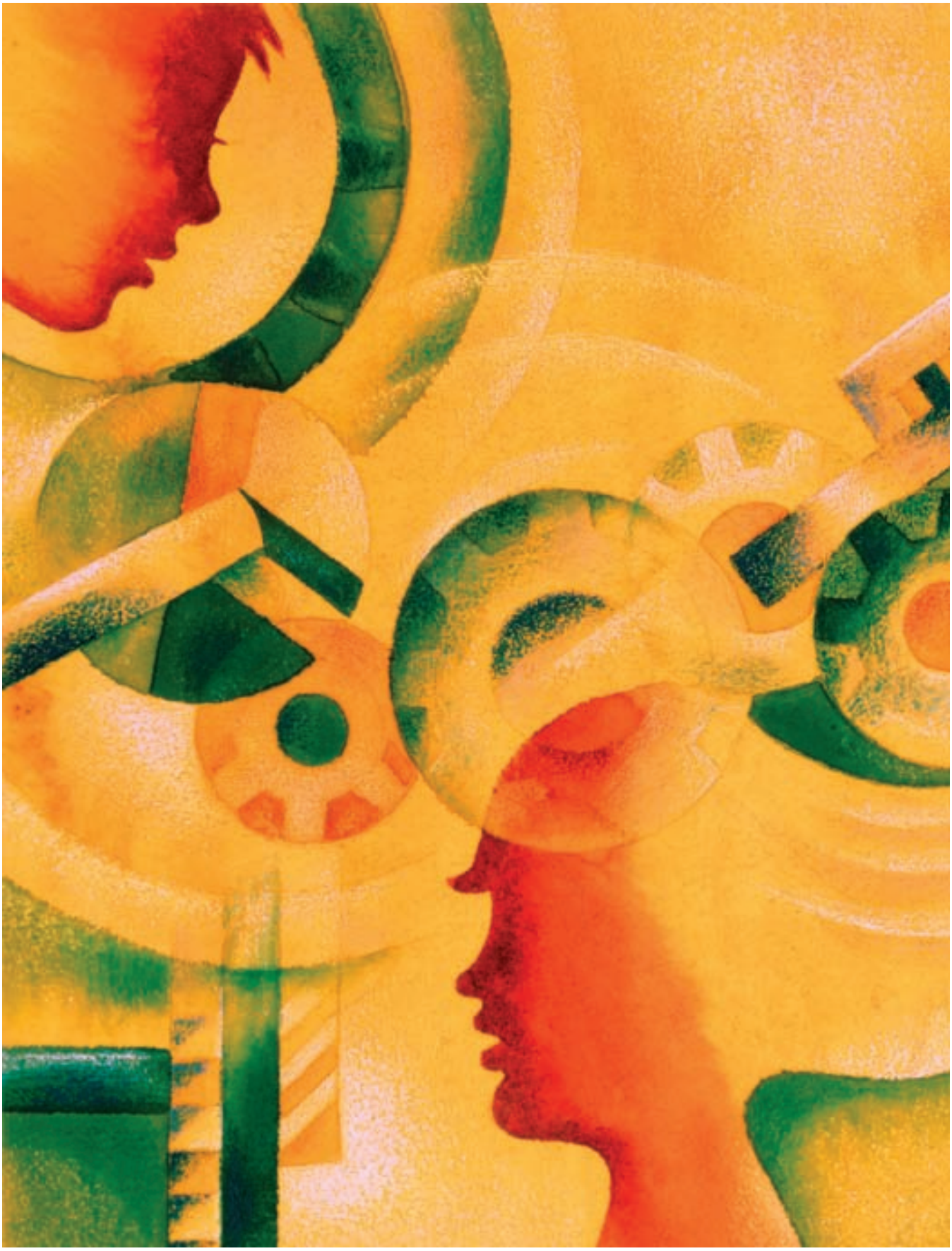

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How Children Learn

Nancy Protheroe

Research-based information about learning can be a powerful tool in a school's efforts to provide effective instruction.

In the fast-paced, standards-based environment of today's classrooms, it is more important than ever before that instruction taps into the capacities of every child. Knowledge about the complexities of human learning can help teachers to do this since "successful learning depends on whether, and how well or how much, learning experiences bring into play the brain's inner resources and the rules of how the brain learns" (Smilkstein 2003).

IN BRIEF

This article presents some key findings from cognitive research on learning and highlights several instructional approaches compatible with growing understanding of how the brain works. These include the use of a thematic and integrated curriculum, cooperative learning, longer blocks of teaching time, and teaching higher-order thinking skills.

This article presents some key findings from cognitive research on learning and highlights several instructional approaches compatible with our growing understanding of how the brain works.

The brain searches for meaning. Learners of all ages discover meaning by making connections. Cognitive research tells us that the need for developing connections is rooted in the basic functioning of the brain itself. In simplified terms, each brain cell receives messages from other cells and determines whether to pass on each message by the amount of electrical charge behind the message. Every time a person experiences something that "connects" with a previous experience and generates a charge, that experience tends to "stick" and something is learned (Parnell 1996). In the classroom, this means that teachers should help students to actively make connections by:

- Building curricula around what students already know. If facts are associated with past learning, the brain is more likely to remember them (Bruer 1997);
- Creating meaning by linking information to real-life experience and personal associations (Jensen 1996);
- Giving students choices about what they learn or how they demonstrate learning;
- Using meaning-making activities, such as journal writing. For example, at the end of a lesson, students write down what they learned, how the learning relates to what they already know, and how they can use this information in the future (Sousa 1998);
- Embedding learning in everyday activities. For instance, students practice language skills by making signs for an event; and
- Creating interdisciplinary curricula or finding times when it is possible to address one topic across disciplines.

Meaning also is created by identifying patterns. The brain resists assimilating isolated bits of information; it prefers to integrate information by recognizing and incorporating patterns (Caine and Caine 1995; Della Neve, Hart, and Thomas 1986). To take advantage of the brain's preference for patterns, teachers can:

- Present a variety of material that initially seems unconnected, then model ways of making connections (*e.g.*, by talking about why and how certain pieces are joined) and
- Encourage students to talk about material in an unstructured way, discovering on their own how each piece of the puzzle fits into something larger and how the connections that are made might vary from student to student (Jensen 1996).

The brain is a complex system of thoughts, emotions, imagination, and physiology that constantly exchanges information with its environment. Information broken up into small chunks, with supplied answers at every turn, does not take advantage of such complexity (Nadis 1993). Teachers should:

- Allow learning to follow its course. Recognize that the brain does not always take logical steps down one path, but can go down a hundred paths simultaneously. Students with varied experiences make connections, extract patterns, and retain information in different ways (Della Neve, Hart, and Thomas 1986); and
- Realize that it takes some students longer to make connections. Instructional planning should provide opportunities for some students to have this extra time, while still maintaining a sense of coherence (Caine and Caine 1995).

"Learning is a social activity that is heavily influenced by…interaction with the larger social environment."

There are many ways to be intelligent. Gardner talks about the multifaceted nature of intelligence, with traditional IQ tests measuring only some aspects (Sousa 2003). This understanding suggests that teachers should:

- Consider more than one type of intelligence when planning instruction. For example, when teachers link music to math or visual art to biology, they are more likely to tap into some of the many ways that students learn;
- Teach students about the theory of multiple intelligences and then ask them to think about which intelligences they use during different activities (Greenhawk 1997); and
- Provide choices so that students can pursue individual interests using individual strengths.

Learning is an emotional activity. Emotions often serve as a link for retrieving information and enhancing long-term memory. In general, how a person feels in a learning situation determines the amount of attention he or she devotes to it—and increased attention is more likely to result in learning and retention (Greenleaf 2003). Teachers can use this knowledge to:

- Create a comfortable, nonthreatening climate. Anything that students might interpret as punitive, critical, or threatening may act as a barrier to learning (Della Neve, Hart, and Thomas 1986);
- Engage students personally through the use of journals, discussion, sharing, and reflection. If there is a significant current event that may have personal meaning for the students, ask them to talk or write about it.

Learning is a social activity that is heavily influenced by the interaction of the individual with the larger social environment. Our minds respond to interaction with others, in part because these situations often engage emotions, as discussed earlier. Teachers can:

- Create a classroom atmosphere in which students interact comfortably and see themselves as part of a learning community;
- Look for opportunities for students to work in small-group settings; and
- Use peer tutoring.

Metacognitive skills enhance learning. Successful students do more than acquire knowledge of facts and concepts. They have an awareness of how they are learning and use it to

monitor their own thought processes and to change their approach to fit the situation or activity (National Research Council 2005). Metacognition involves being aware of one's strengths and weaknesses as a learner. Teachers can:

- Realize that, for some students, weak metacognitive skills can act as a barrier to learning—but that these skills can be taught; and
- Involve students in discussions of their learning process and problem-solving strategies (Bruer 1997).

Practices Supported by Cognitive Research

Many current instructional approaches are compatible with our growing understanding of how the human brain works. Several examples are highlighted here.

Thematic, integrated curriculum. There are many ways to organize learning around common themes and cognitive research clearly supports the integrative approach. Specifically, it creates the expectation in students that there are connections to be made with upcoming ideas in the same course, in other courses, and in settings outside school (Perkins 1991). This process takes advantage of the mind's continual search for meaning.

"Standards-based expectations … are more likely to be met if teachers utilize what we have discovered about human learning."

Cooperative learning. Much research has suggested that cooperative learning can be effective and our knowledge of cognitive research has indicated that working in groups can address the human need for interaction and strengthen learning. In addition, each student's role in contributing to the group and working toward a common goal can act as a powerful motivator (Jensen 2005).

Longer blocks of teaching time offer opportunities to provide experiences compatible with the complex nature of the brain. Teachers have time to introduce a new topic with "hooking" activities that inspire student curiosity. More time is also available to make connections to real concerns, leading to higher levels of student motivation (Fitzgerald 1996). In addition, several different instructional approaches can be used in one period, calling on a variety of intelligences.

Teaching higher-order thinking skills. Nummela and Rosengren (1988) explain that traditional methods of teaching are similar to giving students

a single route to reach a destination, whereas teaching methods that take advantage of the brain's capacity for complex problem-solving are more similar to giving students a map offering many possible routes.

Standards-based expectations for all students are more likely to be met if teachers utilize what we have discovered about human learning. While the knowledge base is both complex and growing, a very positive note is its congruence with practices already identified as part of good teaching. P

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References

Bruer, J. T. "A Science of Learning." *The American School Board Journal,* February 1997, 24–27.

Caine, R. N. and G. Caine. "Reinventing Schools Through Brain-based Learning." *Educational Leadership,* April 1995, 43–47.

Della Neve, C., L. A. Hart, and E. C. Thomas. "Huge Learning Jumps Show Potency of Brain-based Instruction." *Phi Delta Kappan,* October 1986, 143–48.

Fitzgerald, R. "Brain-compatible Teaching in a Block Schedule." *The School Administrator,* September 1996, 20–21, 24.

Greenhawk, J. "Multiple Intelligences Meet Standards." *Educational Leadership,* September 1997, 62–64.

Greenleaf, R. K. "Motion and Emotion." *Principal Leadership,* May 2003, 14-19.

Jensen, E. *Brain-based Learning.* Del Mar, Calif.: Turning Point Publishing, 1996.

Jensen, E. *Teaching with the Brain in Mind,* 2nd ed. Alexandria, Va.: Association for Supervision and Curriculum Development, 2005.

Nadis, S. "Kid's Brainpower: Use It or Lose It." *Technology Review,* November/December 1993, 19–20.

National Research Council. *How Students Learn: History, Mathematics, and Science in the Classroom.* Washington, D.C.: The National Academies Press, 2005.

Nummela, R. M. and T. M. Rosengren. "The Brain's Routes and Maps: Vital Connections in Learning." *NASSP Bulletin,* April 1988, 83–86.

Parnell, D. "Cerebral Context." *Vocational Education Journal,* March 1996, 18–21, 50.

Perkins, D. N. "Educating for Insight." *Educational Leadership,* October 1991, 4–8.

Smilkstein, R. *We're Born to Learn: Using the Brain's Natural Learning Process to Create Today's Curriculum.* Thousand Oaks, Calif.: Corwin Press, 2003.

Sousa, D. A. "Brain Research Can Help Principals Reform Secondary Schools." *NASSP Bulletin,* May 1998, 21–28.

Sousa, D. A. *How the Gifted Brain Learns.* Thousand Oaks, Calif.: Corwin Press, 2003.

WEB RESOURCES

An NAESP *Research Roundup,* "How Students Learn," highlights five key resources to help principals and their staffs learn more about brain-based learning principles.
www.naesp.org/ContentLoad.do?contentId=1859

The brief article, "Teaching with the Brain in Mind," could be used as a resource to stimulate teacher discussion about ways to use knowledge of cognitive research to strengthen instruction.
www.pbs.org/teachersource/prek2/issues/404issue.shtm

Another *Principal* article, "Teaching Students to Be Efficient Learners," focuses on the importance of metacognitive skills in learning and suggests ways in which teachers and schools can help students develop these skills.
www.naesp.org/ContentLoad.do?contentId=851

How Children Learn, a pamphlet published by the International Bureau of Education in collaboration with the International Academy of Education, links 12 research-based principles of human learning to instructional approaches.
www.ibe.unesco.org/publications/practices.htm

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