

Clark, Richard E. (1994). Media and methods. Educational Technology Research and Development, 42(3). Pp.7-10, copyright © 1994 ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS AND TEChnology

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Media and Method

□ Richard E. Clark

□ One way for me to view the several perspectives offered by the authors of the articles in the special "debate" issue of ETR&D (Vol. 42, No.2) is to look at their "degree of fit" to the arguments I have advanced and take issue where the differences are great. Using this approach I would discuss my agreement on nearly all of the points raised by Shrock and Morrison, and I would express my empathy for many of the issues raised by Reiser. On the other hand I would take Jonassen, Campbell and Davidson to task for attributing to me, and to Kozma, points of view, values and assumptions that neither of us entertained, let alone expressed in what we wrote. However, the editor has wisely imposed severe space limitations on our replies, ruling out a blow-by-blow reply. So, while I'm comforted by finding like-minded colleagues on this topic, I'm searching for a key issue that would help me focus my response to those who expressed concerns. With this in mind, I selected only one of the many interesting questions raised by the contributors for discussion: Are instructional methods replaceable or interchangeable?

I have claimed that whenever one finds one medium or media attribute that seems to produce desired learning outcomes, there is ample evidence from both quantitative and qualitative inquiry that the substitution of another medium and/or attribute of a medium will produce the same or similar learning outcomes. I suggested that this fact must be interpreted as evidence that *instructional methods* are the underlying common element of all *substitutable* media and attributes of media. Reiser agreed that media were replaceable but suggested that we try to "... find evidence of an instructional method that is not replaceable by a different method to achieve similar learning results" (p.

46). Shrock noted that "... perhaps there is no one instructional method required to attain a given learning outcome" (p. 50). While this is a complex issue that requires more space for full discussion, let me try a brief review of some of the issues involved.

Three key points form the heart of my argument about media and method: First, that *when learning is influenced by external events, those events must support cognitive processes or structures that are required for learning goals by students who are unable or unwilling to provide them for themselves*. The specification for these external events is what I am calling an instructional method. At this initial level of analysis, other things being equal, instructional methods are not *replaceable* unless learning theories about relevant cognitive processes and structures change, requiring a parallel change in methods. Theory at this basic level specifies the characteristics of human cognitive structures and processes, general knowledge types and motivational mechanisms that are common to all human beings. Media variables have not proved useful at this basic level of analysis when learning is the measured outcome. In fact, there is no cognitive learning theory that I have encountered where media, media attributes or any symbol system are included as variables that are related to learning. In all cases where the effects of these variables on learning have been examined, compelling rival hypotheses about measured effects have been found (Clark, 1983). In fact, there is no reason to believe or expect, based on nearly a century of media research and the past eighty years of cognitive learning research, that any media variable will ever be an instructional method as the term is defined above.

The second key issue is that *instructional designers, developers and researchers often fail to*

adequately link their work to the basic and applied research on learning from instruction. As a consequence, we are too often unaware of the evidence about important cognitive processes necessary to achieve desired performance on learning tasks. Our enthusiasm for media and our focus on context (often expressed as a concern with *ecological validity*) lead us to ignore or misinterpret basic research. Compounding this problem, is a tendency to ignore the *construct validity* of variables used in the design of field studies and successful instructional programs based on new media platforms. At the design stage, this leads us to avoid a careful analysis of the definition and measurement issues associated with instructional methods and corresponding cognitive processes. The result is many different operational definitions of similar instructional methods that are used interchangeably in design with very different results. Methods get confounded with the medium being used for delivery or the symbolic mode being used to express or communicate information. For example, the instructional method of *feedback* is part of most instructional programs presented by a variety of media. Yet the term *feedback* covers a multitude of very different instructional activities and functions that result in very different cognitive consequences, regardless of the medium used to provide feedback (see for example, the discussion by Cronbach & Snow, 1977). So different methods are called by similar names and are developed and implemented in idiosyncratic ways that produce unanticipated, and sometimes negative and conflicting cognitive consequences that, in turn, may lead to different performance outcomes. Reigeluth (1992) gives a number of engaging examples of this phenomenon in the emerging literature on intelligent tutoring systems.

Part of the solution to this dilemma would be to acknowledge that among the requirements for good design are: (a) a plausible model of the general cognitive processes required to learn and perform specific tasks (e.g., the monitoring and correction of errors during practice is a critical cognitive process that some learners have difficulty engaging); (b) an operational definition of the required cognitive processes derived from an analysis of

solid research studies (e.g., external monitoring support is provided by a measurable but still generic method called feedback); and, (c) a plan for developing an externalized cognitive process support in an instructional program designed to be effective and efficient for specific people in a specific context employing a known delivery medium (e.g., a specification for how feedback needs to be shaped, phrased, and delivered in a specific mediated instructional program where real people are learning to perform real tasks under specific resource constraints). In the final stages of this approach to design, methods such as feedback can be placed in a great variety of modes and symbol systems, depending on (among other things) whether the feedback must be: immediate or delayed; information about learning activities and/or motivation; correcting or confirming of learner strategies; and in verbal or pictorial form. The selection of media and symbol systems is critical at this final stage in design because of such factors as learner preferences, available media, and the available time and funds. The most efficient mode and medium used to express and deliver a method like feedback is likely to be specific to one set of learners in a particular context.

A third factor that contributes to the confounding of media and methods is that, when we are conducting design and development for delivery by new media, *we tend to ignore basic and applied research if that research was conducted with older media. We too often act as if we believe that each new delivery technology requires a new theory of learning and performance. Thus we "reinvent the wheel" constantly but inadequately.* The problem here is that designers and media producers look to previous programs developed for specific contexts and media in order to find methods to use in new programs. If the medium in question is new, the chances of finding previous research specific to that medium are slim and the developers may conclude that there is no research and so draw on their own personal history to design programs and so reinvent the wheel. If they find research based on the medium of choice, designers are prone to assume that attractive features of media attributes or symbolic modes from a previous program may be necessary to influence

learning. They often use a specific program as if it were a theory about learning, and the components of these programs are variables.

These issues are discussed in our literature. Remedies have been suggested by critics of design and development. For example, Heinichs (1991); Hannifin (1991); Lantieri (1993); Reigeluth (1988); and Winson (1989) and Winn (1991) argue that the solutions are not enough, nor are they more than a small part of the field.

One of the results of our confounded development is a frustration with narrow and practice in our field. We simply "give up" on quality and embrace phenomenological and qualitative methods as our only alternative. This frees us to reinvent the wheel in designing instructional technologies. Others generally are frustrated with narrow and contextual theories who try to make direct connections between theory and practice without the mediation of intervening processes. Our instructional technologies tend to split disciplines where different methodologies are taught. This split tends to reduce our control over curriculum. In order to have more control over curriculum, effort must spend on developing new instructional developments in response to students because they are interested in finding out how new media can focus their attention on media and not be distracted by coursework in advance of the technology of research. Theoretical and methodological research where we can no longer learn from each other or from research that inform practice.

learning. They often treat the evaluation of a specific program as if it produced generalizable theory about learning, and as if all of the components of these programs were independent variables.

These issues are not new. They are often discussed in our literature, and a number of remedies have been suggested by thoughtful critics of design and development including, for example, Heinich (1984), Hooper and Hannifin (1991); Landa, (1983); Ohlsson, (1993); Reigeluth (1983, 1992); Ross and Morrison (1989) and Winn (1990). The problem is that the solutions are not disseminated widely enough, nor are they generally accepted by more than a small number of people in our field.

One of the results of the confusion caused by our confounded research, design and development is a fragmentation of research and practice in our field. A number of us simply "give up" on quantitative research and embrace phenomenology and related qualitative methods as our sole inquiry tool. This frees us to reinvent theory and practice while designing instruction with exciting new technologies. Others generate radical constructivist and contextual theories, partly due to their frustration with narrow-minded researchers who try to make direct application of descriptive theories without regard for the complexity of intervening processes and local conditions. Our instructional technology graduate programs tend to split away from parent disciplines where learning theory and methodology are taught (Clark, 1978, 1989). This split tends to give technology faculty more control over curriculum, and reduce the effort it must spend to keep abreast of new developments in research. The split serves students because those who are primarily interested in finding applications for new media can focus their efforts on the new media and not be bothered with difficult coursework in advanced learning theory and the technology of research. The result is a theoretical and methodological "tower of Babel" where we can no longer communicate, learn from each other or build systematic theories that inform practice.

AN EXAMPLE OF ADEQUATE INSTRUCTIONAL DESIGN AND MEDIA DEVELOPMENT

Space prevents a full description of the rationale for and examples of instructional design that draws on the results of basic research and design research (also called *prescriptive research*). One good example of a design system firmly grounded in basic and applied research can be found in Anderson (1983; 1990) who makes full use of cognitive descriptive theories of learning and expertise in the development of his ACT design theory. Gagné, Yekovich, and Yekovich, (1993) have extended Anderson's design theory and described how it might be applied to school tasks such as learning to read and write, and to important content areas such as mathematics and science. Anderson has applied his own theory to many local applications including the development of a computer-based program called *LISP Tutor* for training people to use the LISP programming language (e.g. Anderson, Farrel & Sauer, 1984).

Anderson (1983) makes the point that design theory should be generic in that it should accommodate any learning task and any set of learners. Development and delivery theories must be local in that they must apply design theories to a specific context where real people live and work. At this local level we find constraints in values, beliefs, misconceptions, knowledge and resources that must influence the way we implement our design. At this local level, we will find specific media attributes and delivery vehicles that are the most efficient way to *instantiate* or translate instructional methods that have themselves survived the transition from descriptive and design theories to serve the specific needs of a specific group of learners. At the local level, we only have the option to choose a medium that will deliver the method that will influence the necessary cognitive process for the desired learning task performance. We must translate the generic and irreplaceable method to suit the individuals who reside in the specific context we are serving. We would have reasonable disagreements about whether it is possible to present some methods via certain media in the

chosen symbol system or within the time or budget available to achieve a desired performance. For example, it is impossible to present pictures via audio and very difficult to present immediate feedback that is sensitive to a broad variety of learner performance problems with broadcast television or radio.

ARE METHODS REPLACEABLE?

The final answer to the question "Are methods replaceable or interchangeable?" depends on the level or stage in the design process. At the first level or generic stage, methods are defined in terms of the cognitive process they support. At this stage they are not replaceable. However, at the local level, when generic methods are translated into symbol systems for conveyance by media to particular learners in specific contexts, then multiple instances of a required generic method may be possible. Each instance could have a different efficiency characteristic for any given learner. □

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A Reply: M

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