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Education's Technology Puzzle: Solving for the *X-Factor*

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"A new paradigm involves a principle that was present all along but unknown to us. It includes the old as a partial truth, one aspect of *How Things Work*, while allowing for things to work in other ways as well."

Marilyn Ferguson

Paradoxes -- those puzzling, seemingly illogical, conundrums have become a regular part of today's educational environment. Two things we know about these puzzles: [1] They appear when we can't *make sense* of what we experience in our lives. [2] Their solutions usually involve finding something <u>within</u> the situation that isn't being accounted for -- an unknown logical *X-factor*.

Larry Cuban, former superintendent and now Stanford professor, is my favorite *paradox* prober. This time, in an article *The Technology Puzzle: Why Is Greater Access Not Translating Into Better Classroom Use?* [EdWeek, 8/4/99], he challenges "both cheerleaders and skeptics of using new technologies in the classroom" to figure out why "in other organizations (think hospitals, major corporations, supermarkets), computer use is ubiquitous. [but] not so in schools."

And for those whose quick answers blame teachers' "insufficient preparation in universities, their lack of specific training, too little time to learn, too many older teachers, technophobia," etc. he poses another paradox.

Out of every ten teachers in this country fewer than two are serious users of computers in the classroom, three to four are occasional users, and four to five teachers never use the school machines at all. Yet seven of those *same* ten have computers at home and use them to prepare lessons, communicate with colleagues and friends, search the Internet, and conduct personal business. Most teachers use computers at home more than at school. If they are so fearful and unprepared, why?

As a possible answer, Cuban then offers five conditions teachers deal with that may offer explanations for this puzzle:

- Contradictory advice from experts.
- Intractable working conditions
- Demands from others
- The inherent unreliability of the technology.
- Policymakers' disrespect for teachers' opinions.

But, while truth can be found in each, they don't really lead to the answer Cuban seeks when he asks us to figure out why "in other organizations (think hospitals, major corporations, supermarkets), computer use is ubiquitous...but] not so in schools."

Many of those *same* conditions exist in these other organizations, yet effective integration of technologies in their work hasn't been hindered. In fact, their acceptance as *the-way-work-gets-done* has made them relatively transparent -- buried in the invisible assumptions underlying everyday actions.

The X-Factor

Like all classical paradoxes, the answer to this puzzle also can be found in "an unknown logical X-factor <u>within</u> the situation that isn't being accounted for." But what could be hidden in the very familiar everyday practice of schools that somehow we can't see? To discover what our over-familiarity may be hiding, let's first look at those other technology-using organizations Cuban suggests we think about.

At first glance the "work" of hospitals, product-developing corporations, and supermarkets seem totally different. But their work processes share one characteristic that seems so logical that it remains hidden as an assumption of *what-just-has-to-be* --no choice! In each case, at the core of the visible work process is a fundamental sequence of events that is determined by the <u>unique nature of the final result</u> -- the "product" of all the work that must be done.

It seems obvious that the final shape and nature of a car determines the flow and structure of its construction. Similarly, in a hospital, it is the universally-accepted, fundamental nature of the human body that determines the core structure of the hospital's work process. Think about the ever-present wall chart portraying the human body and its interconnected parts found in medical settings . Universal acceptance of everyone's "sameness" in the ways they are internally organized and function actually enables the work of medical practitioners to focus on and respond to the "differences." A base of common knowledge like this -- universally accepted as fact, not theory -- is the hidden "X-Factor."

With the facts of the body's nature serving as their starting point from which to identify "differences," the medical practitioners' work -- "treatment" -- has at its core a mandatory requirement for becoming, and continually remaining, aware of those differences, responding to them appropriately, and then continually repeating that cycle. This fundamental self-correcting process of interactive diagnosis and prescription [e.g., "Take two aspirin and call me in the morning"] grounds all medical practice. This informed interaction has become such an invisible "given" in the equation that it is just assumed. One wouldn't go to a hospital that treated everyone the same.

And this core interactive process is not just found in hospitals. All effective organizations today are structured and managed around the same simple, common sense process regardless of whether they provide services or products. The process consists of two elements:

1. A core work process that is by nature responsive to the needs and requirements of the client, customer, or product. In that process it is informed interaction between the "worker" and the object of the work that engages the human mind's natural trial and error way of solving problems and achieving purposes. At the "end" of that process, the "quality of results" -- the match between intentions and outcomes, between needs and results -- is directly dependent upon the frequency of that interaction and its appropriateness. And "appropriateness" is shaped by the knowledge that informs it.

2. An organization in which every function supports the response-ability of the core interaction. That is, continually informing the interaction between caring workers and the "outcome." The organization's flow of information informs that interaction, and time and tools are provided to support the process's interactivity.

It's easy to see why industry calls those critical interactions at the "results" end the "moment-of-truth" -- the choices made by the "last person in the line" that fulfill or diminish all those decisions from "above" that went before. In medicine, as we've noted, they call this type of informed interaction -- sound "diagnostic/prescriptive" health care. In education, it's always been known as the essence of "good teaching."

But when we turn from those other organizations back to education we find the organization, as opposed to other human response services, not organized to support those "moments-of-truth" as if they were in fact a core requirement of the process. Why is this X-Factor -- the essence of good teaching -- hidden in the educational process?

In Search of X

The hospital offers a good jumping-off place for looking at how the X-Factor got lost in schooling. In many ways there are fundamental similarities in the nature of the work the professionals in each do and manage --teaching and curing; as well as what their customers do and ultimately manage -- learning and healing. Yet the X-factor, which requires an organization to address the unique nature of its "product"-- in the case of schools, the learning capacities of each child, is not a basic operating assumption for schools.

The strategic consequences of this missing assumption could be seen recently in the words of a national school leader, who, in advocating "teaching every child according to the child's needs," went on to say --"the most unequal treatment given to children is equal treatment." Unfortunately, posing the truths of the conventional equity-excellence struggle in this way offers no solution. Hospitals don't have to deal with this "every" vs. "each" dichotomy because they manage a core "equal treatment" for all that enables them to provide differentiated treatment for each.

Why should it be so hard to apply this understanding in schools where everyone wants to make a difference with the children whose lives they touch? Another paradox? Not when one understands how little of what society accepts as the work of schools has been informed by "the unique nature of its product." One finds a general lack of acceptance of current knowledge about the workings of another "body part" -- the human brain. It remains as "nice-to-know-and-someday-we'll-have-enough-time-to-deal-with-it" information, not at the same level of what-just-has-to-be belief that allows hospitals to build their services and structures outward from common knowledge of how the rest of the human body works.

At the same time, as a consequence of research on the human brain, understanding of learning -- the seldom questioned reason why classrooms, schools, and school systems are structured the way they are -- turned around 180°. Learning now can be understood as more than accumulated content. It is, instead, a biological capacity inborn in every child. This capacity to weave skills and knowledge into effective actions, is driven by a natural will that if not extinguished in the early years of life fuels life long learning. Many education reformers have picked up on the implications of this knowledge for schools. They see that the continual development of this learning capacity is schooling's purpose or "product."

The same research on learning also has contributed related understandings about teaching -- the ways to develop that "product." The single concept emerging from brain research and neuro-science about how the human brain develops and continues to increase this capacity throughout life is that this result we call "learning" is the product of interaction.

While this was not new information to anyone close to teaching -- effective teaching has always been a process based upon managing interactions appropriate to the needs of each child -- it provides a key knowledge bridge for linking to schools the knowledge of how other organization's use technologies to increase their interactivity, and consequently, their effectiveness.

The Y-Factor

Understanding this missing role for technology in schooling also requires noting that the critical final interactions above are not the only "work" we see going on in these other organizations. While the X-Factor determines the basic nature of the work, we see another more visible "work process" [we'll call it a Y-Factor] wrapped around this common core of interactive diagnostic and prescriptive work that determines its scope.

This process involves the human beings who create the organization's results, outcomes, products. And, interestingly, this process -- the primary focus of management and leadership theory and practice -- is "product" or "results" driven, but "product"-free. It's scope and structure is determined more by the unique nature of people when they work together effectively to produce "any" product.

The "hidden" nature of these processes also have only recently become generally understood. The concept of an organization as a single system -- parts connected to a common purpose -- has been a fundamental principle of organizational observers such as Drucker, Wheatley, Senge, Deming, and

Ackoff. Their significance to our concern is their view of those "connections" as interactions. Organizations could be viewed as a function of the interactions between and among the people who operate its parts. And effective organizational leadership now could be understood as the envisioning, creation and management of these human interactions.

And here is where the new understandings of cognition and management merged. The new knowledge of the nature of human learning -- with its requirement for interaction to continually develop it as an individual capacity -- suddenly became a factor both inside and outside of the organization called "school." In both cases, the human mind was at the core. That is, the interactive human relationships [processes] that define the scope and nature of an organization's work, are always anchored in single minds that require interaction for their continual growth and development.

X + Y

When these two "work processes" are seamlessly integrated, they provide a sustainable infrastructure for making the core interactive work process increasingly more effective. And where technology has become "ubiquitous" it provides the scaffolding for that people-product-connecting infrastructure.

As a consequence of the new knowledge of the means and ends of learning environments called schools, there now seems to be a common, and universal, reference point against which reformers can judge appropriate teaching and schooling practices:

Do they contribute to this interactive process of capacity development in each individual -- child and adult?

Puzzle solved?

Our search for the hidden reason why technology use in schools differs so greatly from use in every other social organization led us to assumptions hidden in the work processes of schools -- assumptions about the school's "product," and about the "people" who produce it.

But this leaves us with a new paradox. The knowledge we now have about cognition and management from both research and practice is sufficient enough to support totally different operating assumptions. They could provide a critical base for the major pedagogical and structural reforms sought today. And these assumptions would lead education to the same "ubiquitous," semi-transparent use of technology as found in other organizations in society.

But this paradox, too, has its X-factor -- something within the situation that isn't being accounted for. Most of the ways technology is being used in education today -- as effective and "promising" as they may be -- do not provide models of what has made the same tools so vital and value-adding in other organizations. And without practical experience with these ways to use technologies there is little chance to develop and integrate the base of assumptions that underlie their acceptance.

Where can this experience come from? No major educational reform strategy today includes this core, "ubiquitous" role for technology. They, too, seem to be operating from a common body of out-dated assumptions about people and organizations that leaves them with the "teacher" as the accountable agent for "technology" use.

But how can the person at education's end point -- the moment-of-truth where the "system" interacts with the child -- be expected to function as an isolated practitioner any more than one expects a hospital staff member to function without the organization providing the technological means to continually monitor and do something about his or her effects on a patient. The hospital, as a total organization, is held accountable for informing and supporting the interactions the individual doctor or nurse manages or contributes to.

Hopefully, educational professionals themselves might support this different concept of accountability because they recognize that the core work that defines one as a "professional" [think nurse, doctor, lawyer...] is structured around interactivity. In fact a Texas judge recently banned sales of a do-it-yourself

legal software package [Quicken Family Lawyer 99] because it "ventured into the unauthorized practice of law." The reason: its interactivity.

If this paradox with it's solution so close to its surface can be solved, the possibilities for technology and education are limitless. The question driving technology's use would shift from "What can technology do? to "what can people do with it to accomplish their core work -- making a continuing difference in the lives of children?

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SOLVING FOR X

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Solving an equation can be easier if one sees what's on the far side of the "=" sign. In the same way we sometimes use a jigsaw puzzle's box cover to give us clues about the big picture.

So what might our puzzle solution look like if technology were "ubiquitously" used to enable response-ability in the work of schooling? What would we see when we observed technology-supported people at work in schools? What would be different for children and adults?

Here's a way to draw the "box cover" for yourselves.

Group Exercise

A.   Each table will design a school district to accomplish one of these three purposes:

1) You would want your child's elementary and secondary school years to take place there; or

2) You would want to work there if you were an educator; or

3) You would be willing to support it with your taxes if you were a local business person.

Here are three "givens" of your situation:

Condition 1. You have a staff with needs:

• to orient themselves and gain personal meaning; to understand how they personally "fit" or relate to the   organization's purposes (through vision, mission, goals, values)

• to know the effects of their own actions so that they might self-correct(through coaching, access to formative feedback, and opportunities to reflect)

• to know what behaviors are expected, ideal, successful (by modeling, rewarding)

•   to realize what can be done (through opportunities for experience-sharing with peers and access to research)

•   to continually develop an understanding of the conditions and situations to which they respond (through opportunities to analyze scanning data, trend analyses, and student data).

Condition 2. You have information technology available that can:

• connect new work patterns, roles, and relationships to allow regular organizational interaction among practitioners with common agendas;

•   provide access to information and other resources at the places and times needed for timely responses;

• store information about prior actions that can serve as a focus for reflective identification of patterns, strengths and needs;

• store & process information about multiple and varied aspects of situations to facilitate new insights and understandings.

• facilitate trade-offs that permit the start of solution strategies before all the "right" parts are in place.

Condition 3. Due to changes in local and state economic conditions, you cannot predict the types of students (e.g., socio-economic levels, ethnicity, at-risk, etc.) who will be attending your schools within 3 years. All you know is that each student will have needs:

• to orient themselves and gain personal meaning; to understand how they personally "fit" or relate to the world around them

• to know the effects of their own actions so that they might self-correct

• to know what behaviors are expected, ideal, successful

• to realize what they can do - their capacities

• to continually develop an understanding of the conditions and situations to which they will have to respond through our life.

B.   When the individual groups are ready to describe the major features of their "dstrict design," have them meet with the groups representing each of the other district designs, and compare their visions.

•• Where are they similar, why?

•• Where are they different, why?

C.   As a total group, now design a district that would have the capacity to respond *simultaneously* to the needs of the students, staff, parents, and community.