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In the next few years we should be able to reflect and build careful models of technology.

The next decade of instructional technology research

by Richard E. Clark

I've always thought that writers who try to predict the state of a field beyond a few months are guilty of projecting their wishes onto supposedly objective forecasts of the future. For that reason I tend to set aside unread all manuscripts which begin—"By the year 2,000 . . . ."

Even presumably objective methods of future forecasting such as Q-sort and other summaries of "expert opinion" are suspicious because they tend to be highly subjective individual goal statements in summary form. With this bias in mind then, I am going to try to make some limited projections concerning the direction of research for the next few years while attempting to separate my wishes from what I perceive the "reality" of things will be. With your forbearance, I'll begin with my view of the realities of research in our field during the next 10 years.

Realistic Trends in Instructional Technology Research

I generally find four crucial realities confronting research in instructional technology, and three of them are mildly alarming:

1. Graduate programs in instructional technology will continue to deemphasize research and research training and focus instead on design and development.
2. Research questions will become increasingly distant from the most popular design and development models.
3. Media research will continue to dominate the field in spite of evidence that media variables do not contribute to learning, achievement or performance.
4. Our knowledge of prescriptive theories and research strategies will increase with a parallel increase in the potential of research to solve immediate and practical problems in instruction.

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I. Research Deemphasized

There is no indication that the trend has diminished. We can hope that this is a temporary problem. It has been partly caused by the difficult economic times which have led to greatly diminished financial support for both research and research training. Other possible contributors are the increasing concern with jobs on the part of prospective graduate students and the reluctance of faculty to insist on rigorous training. Students assume that research training is preparing them for jobs in research laboratories and correctly assess that there are few of those types of jobs available. Of course, they tend to forget that indepth knowledge of research is required to acquire "consumer" skills which allow technologists to advance their profession. Faculty contribute to the trend through a fear that the diminishing pool of graduate students will select programs which deemphasize research in favor of instructional design or media production. Programs without students tend to be eliminated by cost conscious universities.

Of course, it is research which leads most directly and consistently to successful technology. When research is deemphasized by our graduate training institutions, the young people enter the profession with little training or inclination to advance knowledge. This may lead to a situation in which there is increasing distance between the types of questions asked in our limited research programs and the instructional design models currently being utilized.

II. Increasing Distance Between Research Questions and Design Models

Our most successful and popular instructional design models are the "mastery" approaches which have been derived from behavioral research and "learning rate" studies. On the other hand, our most popular research questions deal with cognitive processes, individual differences in learning and trait-treatment interaction hypotheses. Researchers, having established that different learners profit from different types of instruction, are in the process of refining that insight and producing specific generalizations. Instructional designers continue to employ models of instruction which ignore individual differences and attempt to find the best instructional method for all students. Evidence that individual differences influence achievement even in the behaviorally based mastery approaches such as the Keller Plan (e.g. Reiser, 1981) is generally ignored by developers.

This is a less serious problem than it appears to be. Part of the problem is that individual differences are very difficult to accommodate in instruction given the current economic and political climate in most instructional settings. Another mitigating factor is that research has not progressed to the point where findings can be utilized to solve instructional problems more efficiently or effectively at this time.

III. Invalid Media Research Persists

It is likely that the next few years will see a continuation of our tendency to repeat a very popular but very invalid type of research question. Since one of the main historical origins of instructional technology was the media and audio-visual movement, it is understandable that media questions would dominate research. However, many decades of research have failed to yield adequate media selection guidelines or a clear specification of how differ-

ent media might enhance learning or performance. As radio and movies were replaced by television and television is slowly being replaced by minicomputers as the hot topic in research, both the research questions and the results of the studies remain typically disappointing.

The reason for the disappointment is that we simply have failed to learn from the results of past research what Keith Mielke warned us about nearly two decades ago (Mielke, 1964). That is that there is no reason to expect a difference in learning when we contrast the relative merits of two or more media since media are generally the "inert" carriers of instructional messages rather than the "active ingredient" in learning. The many surveys and meta-analyses of media research studies which have been conducted since the Mielke article bear his assertion out. When there are learning benefits to be found in a media study, they are inevitably attributable to the instructional methods employed or the content of different programs plus the types of students participating in the studies. This is a highly counterintutitive finding and as such it rubs deeply against our prejudices.

To suggest that different media or forms of media have no direct influence on learning also runs counter to the claims and pressures of a multimillion dollar industry which exists to sell media to educators. All of us have been guilty of being persuaded more by our desires and slick advertising than by the overwhelming evidence from research. If we were to pile up all media comparison studies on a continuum with one end representing studies which have shown extreme learning benefits from media and the other end representing failures, the resulting pile would look very much like a normal curve. There would be very few complete failures and successes but a huge number of equivocal results that are largely uninterpretable.

Even the successful studies would be susceptible to very plausible rival hypotheses due to design errors. Of course, there are valid questions in regard to and a critical need for media in education. Media make the delivery of instruction possible in different forms and to diverse audiences at potentially lower costs than our currently labor intensive delivery system. However, it is very likely that we will continue the very wasteful practice of researching the question of media effects on learning. The alternative is to place more emphasis on instructional methods, content and learners.

Prescriptive Research and Theory Trends

One encouraging trend in instructional technology has been and will continue to be the development of prescriptive instructional theory (e.g. Shuell, 1980). Prescriptive research differs from traditional research in the types of questions it addresses and the ways it draws on prior theory to develop generalizations useful in design and development. One of the main reasons why research has not been more influential in practice has been our nearly total reliance on the descriptive research and theory which characterize the "pure" and predominantly physical sciences. Recently we have begun to understand that additional research and theory must be developed to extend the work of the more basic sciences. A basic theory of learning, for example, does not seem to have any direct utility in the design of instructional methods because it is a description of one version of how people learn. Prescriptive theory, on the other hand, attempts to provide generalizations about how people **might** learn, given realistic constraints and goals. Descriptive theories of learning involving individual differences, for example, have found that there is a strong, positive relationship between intelligence and learning. The higher our general ability, the more we will learn in typical instructional settings. This knowledge does not necessarily help the instructional designer who wishes to enhance the learning of the lower ability student.

Prescriptive research and theory depend on the more basic variety of science for their existence but they **extend** basic research into more utilitarian forms and generalizations. As an activity it precedes design and development which are very complicated problems in themselves. Space limitations preclude a thorough discussion of this very large issue but readers may be interested in consulting articles by Clark (1982), Shuell (1981) and Glaser (1978) for additional information. It is sufficient here to notice that this trend to prescriptive research and theory is one of the more robust and positive forces in instructional technology research and the trend will probably continue to grow over the next decade.

Desirable Research Trends: A Personal View

In a more subjective vein, I have a great fear that our graduate programs will fall victim to short sightedness. Even though we may attract more students by advertising training in design and in popular new media such as minicomputers, the more secure long term contribution is to be found in demanding depth skills in a variety of areas, including research. I have found that it is necessary for professional technologists to have a great deal of knowledge about research in order to understand the problems they confront well enough to generate and understand novel solutions. Giving graduates prejudiced models and solutions enormously decreases the half-life they enjoy as contributing professionals and similarly affects the entire profession they represent. There must be a more positive middle ground between our current curriculums, the often fickle and limited goals of prospective students and the demanding and well rounded programs which will insure our continuing ability to contribute successfully to education and training.

Next, there is great promise in certain recent research directions and less certain promise in others. While we should be reluctant to discourage inquiry of any kind, we simply cannot rationalize the sheer amount of certain kinds of research when compared with the benefits we have derived from them in the past. The media and learning question described earlier heads this list, of course. More fruitful areas deal with the blending of new advances in cognitive psychology with existing technologies which have derived from behavioral research.

I have been impressed with the work of David Rumelhart and Donald Norman on the use of analogies to teach complex procedures (Rumelhart & Norman, 1981); with Henry Levins' extension of the use of keyword mnemonics to teach foreign language vocabulary and facts in sequence (Levin, 1981); with Pelligrino and Glaser's (1980) highly creative studies of the mental processes that underlie inductive reasoning; with the work of Dick Snow (1981) on general ability and Robert Sternberg (1980) on specific abilities which influence learning under different conditions; and with Joseph Rigney's model of the function of external instruction in influencing internal processes (Rigney, 1980). These researchers (and many others) are gradually providing a map of the mental processes which we engage, modify or buttress with external

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instruction. These maps or cognitive models of learning will eventually be compatible with the behavioral technology we currently employ and should blend nicely with existing instructional methods.

Another problem being addressed in research at the present is advance in our knowledge about techniques which promote the transfer of learning. To date we have mixed information about the effectiveness of transfer technologies such as the "identical elements" technique (Clark, 1980). However, work by Royer (1979) has added some coherence to the area and promises to increase greatly our knowledge of technologies which promote the transfer of learning from the training environment to the application setting. One expected byproduct of this advance is more knowledge about how to transfer instructional technologies between nations and cultures.

Limited space prevents listing more than the most outstanding directions which we might take. The problem which confronts us at the moment is that we have many useful directions possible in research and a continuing development of research technology at a time when the activity is out of favor in universities and in the profession. The next few years will probably find research with lower levels of support but with the opportunity to reflect and build careful models rather than act under pressure.

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