Prologue

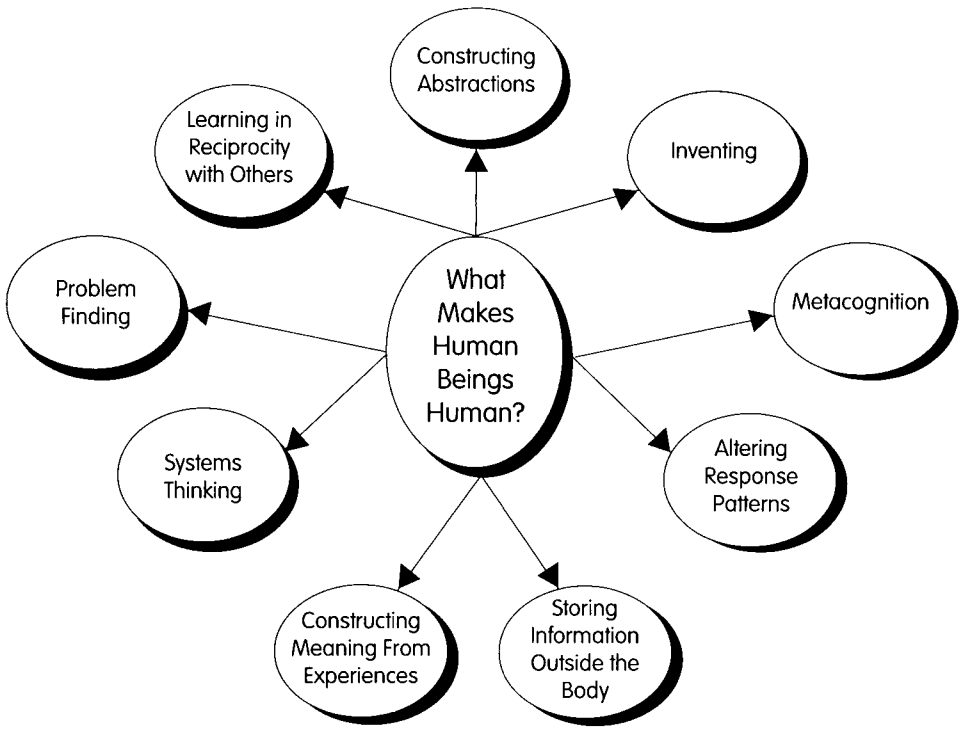
Deeply rooted in constructivist theory, this book draws on philosophical and psychological models of how the mind works, how human intellectual capacities emerge and grow over time, how humans derive meaning, and how knowledge is structured. The intent is to provide educators with insights into how interventions can be arranged and conditions organized so as to educe, enhance, and refine those human intellectual resources.

In reviewing this book and preparing to write this prologue, I reminisced about other constructivist theorists who influenced the formation of my views of learning and human cognitive development: Bruner, Piaget, Taba, Suchman, Feuerstein. I retrieved several of the constructivist mental models that scaffolded their philosophical and psychological search. I found myself returning to Jerome Bruner's compelling inquiry, "What makes human beings human?" I began to mentally reflect on and list some of those unique intellectual capacities that distinguish humans from other life forms.

When I approached the upper limits of my memory span—that magical number 7 (plus or minus 2) items to hold in my head simultaneously—I realized I had to write them down or

FIGURE 1

What Makes Humans Human?

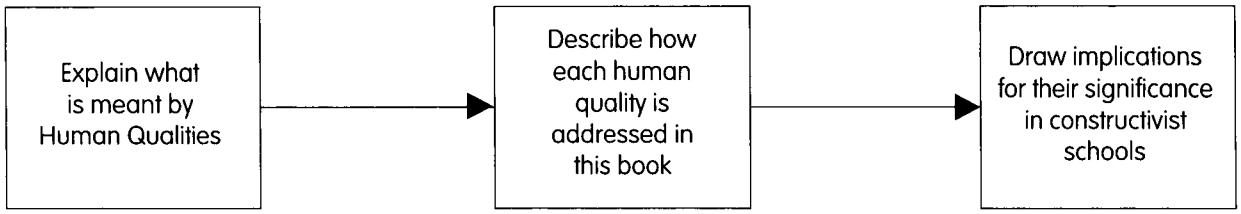


some might drop out. I therefore represented my thoughts graphically (Figure 1).

As I mapped, I also came to realize that what I thought in my head was fuzzier than what I wrote on paper. As I refined what was on paper, I mutually refined my inner thoughts. I realized, for example, that many human capacities, while innate within us, are underdeveloped and will need to be amplified to live productively in the future. Not only did the brainstorming map allow me to see the relationships between these attributes, but it also disclosed overlaps, redundancies, and omissions. I edited here and there to become consistent and then reflected on my map. I felt satisfied that I had a structure that could be decorated with a few insightful contributions about the benefits and potentials of this book. Using the structure, I then turned to composing. As the thoughts flowed from my brain and were translated to individual letters by my fingers and flowed as words onto the computer screen, I again revisited my

FIGURE 2

Prologue Process



map—altering here and there, combining where necessary, and generating more bubbles as additional thoughts emerged that, in turn, stimulated others.

The gift that David Hyerle has bestowed on us in this book, you see, is a set of tools for exploring, enhancing, and refining those unique cognitive qualities of humanness. I would like to:

- Explain what is meant by each of these uniquely human qualities that undergird constructivist theory.
- Describe how Hyerle has so masterfully addressed them.
- Make implications for their significance to constructivist schools where the staff is intent on emancipating themselves, their students, and their communities from the shackles of nearly a century of reductionism (see Figure 2).

The following nine human qualities, then, may illuminate my reflections on this book.

1. Metacognition: To the best of our knowledge, human beings are the only form of life that can reflect on their own thinking processes. Basically, metacognition means that, when confronted with a dilemma or some obstacle, humans draw on their mental resources to plan a course of action, monitor that strategy while executing it, then reflect on the strategy to evaluate its productiveness in terms of the outcomes it was intended to achieve.

The "thinking" visual tools described in this book are forms of metacognition—graphically displayed thinking processes.

We know that what distinguishes expert from novice problem solvers is habituated metacognition; that thinking and discussing thinking begets more thinking; and that thinking and problem-solving capacities are enhanced when students think aloud, discuss, and communicate their thought processes to others—when students make their implicit problem-solving processes explicit.

2. Constructing Abstractions: Humans have the unique capacity to synopsize massive amounts of information and to shape raw data into workable patterns. There was a time when human beings lacked access to information in making decisions. Data were scarce, took long periods of time to transmit, and were simplistic in format and immediate in implication. With the advent of the Information Age, however, an overwhelming amount of immediately accessible and often conflicting information became available. Because of the lack of vast amounts of disparate, available information in the past, the human intellectual capacity for constructing abstractions may have been underdeveloped. And because of the increase in available information, the upper limits of this capacity will be continually tested and exceeded in the future.

This book provides visual tools to assist learners to organize and find patterns among the overwhelming amount of information available today, as well as to make sense out of it and evaluate it.

To live productively in the future, we have found that the capacity to construct abstractions has become prerequisite to survival and will need to be grown. Resourceful humans, therefore, will continue to develop their capacity to gather, organize, make sense out of, and evaluate the overabundance of technology-generated and -transmitted data.

3. Storing Information Outside the Body: I recently had more memory installed in my computer. It was a simple process of installing more DIMMs (dual inline memory modules). I wish I could do the same for my brain! Human beings are the only form of life that can store, organize, and retrieve data in locations other than our bodies. This human capacity probably emerged as a survival mechanism because our ancestors reached the limits of their memory span. They had the need to remember and communicate an increasing amount of information and therefore used tools to record and convey mental visions and concepts. Cave walls, where their dwellers formed their marks and petroglyphs, may be history's first storage locations. Now videotapes, museums, libraries, microfiche, computers, and CD-ROMs assist in accomplishing this human function.

This book fulfills this human intellectual capacity by providing tools to generate, store, and communicate information in such a manner that can be recalled and interpreted at a later time and by others.

Because the archives of the mind are limited and the amount of information is increasing, students will need to learn strategies of harvesting, storing, cataloging, retrieving, interpreting, and communicating vast amounts of information among locations beyond their brains.

4. Systems Thinking: Humans have the unique capacity to see the parts in relation to the whole and thus to see patterns, congruences, and inconsistencies. Human preferences for perceiving parts *or* wholes as separate cognitive inclinations, as some cognitive-style theorists would have us believe, is inadequate for productive participation in a quantum world. In dynamic systems, tiny inputs can reverberate throughout the system, producing dramatically large consequences. Systems thinking fulfills a

human capacity to understand the boundaries within a part of the total system and, at the same time, to understand the interactions with its interconnecting parts.

Hyerle suggests the use of visual tools to guide thinking when we need to simultaneously pay attention to the whole and analyze whether the parts are, indeed, interdependent and interconnected. Visual tools are one way to describe how a system functions when altered or when innovative thinking in one part of the system has an effect on the total system. Maps serve as tools for examining many processes and interactions, such as how decisions are made, how disciplines work together, how new practices are initiated, and how priorities are established.

Families, weather systems, and national economies are examples of systems. To participate fully in any society and to protect a fragile environment, citizens must realize that any system is a synergistic relationship of interlocking parts; as one part changes, it has an effect on the other parts. No one part can operate efficiently unless the other parts of the system work in harmony. This capacity for simultaneously holonomous parts-whole relationships has become essential, not only in the workplace, but also in solving environmental and social problems.

5. Problem Finding: To the best of our knowledge, humans are the only form of life that actually enjoys the search for problems to solve. Being dissatisfied with existing levels of certainty, humans have an insatiable passion for doubting the status quo, sensing ambiguities, and detecting anomalies. Once having intuited such inconsistencies, humans have developed the profound capacity to engage in experimental inquiry, to set up procedures to test and evaluate alternative ideas, and to strive for certitude. The process of modern scientific thought thrives on this human tendency.

Maps are tools for displaying intellectual processes: the clustering of the diverse, complex procedures of experimentation. They represent the sequences, alternative branches, choice points, and pathways that surround the acquisition and production of knowledge. These become the basis for systematic inquiry and scientific investigation.

Process is, in fact, the highest form of learning and the most appropriate base for curriculum change. In the teaching of process, we can best portray learning as a perpetual endeavor and not something that terminates with the end of school. Through process, we can employ knowledge, not merely as a composite of information, but as a system for continuous learning (Parker and Rubin 1966).

6. Reciprocal Learning: Human beings are social beings having a compulsive craving to engage with others. The most hideous form of punishment is to deprive humans of their quest for reciprocity. Humans learn best in groups. Intelligence gets shaped through interaction with others—justifying reasons, resolving differences, actively listening to another person's point of view, achieving consensus, and receiving feedback.

In this book, Hyerle commends interactivity as tools are developed in cooperative settings. Such tools assist in developing students' and

teachers' capacity for flexibility—viewing situations from multiple perspectives, as well as being able to change and adapt based on feedback from others. Using such cooperative tools transcends the sense of self—enlarging the conception of "me" to a sense of "us." And becoming less attached to egocentric orientations permits us to exercise more advanced reasoning processes. Use of such tools provides interconnectedness and kinship that comes from a unity of being, a sense of sharing, and a mutual bonding to common goals and shared values. Students understand that as we transcend the self and become part of the whole, we do not lose our individuality; rather, we relinquish our egocentricity.

Collaboration, cooperation, and interdependence are paramount not only in today's work cultures but also in families, in governmental organizations, and among nations. Schools must enhance students' capacities for holding their own values and actions in abeyance and to lend their energies and resources to the achievement of group goals; to contribute themselves to a common good; and to seek collegiality and draw on the resources of others. Students must come to regard conflict as valuable, trusting their abilities to manage group differences in productive ways, to seek feedback from others as a valued source of learning. They must know that "all of us" is more efficient than any "one of us." Interdependence makes possible the most complete and effective intellectual functioning of human beings.

7. Inventing: Human beings are creative—they are toolmakers. Although some other life forms may perceive the need for and employ instruments to accomplish tasks and solve problems, humans are the only form of life capable of designing and creating new tools.

Further, humans are intrinsically rather than extrinsically motivated, working on the task because of the aesthetic challenge, rather than the material rewards. They constantly strive for greater fluency, elaboration, novelty, parsimony, simplicity, craftsmanship, perfection, beauty, harmony, and balance.

Hyerle disparages giving students ready-made maps to follow and fill in. He emphasizes the need for students to invent their own tools and to hone and refine them as they generate and gather information, process or elaborate that information into conceptual relationships, and then apply and evaluate those generalizations. He believes strongly that there is an inherent motivation within each of us for this inventive process, which can be capacitated through such visual toolmaking.

All humans have the capacity to generate novel, original, clever, or ingenious products, solutions, and techniques. We often try to conceive problem solutions differently, examining alternative possibilities from many angles. We tend to project ourselves into different roles using metaphors and analogies, starting with a vision and working backward, imagining we are the objects being considered. Creative people take risks—they "live on the edge of their com-

petence," testing their limits—if that capacity is developed.

8. Deriving Meaning from Experiences: Thomas A. Edison stated that he never made a mistake; he only learned from experience. One of the most significant attributes that makes humans human is their capacity for reflecting on and learning from their experiences. Intelligent people form feelings and impressions about an event; they compare intentions with accomplishments; they analyze why events turned out as they did; they search for causal factors that produced the effects; they summarize their impressions; and, based on those analyses, they project how they could modify their actions in the future.

The human mind, however, is inclined to distort or delete information to suit its own purposes and biases. Hyerle suggests that the use of maps as tools for reflection can assist us by graphically tracking the procedures employed in an event. Reflecting on the visual pathways, strategies, and decisions is a more efficient and systematic way of holding information than attempting to recall it. The experience can be analyzed more honestly and completely if it has been graphically organized.

Autonomous individuals set personal goals and are self-directing, self-monitoring, and self-modifying. Because they are constantly experimenting and experiencing, they fail frequently—but they *fail forward,* learning from the situation. A major outcome for any school desirous of preparing autonomous humans, is to develop students' capacities for continuous self-analysis, self-improvement, self-referencing, self-evaluation, and self-modification.

9. Altering Response Patterns: Whereas other forms of life are "wired" to respond in certain ways to stimuli in their environment, humans are self-actualizing and self-modifying—they can consciously and deliberately make choices about whether and how they wish to respond. They can alter their habits and can voluntarily select among alternative responses. Whereas we might be inclined to be impulsive, we can choose to be deliberative; if we are disposed to make premature evaluations, we can choose to withhold our judgments; when we are habituated into perceiving egocentrically, we can choose to perceive allocentrically. This decision-making process requires consciousness and flexibility—being aware of our own and other's actions and drawing on a repertoire of response patterns.

Hyerle supports the use of visual tools because they encourage consciousness and flexibility of responses. Deliberately employing mapping tools causes us to restrain our impulsivity, to suspend our judgments, to generate and consider alternatives, and to attend empathically to others' perspectives.

Fully functioning humans engage in continuous learning. If our students believe that their education has been completed on graduation, they've missed the whole point of schooling. Continuous lifespan learning is essential for students today and in the future. With advances

in technology and changes in the workplace and human mobility, we may find other underdeveloped capacities—continuing to learn how to learn, how to change and grow, and how to relinquish old patterns and acquire new ones.

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David Hyerle also proposes that the use of these tools is not just "kid stuff." Cooperatively inventing and employing such tools benefits the human intellectual capacities of the adults in the school as well. When the staff design, generate, and employ these maps, they too become more aware of their data-generating, storing, and retrieval systems. All staff members are at once beneficiaries and leaders of the learning organization. They more readily see the parts-whole relationship. They view their particular operation as part of a larger whole and see that innovative/creative thinking in one part of the system has an effect on the total system. Everybody in the entire system is perceived to be a continual learner—a caring, thinking individual capable of complex decision making, creativity, problem solving, and continued intellectual development.

The use of visual tools throughout the school will have a corresponding and salutary effect on the development of the adult intelligences and capacities that may be prerequisite to the development of student's capacities. Indeed, we are all learners in a learning organization. What gives integrity and coherence to school life is not only the continuity and use of visual tools across departments and grade levels, but also the use of a shared, common language throughout the organization. Perhaps it is this fractal quality that is the unique characteristic of an intelligent school.

Reference

Parker, J.C., and L.J. Rubin. (1966). *Process as Content: Curriculum Design and the Application of Knowledge.* Chicago: Rand McNally.

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