-brush fashion. We've talked about microforms, about microform/digital conversions in both directions and about telefacsimile, but we haven't talked about video. Under development now, and pretty far along, is a video screen flat enough and big enough to hang on the wall like a picture. If we want it, and if we ask for it, we can probably get the capability to use this kind of a screen to display text and illustrations that are recorded on video tape. The idea would be to think of a video tape and a player as being analogous to microfilm and a reader, except that video would add the capability of remote projection, with the player in one location and the viewing screen in another. In any event, it seems possible that electronic recording and playback, with a boost from further miniaturization techniques, will compete with microform in certain areas.

Then, too, we can predict that the next twenty years will offer us some revolutionary developments we can't even conceive of right now. In 1953 could we have predicted something like ISI's Science Citation Index? We knew about xerography then, but could we have predicted today's Xerox machines? Today we know about holography, but can we predict just what it will do for image storage or data storage?

Think about a few of these things. Try making predictions on your own. Try to avoid paper dragons, but don't hold your imagination back. Making a good prediction is something like writing a letter to Santa Claus. Somebody may read it and figure out a way to get you what you want. The only difference between a prediction and a letter to Santa Claus is that the present you get won't be just for you; it will be for all of us.

Design elements related to the overall development of each auto-tutorial minicourse sequence specified in the following chart:



There are essentially four phases to instructional systems development:

1. Specify system objectives.
2. Develop preliminary system design.
3. Developing, testing and revising the system.
4. Installing system and field testing the system.

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MODULE PLAN

(EXAMPLE A)

COURSE NO AND TITLE _____ DATE _____

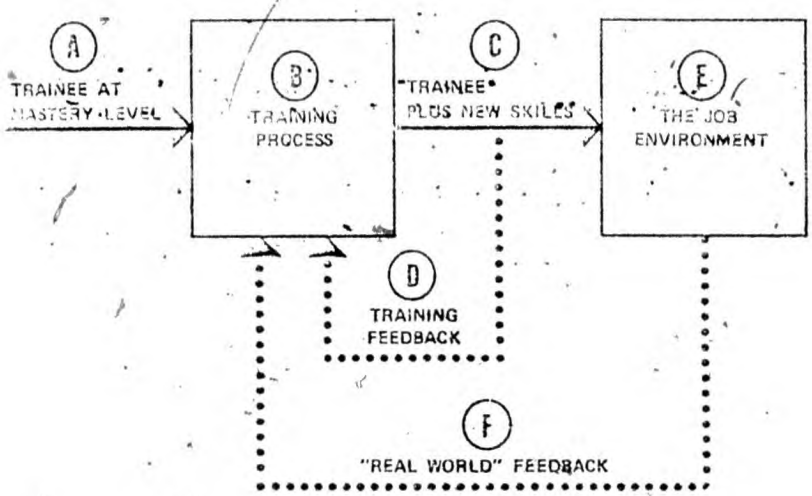
MODULE NO AND TITLE _____ TEST CONDITIONS _____

TERMINAL OBJECTIVE ONE

(DESCRIBE TERMINAL OBJECTIVE ONE IN THIS SPACE)

INSTRUMENTAL OBJECTIVE	REFERENCED CRITERION ITEMS	LEARNING ELEMENTS (content)	TYPE OF PERFORMANCE	INSTRUCTIONAL STRATEGY METHOD	INSTRUCTIONAL STRATEGY MEDIA	REMARKS
1.1 (Describe the first instrumental or sub-objective of terminal objective one.)	(Next to each instrumental objective" identify the criterion test items that will be used to reflect attainment of that objective. Specify instrumental objective number, item letter, and test variation number, if appropriate.	1.1.1 (The first sequence required of the learner as he progresses through the learning steps relevant to the first instrumental objective.) 1.1.2 (Describe the second behavior.) 1.1.3 etc. 1.1. . . . . etc.	(For each teaching point, list the type of behavioral response required of the student to complete the objective.)	(Describe the method(s) the instructor will use to provide a learning situation; example: simulation & discussion, self study, laboratory performance, demonstration-dialogue, etc.) Place the appropriate method(s) on the same line as the related learning elements.	(Specify each medium used to assist the learner to make the appropriate response. If the learner has several options in selecting a medium, write "option" after those media.) This column lists instructor-media or mediated instructional combinations that will achieve the desired learning. These should be aligned with the relevant method(s).	(Comment should be inserted in this column that reflects difficulties or unforeseen factors that reduce the effectiveness of learning. These remarks are used to further refine the next teaching of this lesson. Instructional activities that the instructor may wish to remember may also be listed in this column.)
1.2 (Describe the second instrumental or sub-objective of terminal objective one.)		1.2.1 (Describe the first behavior for the second objective.)				

Table 5



The trainee enters the system (A) at a certain mastery level in terms of his present knowledge and skills and his ability and interest in putting that knowledge to use. He enters into (B) a training process (a course, a filmstrip, a book, etc.), which provides inputs of new or additional knowledge and skills. He then exits the process (C) with some amount of new or additional knowledge and skills. His in-training mastery has been measured by (D), short-term feedback in the form of written examinations and/or hands-on demonstrations of proficiency in performing new tasks or in performing old tasks more proficiently. Then armed with newly acquired knowledges and skills, the trainee moves into or returns to the job environment (E) where he can demonstrate not only what he knows--but what he can and will do. However, for him to do this over a long period of time, the training encountered in (B) must be supported on the job by some means; for example, manuals, reminder cards, checklists, etc.

And from job performance comes the "real world" feedback (F) the evaluation of his performance over how the process should be enriched or broadened to achieve the established goals.

Many training programs progress successfully through Phase (D) but fail miserably in Phases (E) and (F). Why? Because they do not provide (E) the environmental support required to sustain the trainee on the job and they do not provide for the long-term feedback needed to enrich or broaden the training effort so that established goals are reached.