

Maximizing Learning: A Conversation with Renate Nummela Caine

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What do the neurosciences, biology, and psychology teach us about what our schools should be like? How can we change our mental models of education to meet the needs of children? Renate Caine answers these difficult questions in exploring how children learn.

Carolyn R Pool

In Making Connections and in Education on the Edge of Possibility, you and Geoffrey Caine discuss principles of brain-based learning. Some people might say, ‘Well, of course, we learn with our brains – so what else is new?’ But you and Geoffrey have connected the latest cognitive and neurological research to education. What is new? What is the most significant finding that relates to what we do in schools?

We debated about using the term *brain-based learning* because, of course, all learning is brain based. But if we just said ‘learning’ then people might not understand what we were talking about, either. Humans have a marvelous brain, whose possibilities appear endless. So when we refer to brain-based learning, we are concerned about maximising learning – understanding how the brain works best – and we have encapsulated our findings in 12 learning principles that emphasize the connections and patterns our brains make (see fig.1). Our current studies are taking us into the great impact that early childhood development has on the way children learn. These findings have enormous implications for schools – even preschools – because so many neurological pathways critical for later life are laid down from age zero to age 3. These pathways affect the way children interact with formative experiences during later developmental stages. These patterns also include children’s beliefs about themselves and their world, which continue into adulthood.

Figure 1 Brain/Mind Learning Principles

- 1 The brain is a complex, dynamic system.
- 2 The brain is a social brain
- 3 The search for meaning is innate.
- 4 The search for meaning occurs through ‘patterning’.
- 5 Emotions are critical to patterning.
- 6 Every brain simultaneously perceives and creates parts and wholes.
- 7 Learning involves both focused attention and peripheral perception.
- 8 Learning always involves conscious and unconscious processes.
- 9 We have at least two ways of organizing memory.
- 10 Learning is developmental.
- 11 Complex learning is enhanced by challenge and inhibited by threat.
- 12 Every brain is uniquely organized.

Source: *Education on the Edge of Possibility*, by R. N. Caine (Alexandria, Va.: ASCD, 1997)

In your work, you discuss threats that inhibit learning. What are these threats? What happens to learning when we feel threatened?

Many children's lives are filled with threats to learning – child abuse, poverty, malnourishment, family and community violence. These are devastating experiences for the child – and for the human brain. These experiences can program the child to effectively live in anticipation of such experiences. Children who have lived with extreme threat develop perceptual loops; they look for certain signals in the environment that to some extent replicate their own experiences. Their brains are not programmed to help them cope in a healthy way. When we feel threatened, we downshift our thinking. Downshifted people feel helpless; they don't look at possibilities; they don't feel safe to take risks or challenge old ideas. They have limited choices for behaviour.

What does downshifting mean for teachers?

We define downshifting as the psychophysiological response to threat, accompanied by a sense of helplessness or fatigue. The downshifted person experiences a sense of fear or anxiety, not the excitement of challenge. Downshifting is accompanied by a feeling that you cannot access your own ability to deal with the situation. Downshifting can result from very drastic conditions in early childhood, as I mentioned; but what we're seeing is that, to a lesser degree, downshifting is everywhere in the schools.

Do children face threats in school?

Yes, but here we're not talking about traumatic threats like guns in school. We are concerned about emotional threats to higher-order thinking and learning. The system of traditional education can be a threat that inhibits higher levels of learning. If as a teacher I am in charge of the curriculum, you as the student are supposed to learn what I say you must learn. I know the answers that you have to get. I'm also going to tell you how long it will take you to learn this and when it's due. And not only that – I evaluate you and your work. In this approach, where is your input? Where is your self-efficacy? And what are you learning but compliance? So students are doing what teachers want them to do. And downshifted people can do some things well, like memorizing, because the brain perseverates under threat and likes to do things over and over again – repetition provides a sense of safety when you feel helpless. Memorization is compatible with traditional teaching. But real learning – making connections, higher-order thinking, and creativity – is incompatible with that kind of environment.

What are some examples of strategies that are compatible with brain-based teaching and learning?

Let me give you an example that shows how teachers faced a challenge that they first perceived as a threat. Geoffrey and I were working with teachers beginning to use a rich, brain-based approach to learning to read and write. The district suddenly mandated its own literacy program. All the teachers dropped the brain-based approach; they abandoned their new understanding of learning – they just implemented the district's mandates. They were frightened; they did not have the self-efficacy they needed. In the mandated program, the students were scheduled to do unrelated tasks and drills every day. Soon, kids began to ask, 'Why are we doing this? This isn't any fun and we're not learning anything!' Geoffrey and I also asked, 'Why are you doing this?' Basically, the reason was fear; the teachers felt helpless in dealing with the district – they downshifted.

We encouraged the teachers to examine the literacy program and start incorporating it into what they knew about the human brain. The teachers then said 'Okay, what do we know about learning? We understand that children need to be in a community. They need to follow their own interests, and we need to constantly question and

challenge them' The teachers began to see that brain-based learning moves away from what you do on Monday morning to how children learn. They began to see that brain-based learning is not limited to one approach or strategy.

In the process, the teachers took the best from the district's program – but they also took the best out of Reading Recovery, whole language, and phonics. They began seeing kids in kindergarten and 1st grade doing critical thinking and analysis. As a result, this school has gone from the second from the bottom in reading in their district to the second from the top.

What are some ways that a brain-based approach to, say, language arts, might differ from the traditional approach? I remember being intrigued by your discussion in Making Connections of relaxed alertness, orchestrated immersion, and active processing as conditions for learning.

Well, you cannot really separate these conditions. Relaxed alertness means 'low threat, high challenge.' If children are to think critically, they must feel safe to take risks. And if the teacher insists on one correct answer and is going to evaluate them, children are not foolish. They will give the answer the teacher wants. But for making connections and actually changing their thinking on the basis of accrued knowledge, they need relaxed alertness – that is, safety and challenging learning experiences.

As for orchestrated immersion, children learn best if they are immersed in complex experiences and are given the opportunity to actively process what they have learned. The best learning happens when necessary facts and skills are embedded in experiences that relate to real life, when there's a big picture somehow.

Can you give an example?

Even though many teachers creatively use *haiku* and other forms of poetry that appeal to students, most teachers approach poetry as a subject to cover. Many children don't understand or *feel* poetry. One teacher using a brain-based approach to language arts decided to turn her whole classroom into a coffeehouse. The kids helped set it up – low lights, candles on the tables, tablecloths, music playing softly. The teacher asked adults from the school and community to come in and read their favorite poetry and talk about it. Through this complex experience, the teacher gave her students a sense, or felt meaning, for what poetry is and that it is valued by adults in the real world. Teachers can do the same thing in science and math.

What would be an example of brain-based science or math?

In science and math, teachers and students might ask natural questions like 'What happened?' 'How did you do this?' 'What happened when we added this element?' and 'How else might this have worked out?' They ask critical questions that are not necessarily in the book or worksheet. Take the 'owl pellet' lesson, for example.

Owl pellets are material that owls regurgitate after they eat. The pellets include the bones and fur of rodents and birds the owls consume. In a science lesson that I was observing, students pulled some owl pellets apart and then answered worksheet questions about what owls eat. I walked around the classroom and asked another question: 'You know, I'm wondering – how does an owl's stomach know how to separate the meat from the bones?' This was a genuine question. And the students looked at me as though I were crazy because that question was not on the worksheet.

A teacher asking real, live questions provides rich possibilities for students. But for these possibilities to become reality, teachers need to shift their thinking about teaching and learning. They also need extensive resources, including technological support. Brain-based learning is wonderfully compatible with technology.

Your examples remind me of some good teachers I've had. My 9th grade chorus teacher took our class to many concerts, shows, and competitions. Her bubbling enthusiasm for all sorts of music, from gospel to folk to classical, stays with me to this day. What suggestions do you have for teachers to improve their own practice?

In our recent work, we found three distinct styles of teaching. In the first instructional approach, the teacher is in charge, using traditional strategies like lecturing, memorization, testing – the old factory model. When you speak of relaxed alertness or orderliness to teachers who are dedicated to this approach, they tend to think in terms of good discipline, of going along with the teacher's plan. Orchestrated immersion might consist of a teacher's bringing in some World War II artefacts to introduce a lecture, or allowing students to ask questions of a guest speaker.

In the second approach, the teacher is comfortable with many innovative learning strategies and sees new possibilities for defining discipline, but still largely directs student learning. We have found that more and more teachers are moving to the second approach, though most teachers still operate from the mental model of the traditional approach to education, because that was the way they were taught.

In the third (and rarest) instructional approach, which is actually brain-based teaching, learning becomes collaborative – teachers and students have a much more mutual responsibility. Here, students know what they want to do, time parameters are flexible, and orderliness and coherence prevail. Teachers have an extensive repertoire of strategies. These classrooms are characterized by ongoing questioning and analysis. Students and teachers ask experts, they get on the Internet, they learn together.

That reminds me: I heard of a new program called STTC – it stands for Students Teaching Teachers about Computers.

I like that. Students are often much more comfortable with the third instructional approach. On the other hand, some students are so used to the traditional factory model that they are initially confused when they encounter brain-based teaching. And it is difficult for some parents to understand that the traditional approach to teaching is no longer going to prepare their children for the future. But five years from now, if I were a parent and I still saw my children sitting in a classroom with desks in a row and a teacher up front, I would panic because that will absolutely be inappropriate.

What if parents disagree with what you're doing and insist on a certain type of curriculum?

Parents need to be brought into the educational community wherever possible. Orderliness depends on constant communication among teachers, students, and parents. But for parents who fundamentally disagree with the rest of the community, charter schools are a real possibility. Parents can create their own school, organized around their own purposes and meanings. Private and religious schools can also meet some of these needs, though I am not in favour of vouchers. Acknowledging and celebrating diversity – in a democratic country – is an important outcome of principle 12, 'Every brain is uniquely organized'.

Speaking of diversity, what is your view of multiple intelligences?

We all have different talents, skills, perspectives, and intelligences. We need to encourage children's gifts in two ways. First, we need to acknowledge diversity; second, we need to focus on our commonalities, what makes us human and what ties us to the rest of nature.

So Geoffrey and I agree with the basic premise of multiple intelligences. But how is it used in the classroom? Do teachers simply incorporate variation into traditional presentations? Or do they address multiple intelligences by providing complex experiences within which students can use their individual intelligences (expanding

into other types of skills and modes and benefiting from other people's intelligences)? Interaction and complexity are key.

In a recent article, Bob Sylwester¹ discusses neurological research concerning the effects of serotonin on self-esteem – not only through drugs like Prozac, but by positive social feedback students get from portfolios, cooperative group learning, and nurturing from caring adults (see also this issue, p. 16). Where does brain-based learning fit in this picture?

On the whole, I would tend to agree with Bob about the importance of positive social feedback and the benefit of the strategies he mentions. But here, again, we must consider developmental learning and the effects of downshifting on children's ability to become self-motivated, to believe in their own capacities and abilities. We have suggested that the opposite of downshifting is self-efficacy.

I think we need to be very careful that we do not depend on Prozac and other psychotropic drugs for other than temporary assists, particularly for downshifted people who have difficulty in ascribing any success to their own efforts and who are easily influenced by others. There seems to be a real danger here. How can I believe in my own strengths and initiative when I know that a drug has changed my behavior? I know that Bob is not advocating the use of Prozac with children – I am pleading for the exploration of other ways to enhance children's self-esteem and self-efficacy, such as by removing threats from our classrooms and making them safe, challenging places for children to learn. This should be the focus of education.

In Education on the Edge of Possibility, you and Geoffrey describe your work with two elementary schools in implementing brain-based teaching. What was this process like?

Shifting out of an exclusively traditional instructional approach is difficult. Our book relates the challenges and setbacks the schools faced. First, I want to recognize all the teachers who use traditional approaches really well. It's not that their work is wrong; the times are changing on us. Our knowledge base is changing, with new information from the neurosciences and biology and technology. We're living in a different world. There's so much for us to understand, and we can't do it by getting what I call 'surface knowledge' – what somebody else tells us is important to learn.

Second, to change our mental models, we have to address how our brains learn – and immerse ourselves in interactive, real-life, complex experiences out of which we can process new ideas. To help teachers change their mental models, we found that using 'process groups' was critical.

What is a process group?

We encouraged teachers to get together in small groups and look at new information from the sciences, examine educational research, and study the brain/mind principles – as people, not just as teachers. They asked questions like 'What does it mean that the brain is a complex, dynamic system?' Then they began to reflect on how their own practices did (or did not) maximize learning. The groups included not only teachers but also custodians, librarians, and other nonteaching staff, in an attempt to arrive at common beliefs, purposes, and values – the foundation for orderliness. They all shared ideas on how to create a school and environment based on how children learn. The groups came up with their own solutions to the 'time and energy' problems that plague many other reforms: How can we allow time for complex experiences when we have to cover the curriculum? Do children really learn best in 50-minute increments? Where do we get planning time? A supportive administration and funding arrangements gave the groups time to constantly rethink and enrich what they were doing in schools – there's no top-down way to teach a new mental model. It has to come from the educators themselves.

Endnote

¹ R. Sylwester, (February 1997), 'The Neurobiology of Self-Esteem and Aggression', *Educational Leadership*, 54, 5, pp. 75–79.

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