

ExerLearning® : Movement, Fitness, Technology and Learning

Abstract:

ExerLearning provides parents, educators and others with a solid background of the direct connection between regular, rhythmic aerobic activity, balance, eye-foot coordination and academic success. We can increase students' fitness while simultaneously increasing their academic success. Activity breaks have been shown to improve cognitive performance and promote on-task classroom behavior. **Today's exergame and related computer technology can seamlessly deliver activity without over-burdening busy teachers in grades K-12.** Activity isn't optional for humans, and our brain, along with its ability to learn and function at its best, isn't a separate "thing" perched in our heads. The wiring, the circulation, the connection between mind and body is very real. The brain is made up of one hundred billion neurons that chat with one another by way of hundreds of different chemicals. Physical activity can enhance the availability and delivery of those chemicals. Harnessing technology to that activity is the ExerLearning solution.

Biographical sketch: Judy Shasek, M.S.

ExerLearning is poised at the intersection of fitness, education and technology. The author contributes vital expertise and resources in each of these key areas. Judy Shasek has 17 years of experience as a fitness/education consultant and 12 years as a public school teacher, curriculum designer, teacher trainer and grant writer. By assimilating a massive amount of research and drawing on the invention and energy of many educators, researchers and fitness leaders around the country, ExerLearning was first delivered via Generation FIT. It is a program that developed organically over five years– in real schools with diverse students.

Reading, Writing and ExerGames?

Our lifestyles have become ever more sedentary with screens – television, computer and video game – being used for leisure, entertainment, communication, information and a pervasive social-networking culture. With only so much time in the school day it's tough to fit in physical activity, balance training and fitness to counter "screen" time. Research has been done by many independent and university researchers over the past decade. There is adequate evidence on the positive benefits of physical fitness on academic success and cognitive skills. We developed specific ExerLearning strategies that can tap into computer and game technology to easily become an integral part of the school environment:

- ExerLearning can be delivered by technology
- ExerLearning can be led and managed by students
- You can increase students' fitness while simultaneously increasing their academic success.
- Meet the needs of the most challenged, challenging or diverse learners without writing additional lesson plans
- ExerLearning should have you very curious about now!

There is an endless list of factors that impact a student's academic achievement. Among those, maybe the one least understood is the impact of regular physical activity. Throughout the development of ExerLearning concepts and practices, research on the benefits of regular rhythmic, aerobic and balance activity has been explored. Today's brain-scanning tools and a sophisticated understanding of biochemistry have led researchers to realize that the mental effects of exercise are far more profound and complex than they once thought.

The process starts in the muscles. Every time a bicep or quad contracts and releases, it sends out chemicals through the bloodstream, across the blood-brain barrier and into the brain itself. Neurotransmitters incorporate the resulting brain-derived neurotrophic factor, or BDNF. Dr. John Ratey, author of the book "Spark: The Revolutionary New Science of Exercise and the Brain," calls BDNF "Miracle-Gro for the brain." It fuels almost all the activities that lead to higher thought.

With regular exercise, the body builds up its levels of BDNF, and the brain's nerve cells start to branch out, join together and communicate with each other in new ways. **This is the process that underlies learning: every change in the junctions between brain cells signifies a new fact or skill that's been picked up and stowed away for future use. BDNF makes that process possible. Brains with more of it have a greater capacity for knowledge.**

"Exercise optimizes the brain and the person for learning. It creates the right environment for all of our 100 billion nerve cells up there. Exercise promotes the growth of new brain cells more than anything else we know," says Dr. Ratey. Ratey cites studies showing that exercise promotes the growth of new cells in the hippocampus, an area in the brain associated with memory and learning.

That's just the beginning. This chapter will weave facts and findings from brain research, innovative PE programs, unique peripherals that tie technology to physical activity and solid academic research on learning and test success. Our goal is to provide a solid overview of ExerLearning's potential in K-12 learning environments. As we work with educators, students, parents and wellness/learning advocates in dozens of states and hundreds of school Districts, we have found that having a vocabulary for our ground-breaking work together is very important. The term ExerLearning is one that we

can wrap our minds around and begin to connect the dots on strategies that make good sense for lots of students.

ExerLearning allows educators to reach academic goals while integrating aerobic exercise, balance, eye-foot coordination and agility to the learning environment. Physical activity does not have to be restricted to the gym. We love PE and welcome all a school can deliver. Budgets and philosophies differ across the country and there is no denying that we are not meeting PE mandates even in the 44 states where they have been set. Until budgets, schedules, time and resources are allocated we offer ExerLearning with its cost and time-effective choices. No matter what your stance on standardized testing it is time for our test-prep practices to get a boost. Our current efforts at raising performance for the 30% most challenged and challenging of our students remains frustrating for all. We hope to provide the case for meeting them where their needs and learning style intersect:

- Provide movement during academic work right at the computer using educational software and learning games already integrated in a school's curriculum. FootGaming™ via the FootPOWR™ peripheral can do that.
- Provide leadership and collaborative practice for students in need of confidence and social skills – Generation FIT delivers exactly that
- Decrease negative behaviors and increase attendance (28% on average)
- Prepare the brain to learn via the very process and physical development the brain was meant to experience during cognitive tasks

Physical Activity May Strengthen Children's Ability To Pay Attention

Charles Hillman, a professor of kinesiology and community health and the director of the Neurocognitive Kinesiology Laboratory at Illinois, and Darla Castelli, professors of kinesiology and community health, have found that physical activity may increase students' cognitive control -- or ability to pay attention -- and also result in better performance on academic achievement tests.

“The goal of the study was to see if a single acute bout of moderate exercise was beneficial for cognitive function in a period of time afterward,” Hillman said.¹

For each of three testing criteria, researchers noted a positive outcome linking physical activity, attention and academic achievement. Study participants were 9-year-olds (eight girls, 12 boys) who performed a series of stimulus-discrimination tests known as flanker tasks, to assess their inhibitory control.

“What we found is that following the acute bout of walking, children performed better on the flanker task,” Hillman said. “They had a higher rate of accuracy, especially when the task was more difficult. Along with that behavioral effect, we also found that there were changes in their event-related brain potentials (ERPs) – in these neuroelectric signals that are a covert measure of attentional resource allocation.”

In an effort to see how performance on such tests relates to actual classroom learning, researchers next administered an academic achievement test. The test measured performance in three areas: reading, spelling and math. The researchers noted better test results following exercise. The following should bring smiles to the ace of hard-working teachers concerned about reading achievement and scores.

“When we assessed it, the effect was largest in reading comprehension,” Hillman said. In fact, he said, “If you go by the guidelines set forth by the Wide Range Achievement Test, **the increase in reading comprehension following exercise equated to approximately a full grade level.**”

Given the preliminary study’s positive outcomes on the flanker task, ERP data and academic testing, study co-author Darla Castelli believes these early findings could be used to inform useful curricular changes. We suggest ExerLearning, particularly the easy-to-implement FootPOWR computer peripheral for school personnel interested in integrating physical activity into the curriculum.

Fit to Learn?

Only 3.8 percent of elementary schools, 7.9 percent of middle schools and 2.1 percent of high schools provide daily P.E., according to a CDC survey. A study published in the 2007 issue of *Health Economics* stated that daily P.E. for high school students declined from 41.6 percent in 1991 to 28.4 percent in 2003. (The survey did not have statistics for middle and elementary schools.)

- 22 percent of schools don't require kids to take any P.E.
- Nearly half -- 46 percent -- of high school students were not attending any P.E. classes when surveyed by the CDC.

In more than 44 states, mandates to provide more physical education are being flouted due to lack of time, space, or competition from academic requirements, according to some educators. Dr. David Satcher, former U.S. Surgeon General and the founder of an organization called Action for Health Kids, was quoted as saying schools that don't offer enough P.E. are "cheating" children. *Active Living Research* (ALR) a national program of the Robert Wood Johnson Foundation, found that, although more than one-third of U.S. children and teens are considered overweight or obese, schools are increasingly replacing physical education with academic coursework in their push to improve standardized test scores.

The report points out, however, that decreased P.E. time is not associated with improved academic performance. In fact, the report indicates:

- Children who are physically active tend to perform at higher levels in the classroom and on standardized tests.

- In addition, active students exhibit fewer behavior problems and better concentration skills.

According to Jerry Gabriel cited in the Brain Connection, a “growing body of research [suggests] that physical activity is integral to keeping cognitive processes working on all valves.” Current educational practices were developed in the early 19th century well before any of the brain research existed. It’s time for a change.

On average, the PE mandate requires 150 minutes per week for all elementary students and 225 for middle and high school students. The budgetary support for this mandate spans “not enough” to “next to nothing.” Some schools have stretched the “physical activity” point so far that they count the time children use to move from class to class – calling it 30 minutes per day and their fulfillment of the mandate. The impetus for doing that is as understandable as it is pathetic. Sometimes there seems to be no other viable solution.

What are over-scheduled, busy teachers to do? Our reply is, empower tomorrow’s fitness and tech-leaders today, make use of the time, energy and expertise of your students now. Budgets are tight and such increases are not being funded or enforced as needed. Teachers are busy and the school day is already over-scheduled. Technology tools and unique peripherals like the FootPOWR pads can enhance computer technology while saving teachers time. The concepts behind ExerLearning are ones that we can wrap our minds around and begin to connect the dots on strategies that make good sense for lots of students.

What if you knew that physical activity actually enhanced academic success?

While the sedentary habits of our youth are conclusively adding to the overweight crisis, we argue that *not including regular and daily physical activity breaks also short-changes the productivity, focus and chance for academic success we’re working so hard to deliver*. Consider this: *exercise and balance- activity practice has been shown to directly improve students’ cognitive development and academic achievement*. This adds a new dimension to the rationale we hold when we define “what is learning?”

The greatest limitation to the addition of physical activity to the learning environment is over-scheduled and over busy teachers. School schedules are full and test-prep takes preference in terms of time and scheduling. The recent development of the FootPOWR pad, a computer peripheral that can do anything a mouse can do, add activity simultaneously with learning outcomes and seamlessly integrates into the classroom.

What’s a FootPOWR peripheral?

FootPOWR pads look like the dance mats conventionally used in dance video games. The similarity ends there. Added FootPOWR microcontrollers turn the dance mat into a computer peripheral that can do anything a mouse can do. You simply plug the pad into the computer USB port, stand on the pad and move your feet to move the cursor. Suddenly many existing educational software games and hundreds of other software can become physical activity and balance generating interactive tools for your students. By re-inventing the computer “controller” from a mouse or keyboard used while sitting, to a

dance-mat type tool that requires rhythmic activity and balance we can positively and easily impact learning and the needs of diverse learners. For more, see www.FootGaming.com

Evidence that physical activity affects the brain in ways that improve learning has been mounting from the fields of molecular, cognitive, behavioral, and systems neuroscience, psychology, and directly from field studies performed in schools. That information inspired the development of Generation FIT over five years and led to the development of the FootPOWR pad. Teachers need easy to use tools that deliver results. Schools need fitness tools that can be obtained via reading, math, Title I and technology budgets when PE budgets are not enough.

Generation FIT is a program in which the 30% most challenged or challenging students in any class are trained to lead and manage a technology-delivered exergame program. The program provides 10-15 minute rhythmic aerobic and balance activity breaks throughout the learning day. In addition to improved health, studies have shown that fitter students have greater academic achievement.

Imagine how well an educator can do what he or she does best – teaching and facilitating in a learning environment - when all students are ***prepared to learn both mentally and physically***. ExerLearning breaks throughout the day can deliver exactly that. When students in the Generation FIT program (www.generation-fit.com) lead and managed the use of exergames during the learning day we found that participants:

- reduced absenteeism by 28%
- Increased leisure reading
- Reduced negative behaviors, frustration and improved mood
- Gained confidence and social/teamwork skills

Programs like Generation FIT and FootGaming which deliver physical activity for a healthy body *and mind* are crucial, especially for the most challenged learners. The mind-body connection is well-known and widely noted, as a new study published in the *Journal of School Health*² demonstrates. Elementary school children who are physically fit score higher on standardized math and English tests than do their less fit peers, the research shows.

The study, led by Virginia R. Chomitz, PhD, found a significant relationship between physical fitness and academic performance. She and her team examined the test scores of over 1,000 children enrolled in grades 4 to 8 for the 2004 to 2005 academic year. Looking at two sets of figures—the MCAS test (Massachusetts Comprehensive Assessment System test) and physical fitness tests—Chomitz and her fellow researchers found that the likelihood of passing the academic tests improved as the number of fitness tests increased, even when controlling for gender, race/ethnicity, and socio-economic status.

How can educators inject more sensorimotor experience into the regular classroom, in after school programs and at home?

In times of diminishing financial resources, educators must make hard choices.

- Do dance, recess, exercise breaks and physical education belong in the budget? Are they frills or fundamentals?
- When classroom teachers are over-scheduled and busier than ever is there time for movement, exercise and dance in the regular classroom learning environment?
- We need to invest in test prep strategies, reading interventions, behavior modification and meeting the needs of students with diverse learning styles?
- Students must acquire content and technology skills via increased time interacting with ‘screens’ – how can we add the physical activity and fitness factors they need to best succeed?

ExerLearning can address many of these needs simultaneously-saving time and money.

Research and recent “Learning Readiness PE” (LRPE) classes at Naperville Central High (IL) indicate that physical activity can impact student performance enough to elevate test scores. “We're putting kids in P.E. class prior to a classes that they struggle in and what we're doing is we're finding great, great results,” said Paul Zientarski, who helps run LRPE program at Naperville Central High School. The program was started in response to research showing a link between exercise and increased brain function. He says that he has seen the results.

"Kids who took P.E. before they took the math class had **double the improvement** of kids who had P.E. afterward," Zientarski, explained. Naperville Central High School has embraced the idea that working out helps a child learn. There you can find exercise equipment in some classrooms.

"Their bodies are moving and their brains are thinking and they're engaged - not sitting still trying to memorize something," said Maxyne Kozil, a reading teacher, who believes that kids learn best when they're moving. An example of this is having a student work on her vocabulary while standing on balance boards.

"They say having to balance actually helps them to concentrate even better," Kozil said.

It is time for our test-prep practices to get a boost. Our current efforts at raising performance for the 30% most challenged and challenging of our students remains frustrating for all. We hope to provide the case for meeting them where their needs and learning style intersect:

- Provide movement during academic work right at the computer using educational software and learning games you already use (FootGaming – the FootPOWR pad connects to the computer via USB and does anything the mouse can do)
- Provide leadership and collaborative practice for students in need of confidence and social skills

- Decrease negative behaviors and increase attendance (28% on average)
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Do physical activity and physical education interfere with academics?

In many states physical education is done away with because “academic classes” are considered more important. Importance being “you get what you measure” and we measure reading and math scores far more than fitness and wellness choices our students make. Further, 20% of all elementary schools in the U.S. do not provide students with recess (Tyre, 2004) so that they can spend more time in the classroom preparing for standardized high stakes testing.³

A two year study in San Diego that examined standardized test scores revealed that students having a physical education class outperformed those that did not (Sallis et al, 1999).⁴ Researchers have demonstrated that physical activity improves brain function, elevates mood, and promotes learning. Exercise improves blood flow to the brain and spurs cell growth, leading some to compare the brain to a muscle which performs best when the body exercises.

Teachers and administrators are working harder than ever to provide what each student needs to be a successful learning making the most of skills, aptitudes and learning styles. A variety of funding sources for academics, including No Child Left Behind (NCLB) are being used to their maximum. But are we impacting the students who need it most by implementing strategies that shift the paradigm of what “test prep” and learning look like?

Activity breaks can improve cognitive performance and classroom behavior.

According to many studies involving elementary students, regular physical activity breaks during the school day may enhance academic performance. Introducing physical activity has been shown to **improve cognitive performance and promote on-task classroom behavior**. Investigators in Georgia studied the effect of an activity break on classroom behavior in a sample of 43 fourth grade students in 1998. Students exhibited significantly more on-task behavior and significantly less fidgeting on days with a scheduled activity break than on non activity days. This isn’t just a case of a distracting insertion of random “playtime.” Short activity breaks during the school day can improve students’ concentration skills and classroom behavior.⁵

Judy Shasek, author of this article and developer of Generation FIT and FootGaming, discovered that students as young as age 8 are eager to learn exactly *why* regular aerobic activity and balance practice helps a brain to be more productive, to increase BDNF and neurotransmitters and to help them focus. During field studies, we used a simple PowerPoint slideshow. With it and others created by students, hundreds of students have shared complicated brain research with peers and teachers. For many struggling students it is a major relief to understand why learning is often such a struggle and how they can do something that actually **enjoy** to increase their academic success (and often their behavior). Many challenged learners are relieved to discover that their lack of “sit still and focus” is linked to a real, physical and brain-driven need to move on

a regular basis throughout the learning day. Once we harness technology to deliver that movement practice in an orderly and seamless manner everyone is happier

What does the research say?

- Ten minutes of rhythmic aerobic exercise before a cognitive task (like reading or math) resulted in better success at that task
- Students who did 10 minutes of rhythmic aerobics before a standardized test, did up to 25% better at that test than students who received 20 minutes of test-specific tutoring.
- School-age children who have a higher level of aerobic fitness processed information more efficiently

A cross-sectional study conducted in 2002 by the California Department of Education⁶ demonstrated a strong association between physical fitness and academic performance. Using the Fitnessgram®, a six-faceted measure of overall physical fitness, and students' grades on the SAT-9 state standardized test, nearly one million students in grades five, seven, and nine were evaluated. The consistent finding: not only did those with higher levels of physical fitness score higher on the SAT-9, but there was a positive linear relationship between the number of fitness standards achieved and academic achievement. This result held for boys and girls in both math and reading, but was most pronounced in math.

Even when time allocated to other subjects is reduced, shifting more curricular time toward physical activity does not negatively affect academic achievement. In one such study, a reduction of two-hundred forty minutes per week of class time, replaced with increased PE, led to higher scores on standardized math examinations.⁷ As we review studies that assessed the association between physical activity and academic outcomes among school-aged children, we conclude that there is evidence to suggest that short term cognitive benefits of physical activity during the school day adequately compensate for time spent away from other academic areas.” A recent CBS news video sums it up with compelling reports and images.⁸ According to Dr. Debbye Turner Bell, researchers are finding that exercise can do more than keep you fit; it can also make you smarter. One school in Illinois has developed a program that gets kids moving and learning. Although it may appear that these kids are working out, they are actually trying to adjust their brains chemistry to maximize their ability to learn.

A 2007 middle-school intervention study found that adding PE did not automatically improve academic achievement (grades or standardized test scores). When analyzed, in many instances, PE classes averaged only nineteen minutes of actual moderate-vigorous activity per fifty-five minutes class.⁹ This is a vital point. The benefits of sustained aerobic activity are real; but to achieve them students actually need to be active. PE in schools is of variable quality, frequency and intensity. While it's an obvious way to promote physical activity in children and adolescents we need to be careful that we get what we anticipate and what students need. Quality PE and powerful courses like those developed by organizations like PE4Life (www.pe4life.org), are options that too few students have on a daily basis.

The research is profoundly relevant to today's health and fitness crisis. At the same time the fitness-overweight dilemma is growing, funding for programs like physical education in schools are being reduced or eliminated. Kids are spending an average of 5.5 hours a day in front of a screen of some sort.

Over-scheduled teachers and over-scheduled school days beg the question, "When we will have time to add 15-45 minutes of daily – or even weekly – physical activity? Preparing healthy, active children for life has taken a backseat to preparing the K-12 student for standardized tests.

Educators have been mandated to address both the fitness **and** the test-score issues, but they need help.

Key Concept: In order to add more activity to the "ExerLearning" we can tap into technology that can add exactly the sort of physical activity students need and deliver it simultaneously with core content. ExerLearning tackles fitness and academic goals simultaneously-while saving teachers' time – and Districts' money. ExerLearning engages the very students we target while harnessing computer technology to consistently deliver any time any where rhythmic, aerobic activity.

Physical Education, Daily Activity and Learning

As you are aware, an astonishingly high percent of K-12 American students do not participate in a daily physical education program. That is not the case at Naperville Central High School (NCHS) where PE4Life founder, Phil Lawler, and Paul Zientarsky have re-invented "prepare to learn." As Zientarsky says, "In our department, we create the brain cells. It's up to the other teachers to fill them up." Go ahead, read that again. It's *powerful* stuff. Research meets reality under the heroic leadership of Phil Lawler and Paul Zientarsky in the Naperville, IL school district.

Results and Outcomes:

- Being more focused and energized in class
- Increased confidence and engagement in the learning process
- Test score improvement
- An understanding of the physiology, brain research and kinesiology behind the effects – and that made all the difference!

NCHS LRPE = MIND and BODY CONNECTION

Learning Readiness Physical Education (LRPE) was designed based on research indicating that students who are physically active and fit are more academically alert and experience growth in brain cells or enhancement in brain development; NCHS pairs a PE class that incorporates cardiovascular exercise, core strength training, cross lateral movements and literacy and math strategies with literacy and math classes that utilizes movement to enhance learning and improve achievement.

LRPE students have experienced notable gains in their reading ability and comprehension as well as improvement in math and other courses. Starting their day

with physical workouts seems to be "waking up" their brains. The study incorporated in this project is providing the justification for expanding the program so many more students can experience the improvements and achievements of the original group.

Naperville Central High has embraced the premise of ExerLearning with full support of Reading, Math and PE teachers, District budgets and parents. Such a comprehensive program did not happen overnight and every school may not be ready for such an investment just yet. FootGaming is one way to test the waters, so to speak. It could move your students toward the sort of gains made by the LRPE students in Naperville.

With ExerLearning programs integrated right in classrooms and computer labs, such activity is easy to integrate into the regular school day, not only in structured Physical Education classes. When neurons fire together they "wire together." If we already don't include words like glutamate, serotonin, norepinephrine and dopamine when we talk about learning, hopefully we soon will. ExerLearning students as young as age eight easily banter about, "increasing neurotransmitters," "sending oxygen to your brain," and BDNF as "Miracle Gro" for the brain as reasons they lead their peers in regular sessions of FootGaming and other "exergames." The very students who struggle to read at the second grade level in sixth grade, most readily absorb the ExerLearning philosophy and practice. ExerLearning programs aim to deliver many of those important outcomes for teachers and schools with limited time or budget – right now.

Mandated PE Minutes:

What's a busy teacher to do when presented with the challenge of adding 150-225 minutes of physical activity for students each week? There is no way to add 30+ minutes a day to an already full schedule without removing something else – or is there? The very students who wiggle, demand more technology, seem married to their "screens" and eagerly spend upwards of three hours a day playing video games could provide the solution. Technology is readily available that can deliver physical activity into the same time students spend working on reading and math software in a computer lab. Not only will your students gain valuable "learning time" by moving as they learn – they will gain the mandated activity minutes.

Much research has been done to quantify the physical activity afforded by such an intervention – at little more cost than a high quality mouse. For example, consider this study, "Energy Expenditure of Sedentary Screen Time Compared With Active Screen Time for Children."¹⁰

SUMMARY: The team examined the effect of activity-enhancing screen devices on children's energy expenditure compared with performing the same activities while seated. Their hypothesis was that energy expenditure would be significantly greater when children played activity-promoting video games, compared with sedentary video games. Energy expenditure was measured for 25 children aged 8 to 12 years, 15 of whom were lean, while they were watching television seated, playing a traditional video game seated,

watching television while walking on a treadmill at 1.5 miles per hour, and playing activity-promoting video games.

They found that energy expenditure more than doubles when sedentary screen time is converted to active screen time. Sitting in front of a television, video game, or computer screen has been associated consistently with low levels of physical activity.¹¹ Weekly screen time for children is as high as 55 hours/week,⁵ and the average home in the United States has a television on for 6 hours per day. Although many programs have attempted to separate children from the screen, these activities are highly valued and children are resistant to relinquishing them. An alternative approach is to examine whether sedentary screen time can be converted into active screen time. This is exactly what FootGaming was created to do – and to do right in the home or classroom.

CONCLUSIONS. Energy expenditure more than doubles when sedentary screen time is converted to active screen time. This is a strategy upon which ExerLearning is built.

We help teachers by harnessing technology to the *expertise, skills and power* of grade 3-12 students to manage, deliver and lead the entire program.

What does ExerLearning™ Do?	How does that happen?
ExerLearning opens up a direct channel to the brain/mind-	The mind becomes a sponge: absorption, processing, integration, retention, cognition (i.e. LEARNING) all improve.
ExerLearning gets the brain pumping The brain is muscle that can be developed through physical training	By getting the heart pumping. Just like the heart the brain can be strengthened via physical training.
ExerLearning adds physical movement	Utilizing the mind-body connection
ExerLearning optimizes the learning environment for diverse learners	Harnesses technology to deliver rhythmic physical activity and valuable fitness factors to the learning process
ExerLearning allows neurogenesis: growth of new brain cells	Exercise enables more blood and proteins to enter the brain

Balance – The ExerLearning Bonus Benefit:

Everyone knows the five basic senses; seeing, hearing, taste, smell and touch. But there are other senses that are not as familiar including the sense of **movement (vestibular), and sense of muscle awareness (proprioception)**. Unorganized sensory input creates a traffic jam in our brain making it difficult to pay attention and learn. To be successful learners, our senses must work together in an organized manner. This is known as **sensory integration**.

The foundation for sensory integration is the organization of tactile, **proprioceptive and vestibular input**. A person diagnosed with ADD or ADHD, due to their difficulty paying attention, may in fact have an immature nervous system causing sensory integration dysfunction. This makes it difficult for him/her to filter out nonessential information, background noises or visual distraction and focus on what is essential. There is a direct relationship between sensory integration, learning and attention.

ExerLearning technology tools, like many exergames and the FootPOWR pad, provide the development of the vestibular sense which in turn provides information related to movement and head position. **The vestibular sense is important for development of balance, coordination, eye control, attention, being secure with movement, emotional security and some aspects of language development.** Disorganized processing of vestibular input may be seen when someone has difficulty with attention, coordination, following directions, reading (keeping eyes focused on the page or board) or eye-hand coordination.

Ironically, the cerebellum, an area of the brain most commonly linked to movement turns out to be a virtual switchboard of cognitive activity. The first evidence of a linkage between mind and body originated decades ago with Henrietta Leiner and Alan Leiner, two Stanford University neuroscientists. Their research began what would eventually redraw "the cognitive map"

The Leiners' work centered on the cerebellum, and they made some critical discoveries that spurred years of subsequent research. First, the cerebellum takes up just one-tenth of the brain by volume. But it contains over half of all its neurons. It has some 40 million nerve fibers, 40 times more than even the highly complex optical tract. Those fibers not only feed information from the cortex to the cerebellum, but they feed them back to the cortex. If this was only for motor function, why are the connections so powerfully distributed in both directions to all areas of the brain? In other words, this subsection of the brain -- long known for its role in posture, coordination, balance, and movement -- *may be the ExerLearning hub.*

Students who tip back on two legs of their chairs in class often are stimulating their brain with a rocking, vestibular-activating motion. While it's an unsafe activity, it happens to be good for the brain. We ought to give students activities that let them move safely more often like dance, rhythmic aerobics, or even movement games. Such interventions, ExerLearning at its best, can change the world of learning for such students.

In one field study using dance mat video games with a fourth grade class, an autistic student whose entire left side was affected by cerebral palsy, participated as a program mentor for 10-20 minutes per day using the dance mat changed his balance, coordination, social engagement and enthusiasm for PE. Studies done by neuroscientist

Eric Courchesne of the University of California have shown that autistic children have smaller cerebellums and fewer cerebellar neurons. He says the cerebellum filters and integrates floods of incoming data in sophisticated ways that allow for complex decision making. Once again, the part of the brain known to control movement is involved in learning. Movement and learning have constant interplay. For more, look for Justin's video clip on the Generation FIT website. www.generation-fit.com

Some of the decline in physical activity is due to schools' implementation of strategies designed to improve achievement outcomes. But the theory that spending more time learning academics in the classroom will lead to higher test scores and grades has not been proven. As you understand ExerLearning is it becoming ever more clear that the opposite is true? In other words, allotting too little time to physical activity may undermine the goal of better performance, while adding time for physical activity may support improved academic performance.

Walking on two feet is very difficult. It takes a lot of balance, coordination, synchronization and timing of muscles. It takes a tremendous amount of motor control to be able to do that. It takes constant output from the brain and constant feedback to the brain. When we are in an upright position these receptors constantly fire back to the brain. They stimulate the brain. It appears that as we stood in an upright position or as we became more and more upright, our brain grew larger and larger in response to this constant stimulus of gravity. Our goal in ExerLearning and its various intervention games and tools is to increase the amount of time students spend standing, moving and balancing under the influence of gravity *while they are learning*.

Decreased stimulation from postural muscles to cerebellum and brain, anything that takes us away from standing and being upright, will affect our brain in an adverse way. It will slow down the temporal processing speed of the brain, or parts of the brain, with resulting "clumsiness" and cognitive developmental delays. ExerLearning's foundation is solidly built upon the need to get students out of the desk or chair and working in an upright, standing position. Simply standing is not very inviting to most of us. We add the playful fun of "games" accessed by controllers that require standing, movement and balance – like the FootPOWR pad.

Children who participated in a Generation FIT-ExerLearning peer mentoring program were absent 25% fewer days than the control group.

This is a key measure and critical for decision makers in schools at local and District levels. Absenteeism costs Districts \$9-\$20 per student per day. In a field study done during the 2004-2005 school year at Vern Patrick Elementary (Redmond, OR), fourth graders who used Generation FIT ExerLearning peer mentoring program were absent fewer days, even during flu season, than they had been in the Fall quarter before the program was begun. They were absent 25% fewer days than other fourth graders not participating in increased daily physical activity. This caught the attention of teachers (more time in class meant more time to make an impact on the student) and District budget staff.

Health is not the only reason children miss school. The most challenged and most disengaged students find numerous and creative ways to be absent. We discovered that many students that fit such a profile made the most improvement in both attendance and engagement in the learning process after being trained as Generation FIT ExerLearning peer mentors and leaders. **Ask any teacher the ramifications of these two changes on the lowest performing students.**

With Districts budgets already tight it would pay to create a preliminary estimate of the potential impact of physical inactivity and related health factors on school funding. The *Executive Summary: Healthy Children, Healthy Schools* predicts the loss in large cities could be \$28 million in New York, Chicago could forfeit \$9 million and Los Angeles an estimated \$15 million. So, obviously, we want our children to get and stay active!

In nine states (California, Idaho, Illinois, Kentucky, Mississippi, Missouri, New York, Tennessee and Texas) collectively serving more than one-third of all students in the US, state funding for schools is determined using the Average Daily Attendance (ADA) methodology. In other words, public education dollars in these states are determined not by how many students are enrolled, but by how many actually show up at school. Student absenteeism can therefore have a negative impact on the school's bottom line. Data from The Finance Project, a nonprofit policy research and technical assistance group, demonstrate how absenteeism can be a significant problem for school budgets. These data suggest that a single-day absence by one student costs a school district in these states anywhere between \$9 and \$20.

While these figures seem small, they add up quickly. An estimated 16 percent of youth are overweight to a degree that affects their health. One study found that severely overweight students miss (using the median number) one day per month or nine days per year.¹² This type of absentee rate among overweight students in a student population with average prevalence of overweight could lead to a potential loss of state aid of \$95,000 per year in an average size school district in Texas, and \$160,000 per year in an average California school district.

In the Vern Patrick Elementary study, additional reasons for decreased absenteeism emerged from anecdotal reporting from both students and their parents. Student mentors who managed the day to day operation of the Generation FIT ExerLearning program gained ownership of the technology-delivered game activity. Their foray into ExerLearning included a leadership/peer mentoring piece that changed their attitudes about school attendance and their engagement in the learning process when they were at school. Increased daily attendance by students who were among the most challenged learners were part of the dramatic 25 percent improvement in attendance over the quarter prior to their program participation. Parents reported that students refused to miss school for any reason on the days they were scheduled to use the dance mats and mentor their peer-team.

A Summary- What happens when we exercise?

When humans exercise, the body-brain goes into a homeostatic state, balancing brain chemicals, hormones, electricity, and system functions. When the body-brain is out of balance because of poor nutrition and lack of physical activity, the student is not in a good learning state. Movement, physical activity, and exercise change the learning state into one appropriate for retention and retrieval of memory, the effects lasting as much as 30-60 minutes depending on the student. Studies show that just 10 minutes of rhythmic aerobic activity prior to a cognitive task improves academic success.

Physical activity provides enriched environments

Physical activity in a positive social setting creates an environment conducive for learning.

Being active grows new brain cells

Aerobic activity releases endorphins, the class of neurotransmitters that relax us into a state of cortical alertness. Exercise also tends to raise levels of glucose, serotonin, epinephrine, and dopamine, chemicals that are known to balance behavior.

Aerobic fitness aids cognition

Researchers found that subjects who were the most aerobically fit had the fastest cognitive responses, measured by reaction time, the speed that subjects processed information, memory span, and problem solving.

Exercise triggers BDNF

Exercise triggers the release of BDNF a brain-derived neurotropic factor that enables one neuron to communicate with another. (Kinoshita 1997) Students who sit for longer than twenty minutes experience a decrease in the flow of BDNF. Recess and physical education is one way students can trigger sharper learning skills.

Cross lateral movement organizes brain functions

Crossing the midline integrates brain hemispheres to enable the brain to organize itself. When students perform cross lateral activities, like dance, sport and most play, blood flow is increased in all parts of the brain making it more alert and energized for stronger, more cohesive learning.

Eye tracking exercises and peripheral vision development helps reading

One of the reasons students have trouble with reading is because of the lack of eye fitness. When students watch screens their eyes lock in constant distant vision and the muscles that control eye movement atrophy. In video games that provide screens with ever changing patterns and whole-body response to those screens, as in Red Octane's "In the Groove" dance games, eye tracking and expectation skills, peripheral vision are all improved

Balance improves reading capacity

The vestibular and cerebellum systems (inner ear and motor activity) are the first systems to mature. These two systems work closely with the RAS system (reticular activation

system) that is located at the top of the brain stem and is critical to our attentional system. These systems interact to keep our balance, turn thinking into action, and coordinate moves. Games and activities that stimulate inner ear motion like Red Octane's "*In The Groove*," are useful in laying the foundation for learning.

Exercise reduces stress

Movement can foster self-discipline, improve self-esteem, increase creativity, and enhance emotional expression through social games like FootGaming.

Movement can help reinforce academic skills for all students.

Eighty five percent of school age children are natural kinesthetic learners (Hannaford). Sensory motor learning is innate in humans. Teachers who incorporate kinesthetic teaching strategies reach a greater percentage of the learners. Kinesthetic learners do best while touching and moving. Kinesthetic learners tend to lose concentration if there is little or no external stimulation or movement. To integrate this style into the learning environment educators integrate creative strategies like:

- Using activities that get students up and moving
- Use activities that include music or rhythm
- Give frequent brain breaks that include activity and moving

End Notes

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