Which theoretical constructs about media and learner characteristics offer the most promise of significant increases in learning?

Media applications to instruction: Current theoretical considerations

by Gerald M. Torkelson

The problem confronting every teacher or researcher concerned with the contributions of media to instructional practice and learner achievement is one of determining which theoretical constructs about media and learner characteristics offer the most promise of significant increases in learning. This is a problem of long standing—traceable to early research efforts at the beginnings of this century and even earlier in philosophical discussions. The search is as current today as it was years ago. A major difference between today and yesterday, however, is that so much knowledge has been accumulated about the nature of media and the nature of learners that old notions have changed about media/learner relationships and about the utility of some of the more traditional research/theoretical orientations.

To reduce the problem to its essentials, it seems reasonable to focus on two main aspects of the relationship, i.e. (a) current conceptualizations about the nature and functions of media (information forms)[1], and (b) current understandings and theoretical observations about learning which, in turn, affect conceptualizations about media and their uses.

In considering media applications to instruction, it is important to first address changes in conceptualizations about the processes of learning because it is against this backdrop that media must be examined.

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The major source of new ideas in recent years concerning how learning may be viewed has been provided by theories related to information processing, storage, and retrieval and to computers to which they are linked (Travers, 1982).

Most studies of media applications to instruction in the first five or six decades of this century were built upon earlier theoretical positions. That is, the effects upon learners of exposure to media of various kinds under varying conditions were analyzed primarily as stimulus presentations which were to aid in making connections between the learner's repertoire and the new material to be learned. In the S-R model of research, for example, the assumption was made that media were primary sources for changes in learner behavior, that there was a direct "connection" between the stimulus acting upon the perceptual system and learner response with minimal concern about the internal processes and memory stores which affected the change.

This earlier period of research was also characterized by the "gross-comparative" model, such as comparing the effects upon learners of a motion picture with the effects of a film strip. The results of this research have been summarized in an analysis of the 25-year history of **Audio Visual Communication Review**[2] (Torkelson, 1977). In the great majority of cases, conclusions of gross-comparative studies were of no significant differences among variables. While it is not my purpose here to elaborate upon this earlier research, I make reference to it to suggest that its theoretical bases were generally inadequate for determining the actual functions of media in processes of learning. With some exceptions, most of the research did not attempt to gather evidence about the effects of varying the internal structure of media or of the effects of learner idiosyncracies upon media effectiveness.

Support for a refined look at media/learning relationships came from a number of quarters. Government sponsored research in motion picture characteristics as related to learning in the late 1940s and 50s was one source; another was the programmed instruction movement which examined the effects of modifying elements within frames of information on learner performance. This attention to variables within information forms also led to a growing awareness that it was necessary to look more closely at the internal conditions of learners as factors affecting reactions to information.

Thus, there has developed a theoretical position that currently focuses upon learning as a processing of information, an orientation deemed more productive for discovering the relationships of media to processes of learning than was possible in earlier associationist theories. Impetus was given also for this theoretical change by expanding knowledge about the physiological, perceptual and cognitive mechanisms that learners use to receive, process, store and retrieve information.

If learning is regarded primarily as the processing of information, then teaching—the other half of the relationship—may logically be thought of as information presentation. As Derr (1979) has said, teaching can do nothing more than induce learning; it cannot presume to expect that learning will occur automatically. Learning is a private

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[1] The word "media" should be interpreted as a convenience term for all forms of information.

[2] **Educational Communication and Technology Journal** is the successor to AVCR.

affair, subject to the whims and repertoire that the learner brings to bear on the information at hand.

As is true with most theoretical formulations, there are progenitors that go back into history. The caution that one must look at the characteristics of learners, their past experiences, their value systems, and their predilections as bases for discovering principles of media usage is not new. Such a caution was voiced in **AVCR** from its beginnings in 1953. The first issue of the periodical contained a discussion by Norberg urging the need to study the intricacies of human perception as a basis for determining functions of media. By 1961 and 1962, respectively, **AVCR** had produced two special issues on learning and on perception theory.

More recently (1975), **AVCR** published a special issue on aptitude treatment interaction (ATI) in recognition of a growing interest in this type of research and as an off-shoot of the programmed instruction movement. ATI represents the theoretical position that having knowledge of the interactive effects of learner aptitudes with instructional treatments would make it possible to predict the proper types of treatments (methods and materials) that would insure given learner responses. But ATI has also had its problems in establishing absolute interactions among almost infinite numbers of learner variables that are the result of idiosyncratic physical, mental, maturational and cultural conditions. Also, in ATI one must face the dilemma of predicting over time the behavior of dynamic, changing individuals by means of aptitude measures that tend primarily to be slices of a spectrum of aptitudes (see Cronbach & Snow, 1977).

Salomon (1979, 1981) has published two books which explore media as symbol systems that interact with the cognitive, social and psychological aspects of learners. This theoretical approach supports the idea that media must be viewed more as agents for presenting information than as agents that become direct stimuli for given responses. As has been aptly expressed along this line (Clark, 1982) in a critical review of a recently published critique of 60 years of research in media:

> We cannot claim any advantage of one medium over another when student achievement is the issue. Media do not contribute to learning any more than the vehicles that deliver experts to a problem-solving conference contribute to the eventual solution of the same. The choice between instructional mediums is based simply and finally on their capacity to carry the intended message and our resources.

I am presuming that "our resources" refers to the learner's repertoire.

If we accept current conceptualizations of learning as information processing and the idiosyncracies of learners as crucial factors in receiving, processing, storing and retrieving of information—then what logically become the functions of media?

First, we must dispel the notion, as Clark has indicated, that media are the primary agents that promote learning in and of themselves. Media, in fact, act primarily as agents for providing information. This means, also, that instead of accepting only the traditional five senses as avenues for gathering information, we need to expand our considerations to include what Travers (1982) labels as the five information collection systems. He separates visual and auditory as two of the systems, but he combines taste and smell into one and discusses the touch receptors in the skin and joints as "haptic" and the basic orienting system as the fifth category. The latter refers to two sets of three canals in each inner ear, not as part of the hearing mechanism but as an information collection system. There is also a reference to pain as another information system, although not as clearly understood as the others. It becomes obvious that one must look carefully at the spectrum of information sources through which learners acquire knowledge of their world. An analysis of media (information forms) in such a context requires going beyond traditional audiovisual terminology and also requires an expanded, more generic interpretation of media functions.

Considering that teaching may be likened to information presentation and learning likened to information processing, terminology to express these conceptualizations ought to reflect this broader orientation. Given this need to name generic conditions, for the past decade or so I have been urging the use of the terms **message, message forms and message carriers** as designators for the broad spectrum of information and information transmission systems. Messages encompass any and every kind of information that one person may wish to transmit to any other person. **Message forms** also include a subcategory of codes or signs that combine to give the message substance or to which the learner must attend as sources of information. Codes are such things as lines, edges, color, texture, shape and so on, which learners use to differentiate forms and kinds of information. This notion of codes is used by Salomon (1979) when he discusses media as symbol systems and when he promotes the notion that the greater the isomorphism or similarities between the coding systems in the message and the coding systems available in the learner's repertoire, the more likely that learning will take place and that the learner may use these coding systems to aid in the processing of information.

Message carriers, referred to above, differentiate the message form from the instrumentation used to make the messsage form available to the learner. For example, an overhead projector is a message carrier in that it is the mechanism for projecting an image (message form). While it is convenient to separate message forms from message carriers for purposes of considering their separate contributions to learner perceptions, there are undoubtedly subtle effects of types of transmission upon perception of the message conveyed. Viewing a television image in one's living room would probably have different effects upon interpretation of the message than would be the effect of viewing the identical image in the classroom.

Any human communicator may—at times or simultaneously—be a message form and a carrier. In the former instance, a learner may attribute value to the message conveyed by the other person in terms of the learner's attitude toward that person, thus affecting the acceptance and interpretation of the message being conveyed. At the same time, a person is a message carrier by being the physical means for transmitting the message. The crucial issue in separating message forms from their carriers is to focus on the uniqueness and appropriateness of the form and carrier for presenting different kinds of information—recognizing that sometimes it may be difficult to distinguish between the influences upon the learner of the message form and its carrier.

The effects of media upon processes of learning must take into account what each learner perceives as reality. It is this reality that is brought to bear on the interpretation of information. The theory of solipsism, for exam-

ple, suggests that the self can be aware of nothing but its own experiences; that nothing exists or is real except the self. If this is the case, the reality that a symbol system (source of information) presents is thus real to the extent that the self gives it reality. Thus, any assumption of a teacher that information will be learned exactly—or even approximately—as presented, runs counter to the theory of solipsism. Media thus become information sources for learner interpretations of the world, suggesting the need for pedagogical techniques that probe student perceptions of information rather than assuming student performance is related solely to teacher presentation. This conceptualization underlines that any analysis of media effectiveness must include the two-fold process of determining the types of message forms best suited to given information and of determining what actually is perceived by each learner.

Popper and Eccles (1978) propose that reality consists of three worlds: World 1 is the physical reality, not of solid objects but of empty space inhabited in part by atoms and molecules which provide us with the illusion of solid objects; World 2, all of the experiences that fill human life; and World 3, the world of culture and ideas which exist independently of the world. World 3 influences Worlds 1 and 2. World 3 is the creation of Worlds 1 and 2.

Given the emphasis today upon cognitive psychology and upon new knowledge of the brain and its functions (Travers, 1982; Chall & Mirsky, **NSSE Yearbook,** 1978), it is apparent that the functions of media (message forms and coding systems) must be analyzed as information systems utilized by learners for interpreting their world. As each of us gathers and interprets various forms of information in our respective environments, there is no doubt that we filter information through a complex system of values, experiences, and capabilities peculiar to ourselves.

As research indicates, much of what we respond to in our external world has structure and that perception involves recognition of that structure. As we observe structure we also filter out irrelevancies and "pigeonhole" or categorize. It appears that the more exact and precise the information, the more the likelihood of "pigeonholing" or assigning of information to subcategories of one's repertoire. Some authors have described the learning process as a "stimulus sampling" for purposes of comparing new information with that already known. The "gatekeeper" concept of cognition suggests that persons respond to and take in information in terms of which gates they open and close, not in terms of accepting without qualification whatever the information form presents. Hart (1975), for example, describes the brain as a structuring mechanism which, in the normal course of events, strives to make sense of and give organization to incoming information. He contends that lessons structured by the teacher to aid learning may be incompatible with the inclination of the human to organize information on its own. This point of view raises questions about theories of instruction and evidence that argue for presenting learners with structures, methodologies, and conceptual Gestalts that are intended to accelerate and fix learning, such as the strategies for meta-processing or learning how to learn.

Part of the theoretical controversy, which also determines how one determines the relationships of information systems to information processing, relates to basic premises about research methodology. Of current interest is the reductionist versus the constructivist approaches to research. The former characterizes a good deal of early research in media where all variables were presumed to be held constant while experimental variables were tested. The reductionist approach has as its goal the confirmation or refutation of an a priori theoretical position.

The constructivist approach, on the other hand, is basically a process of theory generation (see Magoon, 1977). The researcher, such as an anthropologist, approaches the problem or situation with no a priori assumptions but argues that one must spend enough time on location to observe the conditions that affect outcomes.

In the reductionist approach, such as is characteristic of aptitude-treatment-interaction research, one always runs into the question of the validity and reliability of research instrumentation and the question of whether, in fact, a measurement of learner aptitudes is more a slice of a moment in the life of a learner than it is a measure for predicting the interaction of learners with given treatments over time.

While the constructionist approach seems more amenable to the documentation and verification of a wide variety of learner and environmental factors as they affect reactions to media, there are problems of insuring that data collection is unbiased.

Research methodology is introduced here very briefly only to alert researchers and teachers alike to the need to examine the reliability of methods for gathering information about the true interactive effects of information gathering systems employed by the teacher and learner and the effects of perception, memory and physiological and psychological capabilities of learners upon the gathering, processing, storing and retrieval of information.

In applying this brief discussion to the practicalities of instruction and research relating to media in particular, it is reasonable that the following areas of investigation would be most appropriate for advancing knowledge consistent with an information systems/information processing model of media and learning.

1. The uniqueness and appropriateness of coding systems and information forms for conveying different kinds of information;

2. Methodologies most appropriate for maximum interaction of learners with media;

3. Structures within media for focusing learner attention on criterial elements;

4. Methodologies for determining which learning processes and memory stores have the greatest effects upon the interpretation of information sources;

5. The structural elements and coding systems within information forms which may serve as systems for learners to gather and process information;

6. The influences of different kinds of information forms in shaping the cognitive and affective systems of learners;

7. The kinds of information forms most appropriate for developing the potential of each brain hemisphere.

8. The functions of iconic and propositional information systems in the processing, storage, and retrieval of information.

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