Eric Jensen

Moving with the Brain in Mind

Brain research confirms that physical activity—moving, stretching, walking—can actually enhance the learning process.

What is the role of movement in learning? Why should students get up and move around? One reason that many students think that school is boring is the amount of seat work that middle school, secondary school, and college teachers—and staff developers—demand. But boredom is less the issue: It's about learning.

Get Moving

Although many school districts are increasing the amount of sedentary test-prep time, much research suggests that activity is better for students. Here are seven good reasons to have students move more to learn more.

Circulation. Movement increases heart rate and circulation, which often increase performance (Tomporowski & Ellis, 1986). Stretching is especially important when students begin class in sedentary positions. Stretching increases the cerebrospinal fluid flow to crucial areas. More oxygen goes to key brain areas; the eyes can relax a moment, which prevents eye strain; and the body gets a break from musculoskeletal tensions (Henning, Jacques, Kissel, & Sullivan, 1997). Increased physical arousal (with 5-8 percent greater blood flow) narrows our attention to target tasks (Easterbrook, 1959).

Episodic encoding. Movement gives learners a new spatial reference on the room. In animal studies, activity enhanced spatial learning (Fordyce & Wehner, 1993). How? The brain forms maps, not only on the basis of the scenery, but also from the body's relationship to the scenery. More locations provide more unique learning addresses. The room doesn't have to be new—just your position in the room (Rizzolatti, Fadiga, Fogassi, & Gallese, 1997). In my staff development workshops, if I see a group for just one day, I have them switch sides of the room after lunch.

A break from learning. Our brains are designed to learn short bursts of information followed by time to process the information. We need time for memory formation and for "settling." Evidence suggests that time spent *not* learning new content is very important (Pelligrini, Huberty, & Jones, 1995). The human brain cannot learn an unlimited amount of explicit content. Most educators feel pressured to cover more material in the time allotted, but doing so is a serious mistake. You can pour all the water you want from a jug into a glass, but the glass can only hold so much.

The stopover station for processing information before it's stored is called the hippocampus, a small, fast-learning, crescent-shaped structure with limited memory capacity (Spitzer, 1997). The hippocampus organizes, sorts, and processes the incoming information before routing it to various areas of the cortex for long-term memory. Overloading this structure results in no new learning.

Movement can give learners a much-needed break. In Japanese and Taiwanese schools, spaced intervals or breaks allow students to be in school all day and yet still learn. Asian children actually spend less time receiving new content than their Minneapolis counterparts (Stevenson & Lee, 1990). That may be attributed to their regimented breaks, recess, and formal play.

System maturation. As we grow up, our brains change and grow, too. Students experience pruning (the elimination of existing synapses), neurogenesis (the growth of new brain cells), and myelination (the strengthening of existing neural pathways). In some cases, neural tissue doubles in size in a given area of the adolescent brain, whereas other areas shrink. This massive change results in an even greater need for content breaks for cognitive remapping. The nervous system does not even mature until somewhere between ages 15 and 20. If anything, we need more, not fewer, breaks from learning. Psychology professor David Bjorklund says, "Young children in particular may require more breaks from seat work" (Bjorklund & Brown, 1998, p. 604).

Good chemicals. Certain kinds of movements can stimulate the release of the body's natural motivators. Two of the best are noradrenaline (the hormone of risk or urgency) and dopamine (the neurotransmitter producing good feelings). Noradrenaline can be triggered through student relay races, public speaking performances, achievable but tough deadlines, competitions, or socially risky activities. Dopamine can be triggered through positive social bonding, celebrations, nonmaterial rewards, or gross motor repetitive move-

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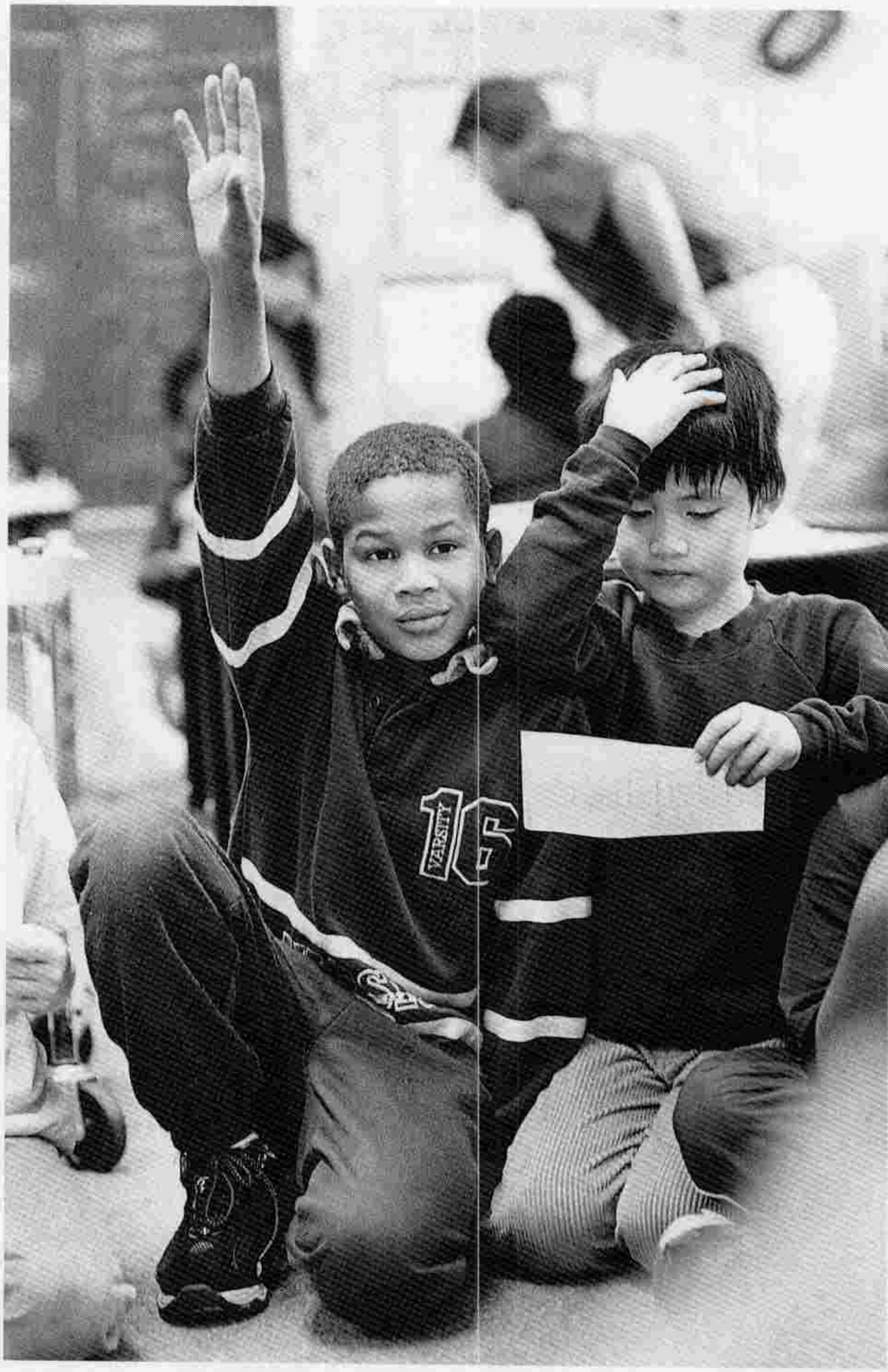
ments. These energizers wake up learners, increase their energy levels, improve their information storage and retrieval, and help them feel good. A very short break or energizer increases arousal, but longer breaks allow the learner to be aroused and then come back to a more sustainable level of energy.

Too much sitting. Although people can learn while sitting, the typical notion of sitting in chairs for an extended time may be misguided. The human body, for the last 400,000 years, has primarily been walking, sleeping, leaning, running, doing, or squatting. It has not been sitting in chairs, which are a relatively new invention in human history, only used for the last 500 generations. The typical student who sits much of the day runs the following risks: poor breathing, strained spinal column and lower back nerves, poor eyesight, and overall body fatigue. We expend much energy just to maintain a posture, even a bad one.

Sitting in any chair for more than a short (10-minute) interval is likely to have negative effects on your physical self, hence your mental self, and at a minimum, reduce your awareness of physical and emotional sensations (Cranz, 1998). The pressure on the spinal discs is 30 percent greater when sitting than when standing (Zacharkow, 1988). That creates fatigue, which is bad for learning. Students may seem restless and unable to concentrate—or worse, they may become undisciplined—when the real problem is bad ergonomics and lack of movement.



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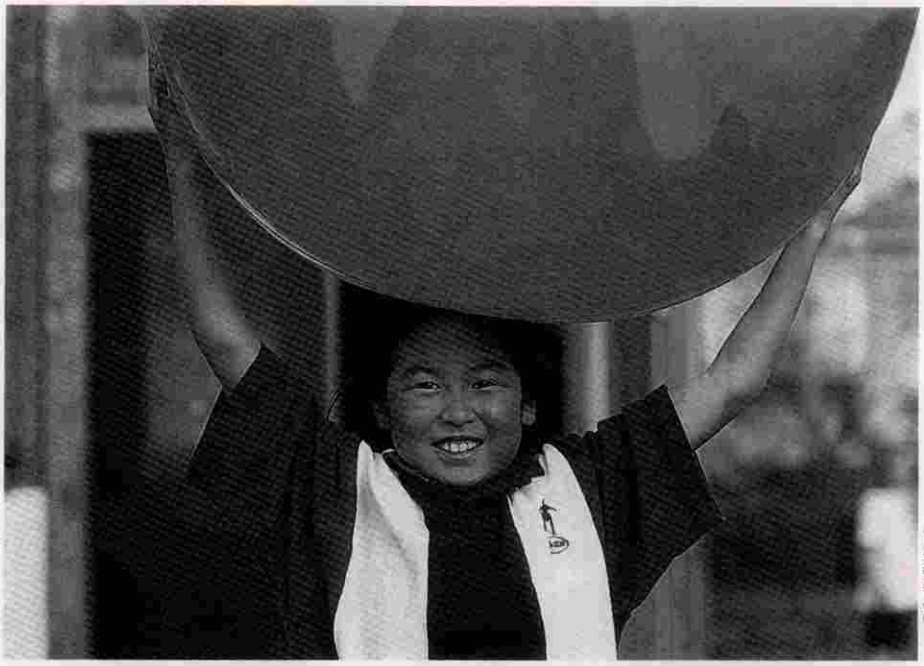
The typical office worker (chair sitter) has more musculoskeletal problems than any other industry-sector worker, including construction, metal industry, and transport workers. Office workers have about the same amount of seat time as most students. One researcher's conclusion: Sitting is as much an occupational risk as is lifting heavy weights on the job (Hettinger, 1985).

We now know that today's chairs do not offer enough flexibility to optimize learning (Tittel & Webber, 1973). But this complaint is not new. As far back as 1912, Maria Montessori described the impact of chairs: "[When chairs were used], children were not disciplined, but annihilated" (Montessori, 1986, p. 797). In addition, children cannot see as far as adults can. As a result, they compensate by leaning over, rounding their backs, and creating strain. Typically, poor sitting posture creates pressure on the diaphragm and internal organs. This restricts internal organ function, reduces blood circulation and oxygen to the brain, and increases fatigue (Grimsrud, 1990). In fact, the



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director of the Institute of Occupational Health in Milan, Italy, said,

> Holding any posture for long periods of time is the ultimate problem; but holding the classic right-angle seated posture in particular has its special stresses, which no amount of ergonomic tinkering can eliminate. (Greico, 1986, p. 345)

The value of implicit learning. Our explicit, semantic learning is what we use as we read this article. Our explicit, episodic learning is made of the memories we'll store about where we were when we read this article, what was around us, and with whom we talked about it. The explicit system works by gathering information about the world in *what* (semantic) and *where* (episodic) pathways.

The implicit system, in contrast, works by organizing our responses to the world around us. This includes the *wow* or knee-jerk responses—such as immediate emotions, conditioned responses, trauma, and reflexive behaviors—and the more measured *how* responses, which are procedural, skills-based, operational, and tactile. It's convenient to make distinctions between explicit (overt) and implicit (covert) types of learning, but there is, in fact, no absolute distinction. Both systems work together—they take in the information about our world, then organize our responses to it. Most commonly, we use the semantic learning pathways for so-called seat work and the procedural learning pathways for movement and skills-based learning, typical in an arts or physical education class.

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The point is simple: We are more likely to remember implicit learning. It is robust, easy to learn, cross-cultural, efficient, and effective—regardless of our age or level of intelligence (Reber, 1993).

Suggestions for the Classroom

Teachers need to engage students in a greater variety of postures, including walking, lying down, moving, leaning against a wall or desk, perching, or even squatting. A slanted desk means less fatigue (better concentration) and less eye strain (better reading). Students experience less painful electromyogram activity in the lower back when they use slanted work surfaces instead of flat ones (Eastman & Kamon, 1976).

Teachers should regularly engage students in movement. "The data suggest that exercise is the best overall mood regulator" (Thayer, 1996, p. 129). Teachers who have learners of any age sit for too long are missing the boat. Taking them for brisk walks is one way teachers can influence students' moods. Howard Gardner writes,

> I believe in action and activity. The brain learns best and retains most when the organism is actively involved in exploring physical sites and materials and asking questions to which it actually craves answers. Merely passive experiences tend to attenuate and have little lasting impact. (Gardner, 1999, p. 82)

Students can use the body to learn. Learners can stand up and demonstrate concepts, such as big or small, tall or short, quick or slow. They can have more fun demonstrating such words as crawl, roll, and surprise. Clapping or stomping out rhythms, words, or beats can make class more entertaining.

Daily or weekly role-plays are helpful motivators. Have students play charades to review main ideas or to dramatize a key point. Create one-minute commercials adapted from television to advertise upcoming content or to review past content.

These energizers wake up learners, increase their energy levels, improve their information storage and retrieval, and help them feel good.

A variety of physical activities also help students learn. Use the body to measure objects around the room and report the results: "This cabinet is 44 knuckles wide." Play a Simon Says game with content built into it: "Simon says point to the south. Simon says point to five different sources of information in the room." Do team jigsaw processes with huge, poster-sized mind maps: "Get up and touch seven colors around the room on seven different objects." Teach a move-around system using memory cue words: "Stand in the room where we first learned about X."

Arm and leg crossover activities force both hemispheres of the brain to "talk" to each other: "The left arm pats the right shoulder" or "Pat your head and rub your belly." These activities also include marching in place while patting opposite knees, patting opposite shoulders, and touching opposite elbows or heels.

If nothing else, stand-and-stretch breaks every 20 minutes can energize the class. At the beginning of class, or any time that the class needs more oxygen, get everyone up to do some slow stretching. Ask students to lead the group or let teams do their own stretching and rotate leaders.

Stay Active

The take-home message is simple: Active learning has significant advantages over sedentary learning. The advantages include learning in a way that is longer lasting, better remembered, more fun, age appropriate, and intelligence independent and that reaches more kinds of learners. Active learning is not just for physical education teachers—that notion is outdated. Active learning is for educators who understand the science behind the learning. Let's support a stronger blend of sitting and moving. ■

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A man has been able to move all four of his paralysed limbs with a mind-controlled exoskeleton suit, French researchers report. Thibault, 30, said taking his first steps in the suit felt like being the "first man on the Moon". His movements, particularly walking, are far from perfect and the robo-suit is being used only in the lab. But researchers say the approach could one day improve patients' quality of life. How does it work?Â Initially he practised using the brain implants to control a virtual character, or avatar, in a computer game, then he moved on to walking in the suit. Media playback is unsupported on your device. Media captionMind-controlled exoskeleton allows paralysed 30-year-old man to walk in French lab. "It was like [being the] first man on the Moon. I didn't walk for two years.