

Architects of the intellect

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The best constructivist teaching today reflects the legacies of educational visionaries. The philosophies and cognitive designs of several innovators in the field, including Jean Piaget, Howard Gardner and Marian Diamond, are discussed.

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The best constructivist teaching today reflects the legacies of educational visionaries.

Students huddle over a table, focusing a microscope. Young learners draw geometric shapes to create sketches of prehistoric animals. Kids gather leaves in the school yard for classification. Adolescents rehearse for the spring musical. A lone girl is riveted to *Little Women*. A freckle-faced boy jives to music. These are the scenes of the active learning classroom, the sights and sounds of engaged learners. And these are the designs of masterful school architects.

Designs with the Brain in Mind

These are not everyday architects who design concrete buildings with steel frames. Oh, no. These are "architects of the intellect," who design exquisite learning experiences for eager minds. Their mission is to create learning experiences that invite students to construct knowledge and to make meaning of their world.

This mission is daunting. Although the human mind innately strives to make sense of input as its neural pathways form intricate connections, its neural linkages are inextricably embedded in the prior knowledge of each learner. How do these architects design learning suited to the unique schemata of each learner?

As we might suspect, the designs require rigor. In fact, three essential attributes are usually present: the creative genius of the teacher (the art and science of teaching); complex tools for instructional excellence (instructional methods); and expansive systems

of interconnectivity to frame these learning experiences (curricular frameworks). When the designs are complete, learning occurs naturally and with purpose.

just as a traditional architect might borrow the fundamental elements and signature styling from a master architect, such as Frank Lloyd Wright, educators borrow from master craftspeople. They borrow from master cognitive psychologists and neurobiologists who have helped shape structures for the intellect. They are strongly influenced by the foundational works of the proponents of a constructivist theory of learning.

The legacies of Dewey, Piaget, Vygotsky, Feuerstein, Gardner, and Diamond speak elegantly to the creative genius of the teacher as architect.

Dewey: Learning Experiences

John Dewey's designs embed learning in experience (1938). His concepts of curriculum and instruction go far beyond the classroom walls into life experiences. He advocated field studies and immersion in experiences to stimulate learning. We see Dewey's influence in community service and civic projects:

reading to the blind, cleaning up neighborhood graffiti, and partnering with local agencies to protest pollution.

We also see Dewey's impact when a class sets up a real store to manage consumer products and to understand the theory of supply and demand. We see his influence in outdoor education experiences and

field trips to museums and county court houses. A Deweyian architect, for example, might design a simulated archaeological dig in which students examine the layers of artifacts found in a classroom wastebasket.

Piaget: Discovery Learning

Jean Piaget's work influences constructivist educators through designs of discovery learning (1970). In these designs, students manipulate subject matter and objects representing the subject matter as they interpret their findings. Piaget theorized that the learners' interactions lead to structural changes in how they think about something as they assimilate incoming data. The influences of Piaget's designs are easy to spot in K- 12 classrooms. We might see students working with an assortment of magnets or experimenting gingerly with the idea of buoyancy as they float various items in a water basin. Students might be stringing electrical circuitry or manipulating Cuisenaire rods as they master the concept of fractions.

Discovery learning supports the curricular architecture of hands-on learning in classrooms today-- Constructing meaning on the basis of one's interpretation of data is the heart of science inquiry, problembased learning models, and case studies.

Vygotsky: Social Interactions

To see the incredible influence of Lev Vygotsky's designs (1978), we need consider only the myriad studies

of classroom interaction patterns. Vygotsky's theory suggests that we learn first through person-to-person interactions and then individually through an internalization process that leads to deep understanding. This belief in the social process of idea making permeates the interactive classroom.

Small groups of students might be bent over a map of Antarctica, deep in discussion of human survival, or pairs of students might be debating the most efficient method to solve a problem of square footage for a painting project.

A teacher might be directing a wholegroup discussion on the changes in Pip's character in *Great Expectations* or reflectively probing as a student illustrates her understanding of the Pythagorean theorem.

Skillful teacher questioning that guides the social interactions in the classroom is the mark of a master architect, clearly reflecting Vygotsky's thinking. At times, this influence may be more implicit than explicit, but the impact of Vygotsky extends far beyond theoretical pedagogy and into the realm of best practices in teaching.

Feuerstein: Mediated Learning Experiences

The portraits of these architects of the intellect would be incomplete without that of Reuven Feuerstein (1980), who performed ground-breaking work in cognitive modifications with traumatized children of the Holocaust. His success with these children through mediated learning experiences has transformed thinking about intelligence and human potential. His mediated learning theory refutes the concept of an unchanging IQ and leads to intense examination of how the classroom affects students' metacognition. He believes that the discovery process requires intervention from the teacher to guide learning.

Witness a student deeply engaged in searching for a pattern that connects a seemingly random series of dots. Listen closely to the expert intervention of the teacher: "Why did you do that? What were you thinking just now? How does this remind you of another problem that we did yesterday? Do you have a good reason for doing what you did here? Tell me about it."

Then, shift to a less intense classroom scene in which the teacher asks students to think about their teamwork upon completing a large mural of the Oregon Trail. "What were you supposed to do? What did you do well? What might you change if you work together again? Do you need any help?" Notice how the teacher goes beyond the cognitive to the metacognitive by leading students to think about their thinking. These architects put

Feuerstein's theory into practice as they guide students toward deeper understanding and reflective transfer.

Gardner: Multiple Intelligences

Howard Gardner's gift to the new architects is his conceptualization of intelligence as multidimensional (1983). He defines human potential in terms of the ability to solve problems in a cultural setting. With this broad perspective, Gardner has identified eight realms of intelligence: verbal, logical, spatial, musical, kinesthetic, interpersonal, intrapersonal, and naturalist. In innumerable classrooms, these multiple intelligences work in various combinations when students execute complex tasks.

Envision a youngster planting a summer garden. Many intelligences must come into play. She may think logically in the planning, interpersonally in obtaining advice about the proper seeds, visually in the laying out of the rows, naturalistically in understanding the gestation periods of the seedlings, and intrapersonally in reflecting on the results. In another situation, as high school students build a rocket in physics class, they think logically as they sequence the steps, visualize as they design the rocket, exercise interpersonal skills as a team, and reflect intrapersonally as they celebrate their success.

We feel the influence of Gardner's genius not only in understanding that there are many ways of knowing about the world and making personal meaning, but also in recognizing that there are many ways of expressing what students know and are able to do. We value performance assessments as an authentic evaluation of learning.

Students might literally perform: driving a car in a simulation, dancing a choreographed piece, demonstrating a basketball move, or playing a selection from Peter and the Wolf on the flute. Performance also may be more subtle: completing a persuasive essay, demonstrating proper laboratory procedures, befriending a new student, managing the school newspaper, or running the supply store.

John Dewey Jean Piaget Lev Vygotsky

Diamond: Enriched Environments

In the 1990s, the explosion of research on the brain and learning has brought the pioneering work of neurobiologist Marian Diamond to the forefront. She describes the growth of dendrites in the brain as the development of "magic trees of the mind" (Diamond & Hopson, 1998). To demonstrate the flowering of dendrites in stimulus-rich environments, she opens a closed hand. And she continues the metaphor as she speaks of an impoverished environment, slowly closing her hand to show how the dendrites shrivel. The influence of her research on enriched environments speaks to the same theoretical base as constructivism. In both domains, the learner is mindfully managing input in

a changing environment. Hallways dripping with printed posters, writings, mobiles, sculptures and paintings. Classrooms overflowing with beanbag chairs, rugs and pillows,

books, magazines, and newspapers. Science corners filled with greenery and tanks of fish, gerbil cages, and rock collections. The listening station alive with classical music, pop songs, ballads, and the blues. These are the sights and sounds of enriched environments-the sights and sounds that cause dendrites to form neural pathways of insight. And these are the sights and sounds of Diamond's influence on today's architects of the intellect.

The Creative Genius of Teachers

The scenes shown here briefly depict the visions of Dewey, Piaget, Vygotsky, Feuerstein, Gardner, and Diamond. These thinkers have left their legacies for new architects.

For today's master teachers, however, the mission is far more elusive. They must design learning that empowers the learner to make meaning through the mindful manipulation of input. These new architects must blend the art and science of teaching into creative cognitive designs.

If we examine the varied work of the masters and try to crystallize the essential elements of the constructivist architecture, we see an array of complex tools emerge. These tools are a learner and life-centered curriculum enriched environments; interactive settings; differentiated instruction; inquiry, experimentation, and investigation; mediation and facilitation; and metacognitive reflection. These seven elements define the constructivist philosophy and illustrate the lasting influence of the master architects.

The new architects of the intellect are learning their craft well. They hear the voices of the masters and see their visions. The intellectual structures of today's architects resonate with the sounds of Dewey, Piaget, Vygotsky, Feuerstein, Gardner, and Diamond. After all, these visionaries designed with the brain in mind-they designed learning experiences for capable apprentices.

Retmen Feuerstein

Howard Gardner

Marion Diamond **[Reference]**

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