Constructing Knowledge, Reconstructing Schooling

The emerging brain research that supports constructivist learning collides head-on with many of our institutional arrangements for learning.

Like many adults, I was slow in coming to terms with using the computer. It was not so for my then 9-year-old eldest son, Peter, who, from the moment he had a home computer, quickly learned to manage an increasing range of sophisticated programs. He either taught himself or learned to solve problems by working them out with friends. At an early stage, teachers asked for his help as his school acquired more computers.

A common enough story, repeated time and time again: Young people learn a tremendous amount when deeply engaged in tasks that fascinate them.

A year or so later my second son, David, three years younger than Peter, decided that he, too, wanted to use the computer. At first, Peter was immensely patient as a teacher, and David learned fast. But then I noticed something curious. Peter sensed that David was coming to rely too much on him to explain new processes, instead of using what he already knew to find the answer for himself. One evening, Peter’s frustration erupted:

Dad, David is just being lazy; by asking me to tell him what to do, he will never learn to solve problems for himself. That’s the only reason that I know what to do—because I had to work it out for myself. If David doesn’t learn to work it out like that, then he’ll never really learn!

That sage observation came from an 11-year-old who had never heard of constructivism, but who understood exactly that by bringing all his previous experience to bear on a new problem, he could construct his own novel solutions. As a boy, Peter learned to listen intently to everything that he heard and to note everything that he saw because he realized at a profound level that it was he alone who could direct his own learning.

This anecdote bears out the truth shown in recent long-term research studies—that four of the greatest predictors of eventual success at the university level are achieved before a child even enters school: namely, the quantity and quality of discussion in the child’s home, the clarity of value systems, the level of peer group support, and the amount of independent reading (Abbott & Ryan, 1999).

Inquisitiveness is what drives children’s learning, and constructivism is the theory that cognitive scientists have devised to explain how an individual progresses from inquisitiveness to new knowledge. Just how does this work?

Constructivism and Brain Research

In searching for answers, researchers in the 1990s have uncovered a massive amount of interrelated evidence in the brain sciences, the biological sciences, and even archaeology and anthropology. This evidence is starting to show in considerable detail how humans actually learn. We now can see why learning is much more than just the flip side of good teaching and schooling. Instead of thinking of the brain as a computer, researchers now see it as a far more flexible, self-adjusting entity—a living, unique, ever-changing organism that grows and
Constructivist learning is an intensely subjective, personal process and structure that each person constantly and actively modifies in light of new experiences. Constructivists argue that by definition, a person who is truly passive is incapable of learning. In constructivist learning, each individual structures his or her own knowledge of the world into a unique pattern, connecting each new fact, experience, or understanding in a subjective way that binds the individual into rational and meaningful relationships to the wider world (Wilson & Daviss, 1994).

Such a view of learning contrasts harshly with the perceived wisdom of many education specialists. A European professor of education recently wrote to us:

Those involved in school management draw a sharp boundary between the areas of education that are reserved for professionals (for example, teachers), and those in which other members of the community (such as parents or retired people) can legitimately be involved. Although many schools encourage the involvement of members of the community for certain activities, those activities are clearly separated from the “professional” work of teachers. It is very difficult and indeed might well be foolhardy to try to blur this distinction.

In the light of recent research on how children learn, this distinction is now dangerously outdated. As neuroscientists Chang and Greenough noted in 1978, two sets of neurons enable us to learn. One set, they suggested, captures general information from the immediate environment while the other constantly searches through an individual’s earlier experiences for meaning. Recent research at the Salk Institute suggests that this is a false dichotomy. Instead of representing two distinct strategies within the brain, these are two separate parts of the same process (Quartz & Sejnowski, 1997). Constructivist learning is the dynamic interaction between the environment and the individual brain.

The Community’s Role in Constructivist Learning

In a constructivist model of learning, nature and nurture don’t compete; they work together. We humans are who we are largely because of our species’ experience over millions of years. Each new generation has a powerful toolkit of predispositions that help explain our ability to learn language, cooperate successfully in groups, think across problems, plan for the future, and empathize with others. Predispositions, both in young children and adolescents, provide individuals with a whole range of skills that enable them to relate flexibly to their environment. Yet, because for most of human history people tended to live in relatively small groups, individuals must develop these skills collaboratively; few individuals ever possess all these attributes.

The speed with which our inherited predispositions evolve is incredibly slow: Researchers think that there have been no major changes in brain structure during the last 50,000 years. Within a single generation, the influences of millions of years of human development mingle with the priorities of a particular culture. As Nigel Nicholson stated, “You can take man out of the Stone Age, but you can’t take the Stone Age out of man” (1998, p. 135). We are enormously empowered by an array of predispositions that enable us to adapt to vastly different circumstances, yet these predispositions inhibit us as well.

As we learn more about the brain and how it naturally learns, we must devise learning environments that go with the grain of the brain. We are now in a far better position to understand that “grain.” Psychobiologist Henry Plotkin aptly summarizes the relationship between nature and nurture: “Nature has itself evolved. Nurture can only be fully understood in light of historical causes. Nature has nurture.” (1997,
p. 19). This goes a long way toward explaining just why humans learn the way they do.

The balance between emotion and logic, the role of intuition, and the relationship between intrinsic and extrinsic motivation are all part of the "complex adaptive system" that best describes the brain's ability to deal with the messiness of ordinary life situations. By drawing on the full range of a learner's experience, constructivist learning strengthens the individual's ability both to find novel connections and to harness peripheral perception (Bruner, 1974). Rather than a focus on intense, encyclopedic recall, constructivist learning leads to deep understanding, sense-making, and the potential for creativity and enterprise (Kalbfleisch, 1999).

This is where it all becomes fascinating—and essentially hopeful. Research from the biological sciences shows the innate nature of these collaborative higher-order skills and attitudes. With appropriate stimulation at an early age (as would have been the case in pre-Industrial times), young people quickly develop these skills. Children are born with latent predispositions, equipping them to function successfully as part of a community. However, during much of this century, formal schooling has struggled, absent the support of the larger community, to provide appropriate simulation of real-life situations. Thus, schools have met with only limited success.

The reason for this from a constructivist perspective is all too obvious. Such limited learning environments stretch only part of young people's intellectual and social predispositions. For all those who have been able to succeed in the decontextualized setting of the school, there are as many for whom schooling has had very little impact. These children are the ones who often feel school, and indeed society, has no place for them.

**New Questions for School Reform**

We must now ask deeper questions about the institutions of schooling than have so far been raised in the school reform movement, with its short-term panaceas of more accountability, site-based management, standardized tests, prescribed curriculums, and longer hours for teachers and students. We have to accept that we are dealing with a deep systemic crisis. Constructivism collides head-on with so many of our institutional arrangements for learning.

It is a cruel twist of history that systems set up with the noblest of intentions can, over the course of time and changing circumstances, create the next generation of problems. Isn't this what educators are now grappling with? Isn't it because we have long misunderstood the nature of early learning that we now have such difficulty in secondary education with bored and disillusioned adolescents? Doesn't this misunderstanding explain why the conventional reaction of teachers to such criticism has been to assume additional responsibilities that are surely more appropriately undertaken by parents and community? Are we not stuck with an education system that has progressively turned childhood into an extended virtual holiday and has shut the classroom door on the world of adult affairs and social responsibility?

Neurology's emerging understanding of adolescence suggests that we are trivializing the energy and the idealism of young people at the very stage when they need support and encouragement to learn to mediate and direct their energies and emotion. The truth is, we can't bring children up to be intelligent in a world that does not seem intelligible to them.

Only recently, however, has it become possible to put all the pieces of this argument together. The learning theory that dominated education in the late 19th and early 20th centuries was generally behaviorist: People expected rewards to do tasks; their brains were blank sheets awaiting instruction; and intelligence was innate and largely inherited. As rapidly industrializing nations created education systems for the masses, these systems reflected the industrial factory model. When universities gave advice on the curriculum, they suggested a highly reductionist model of learning. To such early educational experts, the study of learning was a strictly academic affair. They measured what happened in classrooms when people performed abstract tasks, but they hardly ever deigned to study the calculating ability of a working apprentice or a street trader.

It is true that this late 19th century compromise among the scientific understandings of the day, the needs of industry, and the desire to give all children basic skills increased productivity and lifted standards of living significantly. But this came at a cost. Deep down, many children became frustrated, with so many of their predisposi-
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Considerations of Student Development

Everything that we understand about our intellectual development suggests that before the age of 7 or 8—particularly before the age of 3—we are heavily dependent on external encouragement and stimulation to develop the ability to collaborate and to see across issues. If such skills are not stimulated at an early stage, then learning them later on is simply far more difficult. In late 20th century terms, the functional skills of reading, writing, and numeracy also fit into the category of survival skills. At an early stage of life, every youngster needs to make great demands on adults if he or she is to master these basic survival skills. Good parenting is essential to the development of a child’s mental faculties and social skills.

The natural tendency of young people when they begin puberty is to reverse their dependency on adults. They want to be in control; hormonal changes are pressing them to show that they can now use what they learned earlier to become fully functional, independent people. If they do not have basic survival skills, adolescents are desperately ill prepared to deal with the physiological changes of adolescence. They end up mentally, emotionally, and socially adrift.

Consider the current model of schooling. In many countries, elementary school children are in large, impersonal classes when their predispositions are at their most fertile. In secondary schools, we have instructional approaches that clash with the adolescent’s increasing wish to be independent. Many adolescents, for the most natural of reasons, get completely turned off by schooling at about age 14 because school simply does not seem real in comparison to the emotionally charged environments that they experience away from school with their peers.

For the brain’s predisposition toward constructivist learning to thrive, we must consider all aspects of a child’s learning environment. Constructivism is opened, as is the neural structure of the brain. Education that focuses on specific outcomes and national curriculum targets does not support genuinely creative or entrepreneurial learners. An ever-increasing pace of change has made the ability to learn far more important than any particular skill set.

Toward Dynamic Learning

The territory between the schools and the community presents difficulties for many policymakers and the general public. More people now recognize that a dynamic form of learning such as constructivism requires strong partnerships among all those who help children learn and grow. Yet, professional educators and community leaders still do not fully understand this “middle ground” that incorporates the home, the school, and the community and is sometimes facilitated by new technologies.

There is an irony in all this. Those people most actively challenging the protected and isolated nature of current educational arrangements are those who are often the greatest proponents of education focused on outcomes. Those who most strongly support the concept of constructivism are those with unlimited faith in public education, and they often are least prepared to recognize the need for major institutional change.

We call for an organized middle way. To repeat—constructivism is not only an open-ended form of learning; it is essentially about reality, connectivity, and the search for purpose. Growing evidence suggests that a constructivist form of learning matches the brain’s natural learning patterns. Constructivist learning dictates that learning arrangements must move beyond what occurs in a classroom; it requires a whole new understanding of a learning community—and that involves everyone, not just teachers. Constructivism provides the debating points for those involved in education reform and those responsible for the revitalization of communities.

References


Authors’ note: Although the introductory anecdote describes John Abbott’s experience, this article is the joint production of John Abbott and Terence Ryan. M. Layne Kalbfleisch, research intern at the 21st Century Learning Initiative, assisted in developing the discussion on the neurobiological basis of constructivism.

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John Abbott is author of The Child Is Father of the Man: How Humans Learn (Bath Press, 1999) and President of the 21st Century Learning Initiative. 11739 Bowman Green Dr., Reston, VA 20190-3501 (e-mail: info@21learn.org; Web site: www.21learn.org). Terence Ryan is Senior Researcher at the 21st Century Learning Initiative.