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To: John Black, Howie Budin, Bob Taylor, Rosemarie Truglio
From: Robbie McClintock
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I've read Clark's piece on swimming upstream and wish him well. His assessment of the evidence at which he looks is possibly sound, as far as it goes, but it seems to me bounded by a singular lack of imagination. I do not think it a sufficient way to deal with Kozma's "Learning with Media" (*Review of Educational Research*, Summer 1991 [61:2;179-211]) to observe that it "is a subtle argument which I do not completely understand." Kozma is not all that obscure, and the claim of incomprehension seems to me to belie a kind of willfulness on Clark's part. He wants to consider seriously only those things that fit his view, by which he risks grounding large assertions on a very incomplete marshalling of the evidence. If incomplete, his assessment of the evidence can be quite sound while his conclusions can nevertheless be wildly wrong. Such, I think, is the case.

Scientists can believe in the uniformity of nature without expecting all change to take place in uniform, homogenous increments. Take an elementary instance. Within a wide temperature range between 0 and 100 degrees centigrade, heat has a nearly negligible effect on the volume and state of water, but when the temperature crosses the threshold below 0 or above 100, the effect on the volume and state of water becomes powerfully evident. Most significant changes in history associated with technological innovation consist in changes of phase, not in simple incremental changes, and I think they are hard to measure and predict from controlled studies of the sort normally conducted by researchers like Clark, who is adept at observing changes when one warms water from 50 to 60 degrees, so to speak.

Historical research gives us diverse examples of phase effects in technological change. For instance, for centuries, across cultures, the typical height of buildings did not exceed five stories or so, a few ceremonial towers and domes excepted. It didn't matter whether the building material was stone or wood. One could well have argued that building materials and techniques had little to do with the height of structures, which were really controlled by the constraints of the human respiratory and circulatory system — how high the ordinary person could walk up several times daily without feeling fagged out. In the late nineteenth and early twentieth century those human constraints were negated, along with structural limitations on the economics and maintenance of tall constructions, and functional buildings suddenly sprouted upwards. Architecture went through a change of phase in which buildings that would have been impossible formerly became commonplace. If media have effects on learning, the more interesting ones will be of this sort.

There is absolutely no reason to expect, a priori, that the interesting effects of media on learning should be of a type to be revealed through the research methods Clark deems sound. Several of Clark's examples make sense only if one has in mind the typical, mundane range of things where little is at stake. Take his example of the grocery truck. Assuming groceries are a secure, abundant good, it is sensible to say that the truck that delivers our groceries has negligible effect on nutrition. But to Bosnians starving under siege, whether or not a truck loaded with groceries runs the blockade can make the difference between survival or starvation. Or consider his argument about pharmacological media — "the different ways pharmacists have developed to provide us with the active ingredient in a medicine."

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> Those "media" include a variety of tablets, liquid suspensions, suppositories, or injections. All of these different media serve to deliver the same "active" chemical ingredient with different levels of efficiency, but with equal effects on our physical symptoms.

This argument is sensible only where the locus and threshold of action for the chemical ingredient can be ignored — Clark would be disturbed were his dentist to administer Novocain by anal suppository and in the face of massive infections, the dosage of antibiotics must cross a high threshold in order to have effect, requiring that they be administered intravenously if they are to combat the infection. Education takes place in real social and cultural contexts and the effects of media on learning arise, not from some pure psychological dynamic, operative at any time at any place under any condition, but because the media differentially structure the contexts, making the conditions of learning a this time and place differ from those at another.

Clark's research methods make him discount everything but the psychological efficiency of learning. His proposition rigorously put is rather self-evident — if we carefully ensure that the amount of instruction delivered via different media is the same, any variance in learning can be accounted for by differences in the methods of instruction rather than by the variations in the media of instruction. Most media effects pertain, however, to the cultural character and effectiveness of learning, not to its psychological efficiency. Rigorously, cultural effects arise because media alter the amount of instruction that can be delivered under real conditions — print changes the amount of silent reading in which a given population can engage. These cultural effects simply do not lend themselves well to study through Clark's methods, but that discounts neither their reality nor their significance. Thus we would not say that the introduction of printing was a significant development in Western history because a person could more efficiently learn from a printed book than he could from a manuscript. Rather books became a more ubiquitous, dependable, and accessible sources of learning, under the historical conditions that became commonplace with printing, than books previously had been, and consequently deep changes in the cultural value of book learning built up historically. To say that print media had no effect on learning in cultural history would be absurd. To say that their effects could be predicted by studying the efficiency with which a reader could acquire information from a printed sample compared to a well-formed scribal sample would be equally absurd. The controlled comparison would show negligible differences, but that would not obviate the historic change. *Eppur si muove!*

I would go on to suggest, although I don't have time to develop it here, that historical and cultural research into the effects of media on learning can be very useful in the design of learning systems. One proceeds somewhat like a medical researcher in trying to diagnose the etiology sustaining a current condition that is limiting, debilitating, or adverse. Then one can try to figure out how the introduction of new media, and alterations in the configuration of media, can transform the set of operative causalities in such a way that a different, more advantageous condition can develop. Invention is not quite the same as research and the design of learning systems should be driven by invention as much, if not more, than by research.

Clark, R.E. (1991). When researchers swim upstream: Reflections on an unpopular argument about learning from media. Educational Technology, 31(2), 34-40.