Reinventing Schools Through Brain-Based Learning

Renate Nummela Caine and Geoffrey Caine

After three years of immersion in brain-based learning theory and practice, Dry Creek Elementary School has internalized a more meaningful model of how teachers and students learn.

The overwhelming majority of teachers ... are unable to name or describe a theory of learning that underlies what they do in the classroom, but what they do—what any of us does—is no less informed by theoretical assumptions.... Behind the practice of presenting a colorful dinosaur sticker to a 1st grader who stays silent on command is a theory that embodies distinct assumptions about the nature of knowledge, the possibility of choice, and what it means to be a human being.

—Alfie Kohn, Punished by Rewards (1993)

In Making Connections—Teaching and the Human Brain (Caine and Caine 1994), we outlined a new theory of how people learn based on current research in the cognitive and neurosciences. We wanted to demonstrate that our theory could serve as a practical guide for a dynamic way of approaching teaching and learning.

We, together with our colleague Sam Crowell, have applied our theory in several schools, among them Dry Creek Elementary, a K–6 elementary school in Rio Linda, California. Most children at this Chapter 1 school come from low socioeconomic—and often dysfunctional—families. They have done poorly on standardized tests. And the school has had an exceedingly high student turnover rate—49 percent of all students in the 1993–94 academic year.

When we began working at Dry Creek, we expected students to improve academically, but not until the end of this, the third, academic year of the program. Yet the standardized test scores of students who have been here since the beginning of our program have shown steady improvement. Particularly impressive are the academic strides of special education students.

Much to our delight and the delight of the school and community, the California education department presented Dry Creek with a distinguished school award toward the end of our first year together. The award was not based on standardized test scores (these were still relatively low), but on the school’s commitment to the ideas expressed in the California Elementary Task Force report “It’s Elementary,” which is highly compatible with brain-based instruction. In addition, the National Education Association produced a film about the school that aired on the Learning Channel last October.

Dry Creek has temporarily accepted our notion of an apprentice community as an ultimate goal. That is, a community in which students can experience and test many of the relationships and ideas they will need in the real world in a safe, nurturing, and challenging context. In this environment, each student is engaged in multiple apprenticeships—to other students, to teachers, and to community members.
It is important to note that the staff originally had a vision of the kind of learners they wanted their students to become and that they were engaged in a process of change. But they had no vision of what the school itself would look like. In effect, the entire school set out to discover its own strengths and to reinvent itself based upon a small-group process; continuous reflection on the brain-based theory of learning; and input from shared experiences, from us, from subject matter experts, and from outside consultants.

Dry Creek has taught us about the reality of translating our theory into the everyday life of a school with few resources and an extraordinarily high student turnover rate. The school has made our theory come alive.

**Traditional Teaching and Learning**

Based on our own observations and discussions, almost all teachers at Dry Creek had embraced the traditional model of learning and teaching—their mental model. They were not unusual in this respect. Most teachers have a mental model of teacher roles and learning—deeply held assumptions that are, we believe, physiologically entrenched as a result of early experiences in school.

Traditionally, instruction has focused on memorizing what we call surface knowledge. It has been, for the most part, teacher-dominated, a delivery model to which traditional resources, such as textbooks, lectures, and possibly videos or movies, are closely tied. Traditional assessment is based on quantitative data. It is carried out with multiple-choice and true-false tests that are designed to find out whether students can answer the teacher’s or textbook’s questions.

In this context, teachers see discipline as maintaining the “good behavior” that enables students to absorb information that an official curriculum or teacher plan determines. Students must do so on an inflexible schedule, because learning time is closely guided by an external (artificial) time schedule, which is antithetical to reflection. Finally, computers are largely absent, or used only for paper-and-pencil tasks.

**Brain-Based Teaching and Learning**

The traditional mental model of learning is being challenged in many quarters, but alternative theories are still fragmented and limited to supporting specific approaches, such as thematic instruction, cooperative learning, meaning-centered curriculum, and so on. By contrast, brain-based teaching and learning takes a holistic approach, looking at teaching developmentally, socioculturally, and in other broad ways.

Specifically how does our theory differ from traditional instruction? Above all, we want instruction to shift from memorizing information to meaningful learning. Brain-based learning stresses the importance of **patterning**, that is, the fact that the brain does not easily learn things that are not logical or have no meaning. Because our natural tendency is to integrate information, we resist learning isolated bits of information. Because the specifics of instruction are always tied to larger understandings and purposes, we believe teachers must help their students see the meaning of new information. We expect to see teachers and students using stories and complex themes and metaphors to link information and understanding, and we expect computers to be used for all types of work.

Brain-based learning also stresses the principle that the brain is a **parallel processor**—it performs many functions simultaneously. Therefore, all meaningful learning is complex and nonlinear. This means that teachers must use all available resources—including community resources and multiple apprenticeships—to orchestrate dynamic learning environments. These environments cannot be linked to an artificial time schedule based upon some general need for order or convenience. Instead, schedules should be tied to the actual time it takes a student to explore a point of view or to master a task, much as in a professional, research, or business setting. Yet, as Margaret Wheatley noted in *Leadership and the New Science* (1992), there must be a sense of coherence and orderliness, as well as the sort of safety that naturally engenders risk. We’ve learned that when the community is orderly and coherent, children with special needs can be included in normal classrooms.

In our system, there is not necessarily one right way for students to handle an assignment. Teachers must overcome the natural preference for conveying information tied to clear
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directions and opportunities for students to do it right rather than to explore and experiment. Accordingly, assessment includes, but moves beyond, paper-and-pencil tests. There is authentic assessment of all types, and students participate in evaluating their learning process and progress. In addition, outside experts and expert panels may be called upon to help assess students’ achievements.

As for discipline, teacher/student interactions are governed by a totally different assumption. Students are seen as—and are expected to see themselves as—responsible for both their own behavior and group progress.

Viewing it another way, brain-based learning is a response to a set of questions, which Wheatley (1993) beautifully formulated:

- What are the sources of order?
- How do we create organizational coherence where activities correspond to purpose?
- How do we create structures that move with change, that are flexible and adaptive, that enable rather than constrain?

How do we resolve personal needs for freedom and autonomy with organizational needs for prediction and control?

Putting Theory into Practice

At Dry Creek, we were not interested in achieving these changes through direct teacher training or teaching specific skills, but in using our theory and practice with the entire school. We wanted to change assumptions about schools, learning, and teaching; to encourage teachers’ own efforts to implement brain-based instruction. We hypothesized that if we contributed to theory, process, and instruction, and if teachers had substantial opportunities to learn how they learn, everyone would move toward brain-based learning.

Our ultimate objective was to unleash the creativity in teachers and other staff, so they would take chances based on a much broader understanding of curriculum. In a sense, brain-based learning is improvisational; no two “lessons” are ever the same. Teachers find connections among everything from prepackaged math and science materials to music, art, and computers.

Another goal was to provide academic enrichment. We wanted to empower teachers through greater content knowledge. Many of the teachers we have encountered are academically impoverished. When they limit children to their own learning, they do them an enormous disservice.

Changing the Mental Model

When we first attempted to apply our theory in schools, we discovered all kinds of problems. Educators who had welcomed our book’s ideas saw implementation as another matter entirely. Most wanted instant solutions; they didn’t understand that they would have to change powerful assumptions about learning and teaching that guide their daily decisions, and that this does not happen overnight.

We believed that our theory properly understood, would influence teaching decisions. But we were aware that before the theory could drive change, it had to become a mental model—a “deeply ingrained assumption, generalization, or even picture or image that influences how we understand the world and how we take action,” as Senge defined it (1990, p. 8). Although our behavior may not be consistent with our espoused theories, Senge noted, it is consistent with our mental model—our “theories-in-use.” Yet, he said, “very often, we are not consciously aware of our mental models or the effects they have on our behavior.”

In effect, when our theory of brain-based learning becomes a mental model, it becomes possible to integrate learning, instruction, curriculum, and the system as a whole, because all share common roots. For this to happen, however, the entire system must be reconfigured. We must do more than simply integrate subjects that used to be separate and instead recognize styles and intelligences that used to be disregarded. A certain dynamism is needed to trigger self-organization and change. Such a shift cannot be imposed or put together in a fragmented or mechanistic way; it must be allowed to emerge naturally. The timing and intensity of each stage depends on the school itself.

At Dry Creek, our objective for the first year was to build the appropriate atmosphere and to generate awareness of what brain-based education actually
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processing. Dry Creek teachers had to be free to explore ideas in an environment that was as nonjudgmental as possible.

A secure environment counteracts "downshifting," that is, the tendency under stress to shift to a defensive mode and become less flexible and open to new information and ideas. Our own teaching experience alerted us to the fact that teachers tend to be extremely reluctant to share their thoughts on education, particularly with their colleagues. This reluctance grows stronger when time limits are imposed externally. Often, the unarticulated need for power, status, and territory, exacerbated by lack of communication, destroys the original vision. In our workshops, downshifting has been an important hurdle to overcome. Predictably, teachers reverted to the tried-and-true, particularly when faced with open-ended projects.

We attempted to counter downshifting in several ways. First, we decided to allow a long period (five years) for restructuring so as to lower pressure and give genuine change a chance. Second, we formed “process” groups, which meet for two hours three times a month. These groups serve as low-threat, high-challenge think tanks, giving teachers the freedom to reflect on the purpose and function of learning, teaching, and schools. They also help teachers learn to trust themselves and one another and to play with thoughts and ideas. Finally, we have countered downshifting by making participation voluntary, although we would like all adults to participate. (Ultimately, almost everyone at Dry Creek has volunteered.)

2. Orchestration of complex experience. Children learn not only from teachers but also from brief events, ongoing activities, and all sorts of social interactions—in short, from the entire experience and physical context. We therefore decided all adults—custodian, librarian, secretary, cafeteria worker, as well as teachers and administrator—should be included in the process. In each of the process groups, we purposely included an interesting mixture of people with different functions. We wanted all participants to see themselves as teachers, contributing either directly or indirectly to children’s learning. (The custodians, in fact, are highly regarded by the teaching staff, and are emerging as real-life counselors for students.)

In addition, we set out to have our theory and principles embedded, as much as possible, in the day-to-day routine of the school. And we also applied the principle of orchestrated immersion to all adults. We immersed them in our writings and periodic workshops and gave them other opportunities to bring their own understandings to bear at any point.

3. Continuous active processing of ongoing changes and experiences to consolidate the emergent mental model. To create a genuine learning community in which staff internalize our theory of instruction, staff must reflect on and actively process the ideas in a social setting. We therefore provided each participant with our book Mindshifts (Caine et al. 1994), which guided them through the principles of brain-based learning and open-ended experimentation. The book has also been a gentle focus for the process groups in their meetings. It encourages them to reflect on how they themselves have learned and do learn, and to relate those insights to specific teaching situations.

Becoming a Learning Community
We have spent much time at Dry Creek creating a coherent community, where common practices and routines and celebrations provide continuity. In a two-day retreat at the beginning of the year, all staff members were involved in a mixture of creative self-direction with some very precise guidelines. The retreat included a ceremonial or formal way of starting each meeting, a process for the orderly sharing of individual opinions about some general principles or pithy sayings or extracts from a book, exploration of one of the brain principles, and a ceremonial or formal closing.

In addition, all process group members participated in a four-day workshop on brain-based instruction. Here, the community worked to
understand the meaning of orderliness and coherence, where people are connected by mutual caring in an intellectually challenging climate. We examined authentic assessment, innovative instruction methods, and ways to become more creative.

After three years of work, Dry Creek is now a learning community, with cross fertilization of learning in the school as a whole. This is reflected in a host of ways. Parent-staff interactions are far more positive and friendly. Classrooms have been redesigned to reflect a more natural, dynamic approach to learning. Notwithstanding the extremely high student turnover rate, staff have maintained their interest and enthusiasm.

Perhaps one of the most exciting results has been the jelling of the process groups. Within about two months, people who rarely associated with one another had bonded quite closely, and their commitment to the school as a whole was stronger. This was powerfully reflected in the anonymous survey that the principal, Cindy Tucker, conducted. Some typical comments:

It’s great getting to know group members in a new way.... There’s a feeling of excitement here.... People are working with their colleagues, sharing the kids in their classes through peer tutoring, cross-age work, and study buddies. We’re not as isolated as we used to be.... The process was often exhausting, but it was a rich place to be as an educator. The biggest change I see is that, yes, this is a community of learners. It’s moving from my class to our kids.

**Trials and Rewards**

It has not been all clear sailing, of course. Some teachers stuck resolutely to lecture and directed instruction, even while studying about diametrically opposite ways of looking at instruction. They were looking for directions from us—cookie-cutter types of directions. Yet they also experimented and began to do things that looked very much like brain-based instruction.

Our major breakthrough occurred several months ago. As part of our inservice, we invited four lead teachers to present to their colleagues math and science programs implementing brain-based instruction. We then began teacher demonstrations with team feedback.

The shift in mental model is invariably a messy process and teachers need to develop a great deal of tolerance for ambiguity. We have learned that genuine restructuring ultimately must result in systemic change within the individuals as well as the school and the broader community. The dance between letting go of old beliefs and taking on a new way of thinking and perceiving is delicate and complex. At Dry Creek the entire community is engaged in intellectual discussions that link theory to practice, applying the force of a coherent, orderly mini-society.

The pressures of time were, and continue to be, daunting. The entire process would have been too difficult, if not impossible, without outstanding and continued leadership from the principal and the assistant to the principal, Chris Halverson. Fortunately there also was support from many parents. And the district offered consistent support, agreeing to allocate all monies for staff development days to this one program.

Many schools around the country are organizing their school days differently. It is important to emphasize that neither the schools nor the teachers themselves need to come up with the same solutions. In fact, we have continually adjusted our process to Dry Creek’s particular needs and experiences. Dry Creek, in turn, continues to prove that our theory works with average teachers and children.

**References**


**Renate Nummela Caine** is Associate Professor of Education and Executive Director of the Center for Research in Integrative Learning/Teaching, California State University, San Bernardino. **Geoffrey Caine** is a consultant specializing in adult learning and an Adjunct Member of Faculty, Whitehead Center for Lifelong Learning, University of Redlands, California. Both are partners in Caine Learning, P.O. Box 1847, Idyllwild, CA 92549.