

SMARTfit Functional and Brain Training Games

The Science Behind Its Brain-Body Integrated Approach for
Children with Sensory Processing Disorder



SMARTfit
Functional and Brain Fitness Training Games

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University Researchers Rated SMARTfit #1 in User Enjoyment and Energy Expenditure¹

Introduction

Multisensory Fitness Inc. founder Cathi Lamberti first realized the potential benefits of using technology to motivate kids and improve their physical and neurological performance while observing the talents of video game players. Watching one player, she first dismissed the activity as a waste of time and money. She soon became aware, however, that there was something special happening, a remarkable convergence of hand-eye coordination and brain speed combined with the fun and challenge of the striving to improve and attain the best score.

A tennis backboard manufacturer and former teacher, she also realized the limits of what she was seeing. If she could find a way to use similar interactive technology in a real and functional, rather than virtual, play environment with full body physical activity requiring multiple senses to achieve success, participants could see improvements in much more than hand-eye coordination and reaction speed.

Lamberti knew how our multiple senses affect performance in everything we do, from basic everyday functions to high level sports. Our senses give us information about the physical conditions of our body and the environment around us. She understood that sensory integration is the key to appropriate and effective responses to the world around us. Even though at that time obesity was much less an issue than it is today, Lamberti also knew she'd observed something in the technology that could motivate people to exercise, to do so because they wanted to, not because they had to. That her products appeal to all ages and abilities has proven crucial to success. Little did she know, at that time that an essential key to providing effective sensory integration treatment, is finding and providing activities that are motivating and rewarding in order to tap into an individual's intrinsic drive for acquiring needed development or advancing skills.

The technology she had observed, while limited, clearly affected motivation, sensory integration (the organization of senses by the brain for use in moving, learning and behaving) and physical performance (speed, agility, accuracy). She began to envision applications that would improve functional fitness (before it was called that), sports performance, physical education and sensory processing, (including programs for Autism Spectrum Disorders, ADHD/ADD, Dyslexia, Sensory Processing Disorder/SPD and developmental delays).

The result of this epiphany was the original Sportwall, which became one of the most unique, highly rated and bestselling products in a developing new industry that came to be known as exergames.

Nobel Prize winning Hebbian Theory: Neurons that fire together wire together

Today, brain research has evolved substantially. Lamberti's early conclusions about the relationship between physical activity, multisensory stimulation, brain productivity and performance have been confirmed. The concept of neuroplasticity, the brain's ability to change and adapt, even rewire itself, is now accepted science. The first evidence of neuroplasticity was first discovered in 1923, with greater advances and proof that brains are not hard-wired, but instead are geared for creating new pathways, in the 1980's.³

It is now accepted in science that the brain has the plasticity to change and the ability to create new neural pathways (neurogenesis), including research that even in aging, when the neurons decline in the hippocampus, a massive increase in neurons can be stimulated just by short-term experience of an enriched environment.⁴

The concept of rehabilitation for individuals of all ages and disabilities is based on the plasticity of the brain, meaning that when one highway is blocked, another one can often be used or developed through retraining. Developmental treatment in Early Intervention Programs has long been in play and funded in order to assist delayed children to improve through specific activities with therapists and other interventionists.

Science is also discovering that while all physical activity has a positive effect on the brain ("miracle grow for the brain"), exercise that combines the use of multiple senses with full body movement, including impact and resistance-based activities, challenges the brain at higher levels, requiring more complex cognitive function to make decisions and execute skills. The brain adapts, improving physical, sensory and neurological performance. Programs provided by rehab therapists, early interventionists, teachers and trainers require *just the right challenge* and challenges that are appropriately advanced to *encourage appropriate adaptation by the individual to meet the dynamic requirements of the task at hand*. SMARTfit systems provide hundreds of games that are highly adaptable and flexible, which can be used slowly or with increased speed, with louder or softer sounds, with the addition of cognitive skills, and with a wide variety of standard equipment, weighted or non-weighted, in dynamic or static positions.

Interactive technology further enables this process in ways that traditional fitness cannot, simultaneously prompting and providing feedback to participants' physical and cognitive actions, tracking results and setting benchmarks for improvement.

New SMARTfit technology draws on the latest in brain research and exercise and sports science, and then combines this information with cutting edge multisensory interactive technology to create a new generation of brain-body solutions for improving fitness, education, cognitive, sensory, and motor skills. This has wide applications for schools and sports performance from toddlers to seniors and more. This white paper explores the research and science behind SMARTfit as it relates specifically to sensory processing.

Multisensory Fitness Inc.'s new SMARTfit technology for multisensory Brain-Body Fitness Training, replaces Sportwall electronics with a simple yet dynamic upgrade to convert them to the SMARTfit Trainer, SMARTfit ProTrainer and SMARTfit Play Pods.

These interactive electronic systems, now featuring the revolutionary new SMARTfit Technology, offer a unique approach to improving the physical and mental health of all ages and abilities by utilizing the attraction and engagement of computer games in a live, multisensory environment.

Instead of simulating play, SMARTfit systems engage players in a real multisensory kinesthetic experiences including dynamic, integrated, multi-planar athletic movement with tactile contact and resistance using

real sporting, playground, or PE equipment. The result is a powerful combination of cardio fitness, brain fitness, functional fitness, sports-specific training and action-based learning in one system, easily graded for success for any age, encouraging social skills and interaction as well as teamwork. It has been reported that SMARTfit systems are so engaging that the effects on groups creates automatic inclusion, encouragement and teamwork, no matter what skill level the individual demonstrates.

Karen Perry-Kaplan, P.E. Specialist at Wellesly's Schofield Elementary School observed, "Our system adds a whole new dimension with unlimited possibilities for skills and fitness development. It is very easy to operate and its benefits are limited only by the user's creativity. It is well received by elementary students of all ages and levels of skill. Most noticeable was that the less skilled participants got the most encouragement from their team members and showed the most improvement in both skills and attitude. It definitely improved their self-esteem and motivated them to work hard and do their best."

Success with SMARTfit systems is measured by the ability of participants to keep the game in play with actual physical and mental responses rather than emulated movement such as waving a wand, which has been used in many exergaming products that have incorporated limited physical movement with video game play.

The original concept behind the creation of SMARTfit technology was to create fun, short, full-brain-body games that engage cognitive decision making, motor control and reaction skills, include rewarding sounds, and measure results via electronically generated scores. The system allows the therapist, teacher or instructor to appropriately grade the activity, the speed and intensity of the visual or auditory cues, and the specific way to play each game to fit the needs of the individual or group. Diversity and variety can be expanded as far as the creative leader can imagine. Installed in over 2,700 facilities in 32 countries, this approach continues to incentivize repeated play until mastery takes place.

This concept has evolved into a wide range of applications from sports performance training at all levels to highly engaging, brain integrated physical exercise classes suitable for school PE and after-school programs, seniors, and children with special needs. This enormous flexibility is one of the most unique aspects to SMARTfit programming.

Coaches, teachers, and therapists can choose from a wide array of drills/curriculum/lesson plans and can easily expand the experience with further customization using specific clinic, school and fitness equipment.

The recent trend toward inactivity has impacted both the amount children exercise *and* their desire to exercise. To engage them we focus on providing play-based, fun, interactive activities with immediate feedback incorporating the same video game technology they already understand and enjoy. Our products have been labeled "computer games that make you sweat" and "serious fitness for people who love to play" making "practice as exciting as real competition." Specific training has been developed by qualified instructors and occupational and physical therapists in order to provide education and easy-to-use manuals for everyone who uses SMARTfit with individuals and small groups.

Engaging the brain and body in a comprehensive multisensory experience requires a close look at SMARTfit programming. The following sections review its impact on learning, fitness, motor skills, obesity, mood, social interaction, team building, and brain plasticity (aka neuroplasticity) through feedback with existing users.

SMARTfit Conditioning for Mind and Body: How it Works

When it comes to localizing and tracking moving objects, it is likely that the human brain evolved to develop, learn, and operate optimally in multisensory environments. Thus, multisensory training protocols can better approximate natural settings and are more effective for learning.⁵

SMARTfit programs are multisensory training for all ages and ability levels. Visual, auditory, and physical tasks are integrated in performing the motor skills required. These protocols, with their profound and SIMULTANEOUS brain-body stimulation, are the key elements that differentiate a functional training program from a general conditioning program.

The resistance and motor patterns encountered by the use of real sports/playground equipment creates very dynamic neuromuscular control in a functional setting of play, imitating the sensory-motor challenges and requirements of everyday, real life challenges.

SMARTfit programs are specifically designed to stimulate the body and the brain concurrently. This is accomplished by:

- Encouraging team participation and engaging sustained focus with short-attention grabbing computer games that are played sequentially to pursue mastery of skills and score
- Providing full body exercise by stimulating the hands, feet, eyes, and ears with proprioceptive and vestibular components (stimulating true whole sensory motor, brain-body integration) in playing real games with real (not simulated) sporting goods
- Requiring high levels of attention and focus for success (staying consciously “in-the-now”)
- Engaging in cognitive decision-making while moving in space and visually tracking
- Delivering a cardiovascular workout in a game format
- Providing a choice of games that include letters, numbers, shapes and colors

“Functional Training” is used by occupational and physical therapists as a comprehensive form of rehabilitation to return patients to daily living activities and function, from basic movement all the way to competitive sports, using movement in multiple planes while bearing weight. The idea is to assist a person in regaining ability in all functional tasks. In contrast, “Strength Training” might use a weight machine, bands, or free weights and usually focuses on uni-planar, one joint motion to build muscular strength.

SMARTfit’s brand of functional training uses a variety of activities that can focus on the core/torso, agility, speed, balance, flexibility, power, and strength while SIMULTANEOUSLY developing high levels of neuromuscular efficiency. This process of engaging the hands, feet, ears and eyes develops not only eye-hand, but also visual-perceptual motor skills through the added specialized technology that SMARTFIT provides in its products.

Sensory Processing is Critical to Maintaining Healthy Integrated Brain-body Processing

“Play is the work of children. Through play, children learn about themselves and the world around them.”⁶

Sensory integration is the organization of sensation for use. Our senses give us information about the physical conditions of our body and the environment around us. Sensations flow into the brain like streams flowing into a lake. Countless bits of sensory information enter our brain at every moment, not only from our eyes and ears, but also from every place in our bodies. We have a special sense that detects the pull of gravity and the movements of our body in relation to the earth.

The brain must organize all of these sensations if a person is to move and learn and behave normally. The brain locates, sorts and orders sensations – somewhat as a traffic policeman directs moving cars. When sensations flow in a well-organized or integrated manner, the brain can use the sensations to form perceptions, behaviors, and learning. When the flow of sensations is disorganized, life can be like a rush-hour traffic jam.²

Integrating the senses successfully helps a person adequately interpret the world around them and respond appropriately. Responding to tactile, auditory and kinesthetic stimuli, as well as proprioceptive and vestibular input, (i.e. touch, sound, feeling, body sense, position in space), effects every aspect of communication, social skills, understanding of objects and relationships, and communication. This sensory integration directly affects behavior, focus and attention, balance, posture, impulses and motor coordination. One can think of this as organization of the senses. SMARTfit has taken organization of senses into consideration, along with therapies and teaching related to children’s development and sensory skills, and rehabilitation of adults, as well as advanced sports training.

Frequent feedback from participants in SMARTfit Training have referred to how they experienced greater mental clarity for hours and sometimes days after a class. This appeared to occur regardless of age or fitness level.

Teachers in schools where SMARTfit has been used on a regular basis also have reported that students are calmer in the classroom, with one school reporting a rapid decline in disciplinary incidents for four sequential years after introducing SMARTfit programs on a daily basis. These are examples of the profound effect of an integrated activity creating a better response to the environment, producing increased focus, reduced impulsive behavior, calming, and improved ability to handle social challenges. In the area of sports, some athletes have reported that after a few weeks of training, their focus and perception changed to the point that the ball seemed to slow down, leaving them more time for strategy and technique.

Research suggests that about 85% of school age students need to engage their bodies actively in the learning process. Research has also revealed that students who engage in exercise enjoy greater retention of learned material for up to four hours.⁸ The questions are: how do we introduce exercise into the learning process and how do we make it appealing for the participants and also controllable by the instructors and teachers? Many schools have been looking at SMARTfit for answers. By tying in cognitive training with visual-perceptual-motor skills, auditory input and active movement, SMARTfit provides an optimum environment for learning. With the ability to change the level of sound, the speed of lights, the type of equipment used, and even the location, SMARTfit is highly customizable for the individual or group training. This allows the therapist, teacher or instructor to modify and adjust the activity in multiple ways to fit the needs of the individual or group.

Inactivity has resulted in a number of problems in our society, not the least of which is a rise in obesity in the population. Obesity limits the remediation of Sensory Processing Dysfunction and is a contributor to the noted decline in academic performance in our schools. This paper looks at the basic causes of inactivity and explains how SMARTfit programming can provide activities to help in the treatment process, through group exercise programs in both mainstream and clinical environments.

Stimulation – A Key Requirement for Enhancing Neurological Development

Movement is essential to maintaining physical and emotional health. Unfortunately, the past two decades have witnessed a drastic reduction in physical movement in industrialized countries, especially in the early

years. One cause at the earliest ages is the use of stiff safety car seats which restrict movement. While they have done much to protect infants/toddlers in moving vehicles, they now convert to home carriers. The home carriers then slip into high chairs, which is a convenience for parents, but restrict a child's movement for longer periods.

In addition, years ago, positioning babies was changed from lying on tummies for sleep (prone), to lying on their backs (supine) due to new evidence of the fear of Sudden Infant Death Syndrome (SIDS). Due to this change many babies to this day get little to no time on their tummies, which decreases the developmental time required in that position for proprioception on the arms, lifting the head, rolling from this position, and pushing up to crawl. Studies have shown that although there is evidence of marked decrease in SIDS, the positioning has caused an increase in serious developmental delays from head control to rolling, sitting up, gross motor skills, as well as torticollis (from leaving the head turned to the side while sleeping on the back) and difficulty with fine motor skills and hand to mouth activities also due to shoulder positioning.

All of this has contributed to the normal maturity of effective skills in many areas of life. When the basics are not achieved, developmental problems show up in all areas. Not are only the gross motor skills limited, but so are the perception of the environment and receiving through the senses, including tracking the environment with the eyes, ears, and limbs with sound, visual cues, movement of the head and the body in all directions in space, and pressure on the skin and joints.²¹

From Rigid Baby Carriers to Excessive Television

We have come to discover that movement is essential to promoting neurological development. The over-use of baby carriers and static "babysitters," which restrict natural developmental movements such as months of rolling, head lifting, kicking and crawling, and the lack of time on the floor lying prone on their tummies has resulted in a population that increasingly lacks the necessary neurological stimulation that enhances, develops the brain normally and creates new pathways through healthy neuroplasticity. Thus, stimulation enhancing many aspects of development that provide adequate and advanced sensory integration, social skills and coping mechanisms have been reduced by inactivity.

What most parents don't realize is that hours a day in these baby carriers and sedentary activities like extended periods of time propped in front of television prevent some spinal, neurological, and muscular development which babies and toddlers depend on to learn to lift their own heads and manipulate the curvature of the spine in a wide variety of postures, as well as essential sensory stimulation and development. A child subjected to the discomfort of the floor and given time on the tummy, will attempt to lift his/her head and roll in order to respond to stimuli. Stimulation with play, colors, moving toys, sounds, including pressure on limbs, spatial exploration i.e. sensory input, engages the child to participate in essential developmental skills. These are all critical to jump-start the creation of neurons needed for effective physical movement.

Though science has barely begun to examine the link between this early suppression of movement and the growing numbers of children being diagnosed or untreated with Sensory Processing Disorders, it makes sense that if a child is sitting comfortably in a chair for hours where there is no incentive to move, this must have an impact on the development of the neurological system. In turn, with the research in brain plasticity, the research has identified that new pathways can be built to improve deficits and expand to greater abilities, through stimulation.

There are many other reasons for depressed sensory integration and development that include low birth weight, environmental effects of everything from pregnant mother's ingestion of drugs, alcohol, exposure to environment, including pesticides and chemicals. The embryonic development is so complex that there

are many places that proper growth or proper chemical reactions can be obstructed and cause injury. There is a broad increase of low birth weight babies born from as small as 1 pound that would not previously have lived, if not for the advances in medicine. It is documented that with the low birth weight babies, developmental and serious physical problems may arise. Therapists have been successful in treating children by increasing stimulation in all sensory-motor areas to improve and promote successful development. SMARTfit has put together technology that integrates the sensory input and gradation of treatments that can be specific to the child, and enhances treatment protocol by OT's, PT's and ST's, and instruction by teachers and fitness trainers.

Some of the more common and easily recognized problems include:

- o Trouble catching balls and other objects thrown through the air
- o Misjudgment of physical distances
- o Clumsiness
- o Increased likelihood of accidents
- o Poor posture and reduced postural stability
- o Delayed speech
- o Vision problems
- o Reading and writing difficulties
- o Behavioral problems, pushing, shoving
- o Withdrawal from social interactions and sports

How Sensory Processing Effects Perceived Behavior: Regulation Disorders

If only there were further understanding of the neurological processes and the sensory differences we each have, it would be a more effective and understanding world, in which children would be given an environment to maximize talents and improve lags, including our social skills and interactions. RDSP (Regulation Disorders of Sensory Processing) manifest in a variety of ways, from a temper tantrum to a very loud child, to a highly sensitive child. If a combination of problems in many sensory areas persist, then sleeping, eating and overall behavioral problems can be the result. In turn, inappropriate behavior caused by inefficient sensory-motor development can contribute to traditional punishment, scolding and other methods that may contribute even more to low-self-esteem and acting out.

Implementing a program that provides more appropriate and integrating visual-sensory-motor components will create more balanced, alert and focused children in the classroom. Providing the input and education that is needed will also help both the teachers and the parents.

Imagine what it is like to not feel your body aligned in space, to feel that touch actually hurts, resulting in avoiding contact and activities, having difficulty sorting the sounds of the environment, missing the teacher's instructions, being overwhelmed by sights and sounds, and having difficulty organizing information and/or keeping one's balance. Hidden sensory deficits are more common than meets the eye. When this interferes with function it is helpful to have tools like SMARTfit systems that are easily set for each individual and group to facilitate sensory-motor development and enhancement. What a gift to children to understand more of their so-called behavior problems and to support them in effective growth and development, resulting in more confidence and self-esteem, and better social skills and interactions.

Sensory Processing Dysfunction Now Identified in Growing Numbers

Sensory Processing Disorders (SPD), which affect children entering public schools from kindergarten, are conservatively estimated at 5.3% and may be as high as 13.7%.⁹ In addition, the prevalence of Sensory Over-responsivity (SOR) in elementary school age children is estimated at 16% according to one study.¹⁰

Clearly SPD and SOR are becoming mainstream issues. Less noticeable are the children with Sensory Under-responsivity, who need more stimulation to become engaged and/or need encouragement, or are so overwhelmed in trying to cope with integrating incoming stimuli that they withdraw.

If multifaceted appropriate stimulation does not occur, normal development is stymied and appropriate adaptive responses are not achieved. As a result, mental, physical and emotional development, as well as behavior, are impacted negatively and more profound issues in neuromuscular and visual-perceptual-motor development become more likely.

There is a growing consensus that far too many children are being diagnosed and treated for ADD, ADHD, and dyslexia. Many of these children are likely demonstrating the symptoms of an under-developed or under-stimulated neurological system.¹¹ Dr. Gary Polan, is a specialist in developmental optometry who has successfully treated many patients diagnosed in this group of disorders without using drugs, using instead the SMARTFIT system with notable success.

Early Inactivity Tied to Low Academic Performance

Researchers such as Dr. Alweena Zairi, who studies the causes of under-performance in children, believe the practices described above affect pre-school neurological development and the academic potential of children by the time they start school.¹² As a result, teachers are finding they have to deal with a growing number of children suffering from numerous conditions born out of a childhood of inactivity.

SMARTFIT has been designed to help with these issues by providing equipment based on engaging activities and games geared for children raised on technology and located in a safe space for group exercise. Since 2003, professional treatment centers have been using SMARTfit systems to treat a range of neurological disorders. Some are mentioned later in this document.

Proprioception: A Key to Healthy Brain-body Integration

Proprioception is the inner sense of body awareness allowing a person to know where the parts of the body are in space without having to look. Unlike the six exteroceptive senses (sight, taste, smell, touch, hearing, and balance) by which one perceives the outside world, proprioception is a distinct sensory modality that provides internal feedback on the status of the body. It is the sense that indicates whether the body is moving with required effort, as well as where the various parts of the body are located in relation to each other.¹³

This is the sense that allows people to run up a flight of stairs without looking at their feet. Without this sense people would not even be able to walk on a flat surface without watching where they put their feet. SMARTfit Programming excels in its ability to sharpen proprioception as all of its training components bring together a demand on the player to perform at a higher pace driven by intention and supported by the body's multisensory response to that demand.

Proprioceptive Dysfunction

Proprioceptive Dysfunction is when the proprioceptors are not receiving or interpreting input correctly. It manifests itself as clumsiness, lack of coordination, and difficulty performing common daily tasks and activities, which results in the following clinical signs of proprioceptive dysfunction:

- difficulty with motor planning
- difficulty with execution of planned movements

- difficulty with grading movement
- difficulty with postural stability¹⁵

The Vestibular System

The peripheral vestibular sense is derived from the inner ear, giving us the perception of where our entire body is in space including its response to gravity. Whereas the proprioceptors are located in the joints, giving a sense of where limbs are in space, such as identifying whether one's arm is up, down or out from the body, the vestibular system gives a reference point to integrate the other senses in relation to it. The central vestibular system ties in even more closely with the entire integration of the sensory system in the reticular activating system (RAS) in the brain. This area involves what is called the vestibular nuclear complex and the cerebellum. "Pathology of the central vestibular structures affects integration and processing of sensory input from the vestibular, visual, and somatosensory system," according to research by Jean Ayres, who found it difficult to separate the proprioceptive sense from the vestibular, as they are so closely influence each other.²

This is where we may also see clumsiness, fear of being off the ground (gravitational insecurity and postural instability) and an oversensitivity or under sensitivity to movement, as well as problems with bilateral integration.

Sensory-Motor Dysfunction, Self-Esteem and Behavior in Children

Deficits in sensory-motor processing and modulation, and the associated struggles and challenges faced by those who suffer from them every day, play havoc with self-esteem. Many respond by seeking any type of attention, which is often predominantly negative, while others become shy and afraid to try anything new.¹⁵

Although a child's need for attention may result in difficult negative behavior, this is likely a cry for help. Inefficient mastery over sensory motor skills can create a lack of ability to regulate responses, and thus manifest as inappropriate behavioral issues. Due to others' reactions and the individual's awareness of them, self-esteem and self-confidence can be decimated, creating further damage. Acting out, especially in younger children, can be merely a response to over stimulation or frustration in dealing with the environment through the senses, or poor motor skills and a neurological system that is inadequate to handle normal daily experiences and challenges. Equally problematic are the children who withdraw, shutting down to sensory requirements and ceasing to participate in their world. Considering the likelihood of being teased or bullied for being different, and/or reprimanded by a teacher or parent, behavioral problems typically multiply over time.

"Feeling physically disconnected has a profound effect on a child's ability to develop emotionally and socially. Children who do not feel gravity do not feel safe and grounded and are not able to form normal emotional relationships even with their families."²

Clearly, the downward spiral driven by low self-esteem must be reversed by experiencing success from real performance starting with "baby steps" and moving to ever-increasing skill. SMARTfit systems provide the needed multisensory input that helps to integrate the brain and promote further development and integration. SMARTfit adds effective programming to therapists' sensory treatment methods for overcoming deficits and promoting healthy well-being.

SMARTfit's Brain-body Integrated Training Stimulates the Re-wiring Process

According to neurologist Dr. Carla Hannaford:

Research indicates that when both eyes, both ears, and both feet are being equally used, the corpus callosum (responsible for whole brain processing) orchestrating these processes between the right and left hemisphere becomes more fully developed – cognitive function is heightened and ease of learning increases.¹⁷

SMARTfit training provides this level of stimulation and enables individuals to merge the mental and the physical while continually pushing them to higher levels of accomplishment, which in turn promotes demands on the neurological system to rewire itself more efficiently. Regular use will literally improve the level at which the mind and body function competently together.

How?

In a Q & A session on Facebook, movement specialist Dr. M.A. Greenstein wrote that exercise is “important for generating blood and oxygen flow. This results in neurotransmitter release that has been shown to boost strength of synaptic bonding, stimulating glial cell activity for information flow.”¹⁸

The faster the mind works, the more time seems to slow down, leaving the individual with increased ability to apply conscious decision making as opposed to constant thoughtless reaction to stimuli. That is what athletes refer to as being “in the zone” or what sports psychologists call “the flow.”

SMARTfit programs accomplish this by encouraging development of right and left brain intelligence, cognitive decision-making and response to visual and auditory cues, along with balance and active motion. The programs coax the player to perform movements that connect the two hemispheres of the brain through the corpus callosum, the super highway of connective motor and sensory axons. The games in SMARTfit programs can be graded for sound, speed, and ability, allowing for a people with a wide diversity of physical capability to use programs to improve everything from motor planning, strength training, and range of motion to bilateral integration, balance, visual and auditory tracking, sorting, tactile, proprioceptive and vestibular stimulation, and cognitive training. Other therapy programs and activities can be tied into the use of SMARTfit products to provide all aspects of sensory training and motor development.

Dr. Greenstein writes, “There is an important correlation between the use of spatial intelligence and long term memory. Movement and cardiovascular exercise can help to grow the area of our brain that creates new memories: the hippocampus.”¹⁸ She notes the work of Harvard psychiatrist John Ratey, who says that 20-30 minutes of cardiovascular exercise enables more “fruitful synaptic bonding.”⁸

Movement is essential to the development of all four lobes of the brain. As activity in all lobes of both hemispheres increases with movement, more dendritic connections form, myelination increases, and those dendritic connections extend across the corpus callosum.

The better the connection between hemispheres, the more intelligently we are able to function. Maximum proficiency at critical thought, or skilled movement, requires peak activity of both hemispheres. SMARTfit activity is effective in promoting this type of whole brain thinking.

Treating Childhood Motor Delays, Autism, ADHD/ADD, LD, and Obesity

Fitness for Health (FFH) is a state-of-the-art fitness facility in Rockville, Maryland, specializing in programs for children with coordination and motor delays, ADHD/ADD, LD, weight management, and self-esteem issues. “Parents can't drag their kids away from video games,” says founder Marc Sickel. He continues:

I thought there had to be a way to tap into that obsession—especially if it could help children with special needs. We have devised creative ways to utilize the SMARTfit to meet the needs of our population which include the goals of increasing motor planning and processing, multi-planar movement, improving academics, increasing tracking abilities, and cardiovascular endurance.

Here are some examples of how FFH programming is applied to the SMARTfit ProTrainer:

For sport specific activity to improve processing, motor planning, and athletic skills, FFH places letters of the alphabet above or below each light, incorporating word games. Players use ball throwing, kicking, or even tennis groundstrokes for accuracy while spelling. This improves tracking and processing for an athlete and adds an academic component for children.

Multi-plane skills are often trained on the ProTrainer game level 4-2. Here, children raise their arms to “knock the lights out” as they move right to left with sliding steps across the panels, then left to right to return. The next level of complexity adds the feet to “knock the lights out” which are located below waist level.

After that, children are asked to use the right hand to hit a light to the left and vice versa. Then the feet are similarly asked to cross the midline. Simultaneous centralizing movement can be added by having the participant use both hands to hit a light. All sports require upper and lower extremity movements in single and multiple planes. ProTrainer’s forte is adding difficulty that the player actually enjoys with sounds for scoring.

The “Tic-Tac-Toe” game allows for increased cardiovascular endurance. At the same time, it forces the child to make fast decisions pushing their processing abilities. For more intensity, FFH uses game 4-1 for 30 seconds with a weighted ball to ramp up cardiovascular endurance and motor planning.

A medicine ball is placed 20 feet away from the center of the left wall panel, and a spot is marked 20 feet away from the center of the right wall panel. The player runs up hits lights out, runs to the ball, picks it up and carries it to the other spot, puts it down, runs up and hits another light, and continues the pattern until the time runs out – usually 30 second intervals. That is pretty strenuous!

FFH uses a fascinating exercise to improve cognition, including memory, recall, focus, sequencing, as well as, visual spatial awareness. Laminated cards of photos of the SMARTFIT with different light patterns are used. The child views the card for 3-30 seconds (depending on their level). Then using game 4-1, the child must recreate that pattern from memory during the game.

This is only one example of the system’s versatility, in software engineering terms an attribute of “open architecture” which, allows educators to innovate.

SMARTfit programming certainly helps develop fundamental sports skills, visual spatial awareness, tracking, motor planning, processing, cardiovascular endurance, and more. Still, we feel the system’s capabilities have yet to be fully explored.¹⁹

SMARTfit Training Stations in Developmental Optometry

Eighty percent (80%) of an individual’s information is obtained through vision. Nearly everyone is born with the potential for good eyesight¹¹. Most do not realize that, like any muscular skill, all visual skills are learned. We have learned to see, just like we learn all other skills. Astonishingly, “even the most elite athlete can learn to see better,” says Dr. Gary Polan.

Polan, a pioneer in the field of Developmental Optometry, is based in Pacific Palisades, CA. He has been using the SMARTfit Training Stations in his office since 2004. SMARTfit easily facilitates improvement in

visual-spatial skills, including visual memory, visual form recognition, discrimination and constancy, and figure-ground, while also enhancing and correcting laterality and directionality issues. He states:

I have used the Training Stations as an integrative tool as a part of my visual/perceptual vision therapy (VT). Younger patients with deficiencies in laterality, directionality, gross motor, visual-motor organization, and visual-motor integration are targeted for training on our SMARTfit Trainers. Patients with these diagnoses often exhibit isolated symptoms including poor handwriting, letter and number reversals (often referred to as dyslexia), and poor eye-hand coordination.

Patients with visual tracking problems (pursuits and saccades) can also benefit. Typically, two 120-second consecutive runs are performed. Patients are urged to improve upon their first score.

Most of the procedures are done with hand hitting rather than ball hitting as this allows for a quicker integrative response to achieve desired therapeutic goals. The system can be used to encourage use of right or left exclusively, or activities crossing the midline, depending on the child's specific visual and neurological difficulties

More difficult levels are used as patients improve. "Find the Tune" is a good exercise for multi-sensory integration training, namely visual-auditory processing. All serious vision therapists would benefit from Training Stations in their office. Training Stations has become a useful and fun tool for patients with specific visual perceptual deficiencies. In fact, patients often ask if Training Stations is going to be part of their vision therapy session for the day.¹¹

The largest provider of specialized residential education and care for young people with Autism and Asperger Syndrome in the UK has invested in SMARTFIT in each of their facilities.

Cambian PE Programs coordinator Clare Stockley states:

We chose SMARTfit because it's versatile, straightforward, and a great way of delivering PE through ICT (Information and Communication Technologies). We use the SMARTfit from ages 9-19 and they all love it as it's just as much a fun game as a good workout.

As our students have Autism Spectrum Disorders (ASD) they're not always willing to join in with team games, but the SMARTfit is the ideal medium for them to compete against each other without direct interaction. They can play easily by themselves, but also in small groups without feeling stressed. It engages the students and allows them to think about what they're doing. They develop body awareness and problem solving skills when deciding how to reach each light in sequence at different heights.

The students particularly enjoy throwing things at the lights, which again is great for coordination and developing reaction times. It provides a sensory dimension to the lesson and students can be creative with it. One student likes to play it in the dark so that the lights are even brighter. SMARTfit is ideal for children with ASD's as it enables them to learn by direct experience. The instructional cues are visual, decreasing the human element, which also helps the students to learn.²⁰

Summarizing SMARTfit

While it may be argued that many of the components discussed in this document may be fulfilled with other programs, SMARTFIT excels in the following areas:

The programming is extremely diverse. It can be tailored to work effectively with any age and skill level.

The programming engages many visual-sensory-perceptual-motor skills, imitating real life challenges that require the effective integration of all of these skills for optimum functioning.

The programming does not discriminate with regard to skill level as it meets players at their own abilities. Each player will find it easy to prepare the system for his or her level.

Third, and most importantly, these are programs which have mainstream appeal. They break through the social barriers and gender stigma found in regular sports. They even engage the traditionally inactive. Instead of being highly competitive, the games encourage inclusion and individual success.

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Evidence in this document has been gathered from scientific research, interviews with medical and science professionals, as well as experienced observations by seasoned trainers who have worked with the SMARTFIT products and programs in their facilities during the past seven years.

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