

## Exercise Seen as Priming Pump for Students' Academic Strides

**Case grows stronger for physical activity's link to improved brain function.**

By [Debra Viadero](#)

At 7:45 a.m. each weekday, while most of his peers at Naperville Central High School in Naperville, Ill., are sitting in class and groggy with sleep, 15-year-old Matt Bray is running sprints, jumping rope, lifting weights, and engaging in other activities, all aimed at getting his heart pumping.

This early-morning exercise class is about more than getting in shape, though. A small but growing number of experts and educators suggest that Mr. Bray is priming his brain for learning at the same time he's sculpting his biceps.

"It's been actually raising my grades a little bit higher," Mr. Bray, a freshman, said of the class, which he has been taking since September. "Now I'm getting A's and B's on average," he said. "In junior high, I was getting B's and C's."

Seven or eight years ago, studies offered mixed results on the question of whether exercise can boost brain function in children and adolescents. Experts are beginning to contend, however, that the case is getting stronger.

"There's sort of no question about it now," said Dr. John J. Ratey, a clinical associate professor of psychiatry at Harvard Medical School. "The exercise itself doesn't make you smarter, but it puts the brain of the learners in the optimal position for them to learn."

### Range of Benefits

Dr. Ratey is the author of *Spark: The Revolutionary New Science of Education and the Brain*, a book published last month by Little, Brown and Co. It draws together emerging findings from neuroscientific, biomedical, and educational research that correlate exercise with a wide range of brain-related benefits—improving attention, reducing stress and anxiety, and staving off cognitive decline in old age, for example.

The interest in documenting a link between exercise and learning in children and adolescents comes as trends in physical activity seem to point in the opposite direction.

Studies suggest that, with 30 percent of the nation's schoolchildren classified as overweight, childhood obesity is reaching epidemic proportions.



Students at Naperville Central High pick out heart-rate monitors and watches at the start of a typical physical education class, above. They are instructed to keep their heart rates between 160 and 180 beats per minute for at least 15 minutes.

—John Zich for Education Week

Proponents of the educational benefits of exercise maintain that the federal No Child Left Behind Act, which puts pressure on schools to raise students' test scores in core academic subjects, is prompting some schools to cut back on time for physical education classes and recess. Nationwide, Dr. Ratey writes in his book, only 6 percent of schools now offer PE five days a week. "At the same time," he adds, "kids are spending 5.5 hours a day in front of a screen of some sort—television, computer, or hand-held device."

"Had the creators of No Child Left Behind looked at the data, they would've realized that physical activity is good for the brain," said Charles H. Hillman, an associate professor of kinesiology at the University of Illinois at Urbana-Champaign.

With his university colleague Darla M. Castelli, Mr. Hillman assessed the physical-fitness levels of 239 3rd and 5th graders from four Illinois elementary schools. Their **findings published last year**, in the *Journal of Sport & Exercise Psychology*, show that children who got good marks on two measures of physical fitness—those that gauge aerobic fitness and body-mass index—tended also to have higher scores on state exams in reading and mathematics. That relationship also held true regardless of children's gender or socioeconomic differences.

### 'Bowled Over'

Another **study published last year**, involving 163 overweight children in Augusta, Ga., found, in addition, that the cognitive and academic benefits of exercise seemed to increase with the size of the dose.

For that study, a cross-disciplinary research team randomly assigned children to one of three groups. One group received 20 minutes of physical activity every day after school.

Another group got a 40-minute daily workout, and the third group got no special exercise sessions.



At Naperville Central High School, ball playing is used to keep students alert in a special literacy class.

—John Zich for Education Week

After 14 weeks, the children who made the greatest improvement, as measured by both a standardized academic test and a test that measured their level of executive function—thinking processes, in other words, that involve planning, organizing, abstract thought, or self-control—were those who spent 40 minutes a day playing tag and taking part in other active games designed by the researchers. The cognitive and academic gains for the 20-minutes-a-day group were half as large.

“I was frankly bowled over by the results,” said Catherine L. Davis, the lead author of the study, a preliminary version of which was published in December in *Research Quarterly for Exercise and Sport*. “It’s like a staircase, which is considered strong evidence for causation,” added Ms. Davis, who is an associate professor of pediatrics at the Medical College of Georgia in Augusta.

## PE Experiment

In the meantime, educators in Naperville District 203, a suburban district of 18,600 students just west of Chicago, have been conducting some informal experiments on their own. With advice from Dr. Ratey, the school instituted what is now called a “learning readiness” PE class where students such as Mr. Bray can choose from more than a dozen heart-pumping activities.

The students wear heart monitors, which they check to maintain a heart rate of 160 to 190 beats a minute for 25-minute stretches at a time throughout the week.

When the class started in the fall of 2004, it included about a dozen students who were targeted for extra help based on low test scores in reading and teacher recommendations. Reading teachers were also recruited to infuse a bit of literacy instruction into some of the activities.

One game called for students to race around on scooters to match words with their definitions written on pieces of paper on the floor, said Paul Zientarski, the school's instructional coordinator for physical education and health.



Ninth grader Nina Matas, above, and classmates use a Nintendo DS gaming device to “warm up” before a math quiz.

—John Zich for Education Week

After their early-morning PE session, the students joined other struggling readers and writers in a special literacy class designed to give them extra academic help in those areas.

At the end of one semester, Naperville educators found, students who took part in both the early-morning exercise program and the literacy class showed 1.34 of a year's growth on standardized reading tests, according to Mr. Zientarski. The gain for the students in the literacy-only group, in comparison, was seven-tenths of a year.

Naperville educators tried the same approach the following school year with an introductory algebra class for students having difficulty in mathematics and saw even more dramatic gains. Students who both exercised and took the extra-help math class increased their scores on a standardized algebra test by 20.4 percent. The gain for students in the control group was 3.87 percent, according to Mr. Zientarski.

The school did not get the same results, though, a year later when the “learning readiness” classes and the literacy classes were scheduled six hours apart.

Students who had literacy lessons right after exercising did just as well, but improvements were smaller for students with afternoon literacy classes. That led Naperville Central's guidance counselors to recommend that all students schedule their toughest academic classes right after PE.

“We now have three years of data showing what we have, and we really think we're on to something,” Mr. Zientarski added.

But district administrators would like to enlist university-based researchers to do more-formal studies before incorporating major scheduling changes districtwide.

“We have so many different variables that could affect how we evaluate the course,” said Jody Wirt, the district’s associate superintendent for instruction. “Is it the class size? Or the teachers?”

### **Mental ‘Miracle-Gro’**

Likewise, scientists are still not entirely sure how exercise primes the brain for learning. But, according to Dr. Ratey, they have some good ideas.

Laboratory studies in mice and humans, for instance, show that exercise prompts the brain to produce greater amounts of a protein called brain-derived neurotrophic factor or BDNF, which Dr. Ratey likes to call “Miracle-Gro” for the brain.

It encourages brain cells to sprout synapses, which are crucial to forming the connections the brain needs to make in order to learn. It also strengthens cells and protects them from dying out.

Other research also suggests that exercise plays a role in neurogenesis, the production of new brain cells, in middle-aged and older adults and in laboratory animals.

“There’s no way to say for sure that improves learning capacity for kids, but it certainly seems to correlate to that,” Dr. Ratey said. What seems to continue to be important, though, is what gets put in those brain cells—in other words, whether students are given complex learning fodder to practice and master.

It’s also not likely, Dr. Ratey said, that just any physical education curriculum will produce the kinds of benefits that Naperville saw with its “learning readiness” classes.



One of the school’s teachers uses a hand-held digital device to record heartrate information collected in students’ watches.

—John Zich for Education Week

At the instigation of former physical education teacher Phil Lawler, the Naperville district has been at the forefront of a national movement for the “new PE,” a philosophy that promotes teaching students how to be fit and lead healthy lives, rather than focusing on sports skills and game rules.

[http://www.edweek.org/ew/articles/2008/02/13/23exercise\\_ep.h27.html?tmp=1797071541](http://www.edweek.org/ew/articles/2008/02/13/23exercise_ep.h27.html?tmp=1797071541)

“No more getting picked last for basketball. No more climbing ropes or playing dodgeball,” said Mr. Lawler, who now works for a Kansas City, Mo.-based foundation, called PE4Life, that trains teachers and promotes the concept nationwide.

Mr. Lawler and Mr. Zientarski, for instance, began using heart-rate monitors with all their classes more than a decade ago.

They also raised money to install climbing walls and ropes courses in their schools and brought in kayaks and sophisticated exercise equipment that incorporates video games and virtual-reality technology to make exercise more engaging for students.

Traditional sports are still taught, but the games, such as three-on-three basketball, take place in smaller groups, Mr. Lawler said. “This isn’t just a few PE teachers with a wild idea anymore,” he said. “It’s combining what should go on in a quality physical education program with some of the highest-quality research in the world in neuroscience and cognitive science.”

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