



**Sportwall Target Walls:
The Science Supporting Its
Programming For
Combating Childhood Obesity**

Exercise Technology Incorporated

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Table of Contents

Sportwall: The Science Supporting Its Programming for Combating Childhood Obesity

Introduction	3
Sportwall Conditioning for Mind and Body--How it Works	4
Combating Youth Inactivity, Obesity & Morbidity.....	5
Energy Cost of Exergaming: A Comparison of the Energy Cost of 6 Forms of Exergaming	5
Sportwall Programming Promotes Social Integration	8
Sportwall Training on Mood: A Natural Alternative to Anti-depressants.....	9
Sportwall’s Balanced Programming: The Key to Performance & Adherence	11
Summarizing Sportwall’s Value.....	12
References	13



Sportwall: The Science Supporting its Programming for Combating Childhood Obesity

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

Introduction

When the words “exercise” and “gaming” were combined to yield “exergaming”, the term was used to describe video games that are also a form of exercise.² Beyond repetitive finger movement, these interactive video or electronic games PROMISE whole body player movement, similar to that of “real-life” exercise participation. Not all exergames products are equal and whether they can increase energy expenditure enough to be considered a viable adjunct to more traditional exercise is the question. This paper documents how Sportwall products deliver on that promise.

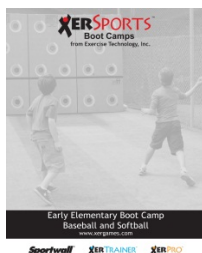
Sportwall’s XerPro and XerTrainer are recognized as two of the original, most enduring concepts in the category of exergame fitness training, but they differ significantly from modified video games that promote physical activity. Instead of simulating play, they engage players in a real kinesthetic experience with dynamic, integrated, multi-planar athletic movement using actual sporting goods. The result is a powerful combination of both functional training AND sports specificity training in one multi-sensory system (see the next section for details).



Instead of simulating play, they engage players in a real kinesthetic experience with dynamic, integrated, multi-planar athletic movement using actual sporting goods.

Success is measured by the ability of participants to keep the game in play as a result of real athleticism rather than emulated movement called for in other exergames. The original concept behind the creation of Sportwall was to create fun, short, fast

moving full-body games that engage maximum intensity and focus with results measured via electronically generated scores and rewarding sounds. Today, this approach continues to incentivize repeated play until mastery takes place.



This concept has evolved into a wide range of applications from training high performance athletes to providing highly engaging, brain integrated, physical exercise for children with special needs. This enormous flexibility is one of the most unique aspects to Sportwall programming. Instructors are free to choose from a wide array of curriculum/lesson plans for every sport and sector of the community. See our web site for curriculum options: <http://www.xergames.com/programs/manuals> <http://www.xergames.com/customersupport/bootcamps.html>.

Sedentary lifestyles have impacted the amount that children exercise AND their desire to exercise. To engage them our systems offer fun, interactive activities with immediate feedback incorporating computer game technology they already enjoy. Our reputation as the company that offers “computer games that make you sweat” and “serious fitness for people who love to play” is well deserved.

Engaging both sides of the brain requires keen art and science. Exploring this requires a close look at Sportwall programming. The following sections describe its impact on learning, fitness, motor skills, mood, and brain activity of its players.

Sportwall 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.³ Thus, multisensory training protocols can better approximate natural settings and are more effective for learning.³

Sportwall programs are fitness training products 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 element that differentiates a functional training program from a general conditioning program.

This unique form of exergaming stimulates greater input to the proprioceptors of the motor system, and with it, greater subsequent refinement of movement patterns. The resistance and motor patterns encountered by the use of real sports equipment creates more dynamic neuromuscular control in a functional setting of play.

Sportwall 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, ears, and vestibular system (stimulating the proprioceptive input to the motor and vestibular systems) in playing real games with real sporting goods (not simulated)
- Requiring high levels of attention and focus for success (staying consciously “in-the-now”)
- Engaging in cognitive decision making under pressure
- Delivering a cardiovascular workout in a game format



“Functional Training” is used by physical therapists as a comprehensive form of rehabilitation to return patients to daily living activities, as well as competitive sports by using movement in multiple planes

Sportwall’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.

while weight bearing. In contrast, “Strength Training” might use a weight machine, bands, or free weights and usually focuses on a uni-planar, one joint motion to build muscular strength.

Sportwall’s brand of functional training (also during weight bearing) 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 just eye/hand, but visual-perceptual motor skills.

As seen in the next section, the added element of integration of the right and left brain hemispheres has been documented to enhance brain plasticity as well as whole brain thinking, cognition, attention, and focus for learning. In short, Sportwall has been proven to help in the classroom too.

Combating Youth Inactivity, Obesity, & Morbidity



Now called the “childhood obesity epidemic,”⁴ the prevalence of overweight children and adolescents has increased dramatically over the past several decades. With it comes previously unheard of incidences of chronic diseases like obesity, diabetes, and heart disease. As children become heavier worldwide, greater numbers are at risk of having Coronary Heart Disease (CHD) as adults.⁵ The culprits in this assault on our health are not hard to imagine.

Screen time, including watching television, surfing the internet and video gaming, have been associated with promoting the inactivity which has led to this rapid increase in obesity. How much screen time? Children ages 8-18 spend over an hour playing video games, 1.5 hours on a computer, 4.5 hours watching TV, and 7.5 hours on entertainment media...PER DAY!⁶

Though video gaming has received part of the blame for the rapid increase in the prevalence of overweight children and adolescents, there has recently been a rise in interest in active electronic games that require physical movement as a way to engage children in activity.

Why not engage them in real sports? The answer is that sports are not universally engaging to children.

Dr. Bruce Bailey, Assistant Professor of Exercise Science at Brigham Young University says, "Previously we've focused on sports as a way to get children physically active," but not all of them are interested in organized sports. He adds, "Schools are trying to make their P.E. classes more inclusive to children of different sizes and interests, and I think this is one way of doing that."¹

Experts agree that finding activities that most, if not all, children will embrace is a challenge. Enjoyment appears to be the key element in promoting adherence to strenuous physical activity for them and deserves detailed study. Enjoyment is important to understand because children tend to participate in physical activity that they enjoy.⁷ So, if exergames are a potent way to engage youth interest, how do the major exergame products compare to each other in terms of their level of engagement and physical exercise?

Energy Cost of Exergaming: A Comparison of the Energy Cost of 6 Forms of Exergaming¹

For the first time, we have some significant scientific research comparing the effects of exergaming on children. The details are worth noting as the perceptions of the children, as well as their physiological response to the exercise, are described.

In a study published in March of 2011¹ at the University of Massachusetts, Boston, 39 boys and girls averaging 11.5 years of age were examined via indirect calorimetry for energy cost and surveyed for

enjoyment/perceived exertion while playing 6 exergame systems and treadmill walking (3 mph). Three of the games were commercial products: Sportwall (Ventura, (space)CA), Bug Invasions (Lightspace Corp.), Goalie Wars--Cybex Trazer (Medway). An additional three were consumer products: Dance Dance Revolution (Konami Corp.), Boxing--Wii (Nintendo of America Inc.), and Jackie Chan Alley Run--Xavix (SSD Company Ltd.).

Each of these systems includes multiple games and multiple levels of difficulty within games. Some levels are too easy both physically and mentally, and others too frustrating.¹ Pilot research revealed which levels for each game would likely be the most aerobically challenging (via ratings of perceived exertion or RPE), while still maintaining the fun gaming experience. Before testing the study group, each child was supervised while getting familiar with each game for 10-15 minutes, twice a week, for a 2-week period.



The Sportwall was unique in that participants were divided into 4 or 5 per team to compete in relay type sprints (intervals) of 15 feet to the wall to score points. Each game was played in 4-minute blocks with 30 seconds rest between games.

During 5 minutes of rest between each activity, children were asked, "How much did you enjoy this activity?" The 10-point discrete analog scale ranged from "not at all" to "very much." This type of analog scale has been successful in measuring physical activity enjoyment in children.^{7,8}

Appropriately, more than half of the children were classified as overweight or at risk for becoming overweight. Critical to our health mission as a society is finding answers for our most at-risk children. These answers should also address differences in the appeal of physical activity to boys and girls. To be successful, we

will need to capture both genders equally, ideally during the same activity. The University of Massachusetts study also speaks to these needs.

Exercise Results

In all exergames studied, every child expended significantly more energy than at rest AND significantly more energy than 3 mph treadmill walking during Trazer, LightSpace, Xavix, and Sportwall.

Energy expended by Wii Boxing/DDR was similar to 3 mph walking, but the other games were significantly more aerobic, with Xavix and Sportwall highest. Since 3mph is considered brisk walking for children as well as adults, this is a significant endorsement of the cardiovascular benefits of these particular exergames.

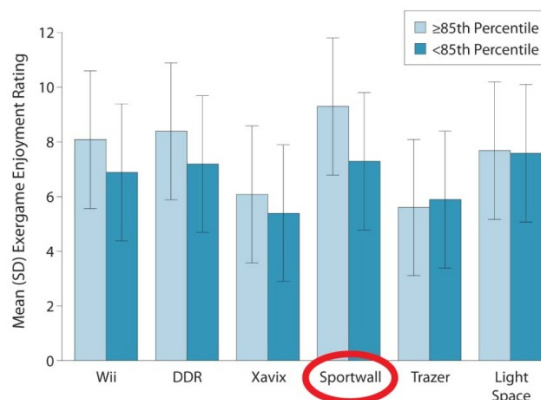
This level of exertion was termed "moderate to vigorous," consistent with US Dept of Health and Human Services recommendations for children.⁹ Remember that these experts chose each game and level to maximize the exertion while maintaining player engagement to better study any therapeutic effect.

The question of whether children, or the games themselves, will push the cardio challenge deserves further study. Clearly, gaming environment, game choice, and game level can greatly influence energy expended. This is likely where parent, teacher, and coach guidance come in for most exergames. Despite the caveats, these

Sportwall invisibly pushes levels in player strategy, focus, power, precision, balance, and footwork. This is exactly what all sports demand.

exergames showed impressive potential for augmenting cardiovascular exercise needs. [Non-research side note: It is our experience that Sportwall is unique in that it intrinsically pushes players to higher levels of exertion, without outside influence.]

Enjoyment Results



Self-reported enjoyment was very high for all the activities in the Massachusetts study, with Sportwall at the top. Dance Dance Revolution (DDR) was rated second, followed by LightSpace, Wii, Cybex Trazer, and Xavix.

Generally, boys enjoyed the exergames more than girls, but there were other noteworthy gender differences found. Not surprisingly, Boys liked Wii Boxing and the Xavix Jackie Chan game a bit more and Girls liked Dance Dance Revolution a bit more.

1) Both genders similarly enjoyed LightSpace, CybexTrazer, Walking, and Sportwall regardless of classification of weight. As noted, appeal to both boys and girls will likely be one important consideration for exergame purchase.

2) Significantly, children classified as above norms for weight - the group less likely to participate in regular sports -- enjoyed the exergames more than the other children.

Self-reported enjoyment was very high for all the activities in this study with Sportwall at the top.

Adolescents and teenagers of NORMAL weight struggle with self-esteem, identity, and fitting in with peers. At this age, the risk is high that they will develop sedentary routines with extreme amounts of screen time that could last for the rest of their lives. For those overweight in this age group, discrimination on the play yard likely multiplies this risk exponentially.

For an exergame to win the battle that THESE young people face, it will have to do more than raise heart rates. It must show those in the above-weight norms that they can succeed physically alongside their more fit cohorts. That this group enjoyed exergames likely reflects surprise, relief, and encouragement all at the same time.

Sportwall Rated Highest for Enjoyment

3) Interestingly, **children in these above-weight norm groups also preferred Sportwall more than the other children.** Among the exergames examined, only Sportwall features short bursts of high intensity and forms teams. This preference for Sportwall held up despite measurements of greater exertion than during the other games for this group. Remarkably, **Sportwall represented more exercise AND more enjoyment for them.**

These researchers believe that exergaming appears to be a potentially innovative strategy that can be used to reduce sedentary time, increase adherence to exercise programs, and promote enjoyment of physical activity.¹ This may be especially important for at-risk populations, specifically children who carry excess body weight.



Sportwall Programming Promotes Social Integration



It is likely that Sportwall provides both genders and overweight children a chance to contribute more subtle physical and mental attributes such as alertness, intelligence, precision, coordination, quickness, empathy, and even leadership to their team. A sense of belonging mixed with accomplishment is undoubtedly a potent concoction at this age when future activity patterns are being created. This would explain a preference for Sportwall as it appears to provide these children a unique stage to perform.

Sportwall programs develop social skills and interpersonal cooperation through social interaction in a spirit of fun. Opportunities to work together as a team create an environment where participants develop and enhance concepts such as inclusiveness, cooperation, and mutual support. In this respect, Sportwall programming certainly distinguishes itself among its competition in terms of socialization.

Learning how to be part of a team as a valued member raises confidence and a sense of self-esteem. Instead of only one winner, with Sportwall training there is a new winner every few minutes, so players have numerous opportunities to improve their scores, and experience the feeling of success.

Perhaps more importantly, the Sportwall system provides an easy way to recover and rededicate in the face of a loss, a task often more difficult on the playground. For children and adolescents who experience this type of discrimination, Sportwall programming may very well feel miraculous.

Opening the Doors to Participation in Sports

“Many schools, gyms, community centers, and hospitals include (Sportwall’s) digital target games that challenge players on speed and motor skills as they throw a ball allowing for sports simulation games that allow users to feel like they’re playing games such as soccer, tennis or baseball.”
Jeannine Stein, Los Angeles Times, March 13, 2011.¹⁰

Sportwall is a perfect match for any participant. It is an opponent that never misses and always plays the ball back at the speed and direction established by the player. Changes in feedback and response are instant. Since most systems are installed in a fairly confined space, required skills to maintain play develop rapidly. The temptation to drive up scores and continue play is irresistible. It invisibly pushes levels in player strategy, focus, power, precision, balance, and footwork. This is exactly what all sports demand.



Beyond enhancing natural skills, the system promotes an intrinsic human need, dare we say even “a love for movement.” Body and brain find a concert of new confidence, which in turn fosters a strong desire to pursue life-long physical activity, a desire that may not have happened otherwise.

On the playground, self-esteem frequently hangs on a child’s ability to throw and catch a ball. Yes, it is a primitive measure of social acceptance among children who MIGHT be picked for a team. We continually observe children previously marginalized to the sidelines being integrated back into playground activity just weeks after Sportwall practice because the system provides a more protected, unintimidating environment at their school. For this purpose, the versatility of the system is essential.

“The number of games and activities that might be used is endless,” states Health and Physical Education Supervisor Eileen Dibattista of Medford High School. “The wall is designed to stimulate the body and the brain simultaneously.” The set-up allows for individual activities or team activities when students might compete to attain the highest scores and both traditional game skills and total body conditioning can be accomplished.

“With childhood obesity being the epidemic that it is, I think it is great that this is available for our kids,” said Medford High School Committee member George Scarpelli, also a coach. As for the specific physical benefits of the XerPro, Dibattista said, “The functional training program of the Sportwall XerPro provides a mind and body connection.” In her words, “This is unlike a traditional conditioning program, which focuses on isolated muscle groups.”

Sportwall Training on Mood: A Natural Alternative to Anti-depressants

Sportwall’s XerGames training is often presented in play format that appeals to those who traditionally do not want to exercise or play sports. This makes it a critical tool to reach the enormous numbers impacted by sedentary technologies.

According to the Harvard School of Public Health, inadequate physical activity and inactivity is now rated as the FOURTH leading cause of preventable death in America.¹¹ This preventable cause of death was ranked above high blood sugar and high LDL cholesterol.



It is easy to believe that this sector of the US population is most likely associated with higher levels of stress, obesity, and mood disorders. Exercise can elevate mood even in our later years. According to one meta-analytic review, “chronic exercise is associated with improved mood in the elderly”.¹²

That said, a routine of exercise to elevate mood and assist learning is best addressed in our youth. For Elaine Alexander of the Kansas City School District, the XerTrainer does just that. She says, “Our students absolutely love the XerTrainer.” She continues, “They ask to play on it and the whole class's demeanor changes to one of total cooperation when they know we are going to work with the XerTrainer. If we need to change from another activity to the XerTrainer, we never hear any complaints. We find the

XerTrainer can be adapted to almost any skill we are teaching. We believe the XerTrainer is the most motivating piece of equipment we have in our program!”

Principal Craig Rupert of Woodland Elementary School says, “PE4Life has had a tremendous influence on the lives of our students. It’s not just the increased levels of fitness we are seeing in our kids which has everyone excited. Students are also more motivated throughout the day, their enthusiasm is way up, and discipline issues are way down.”¹³

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Due to the neurochemical response, many researchers have concluded that we can control mood through exercise and thereby dramatically impact human psychological health. In addition to its

massive appeal to the “at-risk” population, this section explores how Sportwall’s “short-burst-short-rest” style of interval training programs can:

- release endorphins which lift mood,
- stimulate the elimination of adrenalin and cortisol improving the sense of well-being, and
- naturally increase the production of neurotransmitters (building blocks of hormones) such as serotonin, norepinephrine, and dopamine (known as “the happy hormones”).

Endorphins



Endorphins function as neurotransmitters that act as the body’s “natural painkillers” as they resemble opiates in their abilities to produce analgesia and feelings of well being. Endorphins are responsible our ability to diminish, or even ignore, physical pain. They are also partly responsible for the “runner’s high” often reported by devout runners. Importantly, endorphin production increases with the frequency of exercise. All people, regardless of history, will experience a rise in endorphin levels with exercise of even modest intensity. Those who establish a regular exercise routine often report a sense

of beneficial “addiction” for their body.

Sportwall Promotes the production of the “Happy Hormones”

Inactivity is a major contributor to depression. A study of 276 middle-aged women found that those with a positive sense of well being engaged in about 85 more minutes of physical activity per week than women who were clinically depressed.¹⁴

About 10% of the US population (27 million) was taking prescription anti-depressants in 2005.¹⁵ Of those, about 700,000 are ages 5-17, a group that has doubled its use from 1995 to 2005 according to the Archives of General Psychiatry. This is astonishing usage.

While serotonin, norepinephrine and dopamine are critical ingredients found in anti-depressants, they are produced naturally in a healthy person whose diet, exercise, and stress levels are well managed.

David C. Nieman, PhD, author of *The Exercise-Health Connection*,¹⁶ explains that the benefits of exercise far exceed that of any medication or supplement. He suggests since the results of exercise can last for days, it is a safe and natural way to raise neurotransmitter levels and relieve depression.

Neurotransmitter levels affect the way a person feels, which is why they have been referred to as the “feel-good hormones” or “happy hormones”. Aside from enhancing mood, they also help control sleeping habits and digestion.

There are several conditions that may arise if neurotransmitter levels, especially serotonin levels, are low. Depression, migraines, constipation and feelings of increased stress are possible indicators that serotonin levels are low. While serotonin, dopamine, and norepinephrine levels may be boosted using different kinds of drugs or medication, many experts support the idea that exercise may be just as efficient.



Dopamine

Dopamine stores can become depleted with chronic stress, or anxiety, intense trauma, starvation, or low carbohydrate diets. Performing long duration exercise at moderate intensity can elevate dopamine levels.

Norepinephrine

Norepinephrine is the chemical in the brain that controls physical wants and needs and is increased along with serotonin during strenuous exercise and continues long after exercise is completed.

The thrill of play and competition, balanced with intermittent rest, holds the player's focus on the game and not the length of time spent exercising.

Serotonin

Serotonin helps to govern the healthy function of the other neurotransmitters as well as providing critical support to the entire neurological system. Many stress related conditions are being tied to shortages of serotonin production. These include chronic fatigue syndrome, fibromyalgia, migraine headaches, anxiety, and depression.

Serotonin is produced in the intestines and 75% is used to control intestinal activity. The remaining 25% is synthesized in the brain. The rate of serotonin production in the neurons determines mood. High serotonin levels are linked with elevated or happier moods, whereas low levels are linked with feelings of anxiety and depression.

Although all neurotransmitters affect mood, serotonin is considered the most crucial and exercise is one of the most efficient stimulators of serotonin production. While exercise is often linked to weight loss, it can in fact also help a person feel better. Several studies have found that once a person engages in physical activity the brain's serotonin function increases, which in turn reduces depression, anxiety, and stress.

Sportwall's Balanced Programming: Key to Performance & Adherence

While even mild exercise will have a positive effect on our neurochemicals, exact effects vary with the severity of exertion. While exercise at very high intensity and long duration can cause adrenaline levels to become elevated while serotonin levels drop, as long as the body is not over stressed the more demanding the exercise, the better the chances of increasing serotonin production.



Sportwall's interval training (short-burst-short-rest) regimen, when delivered to groups, is an excellent way to achieve the balance needed to optimize results without over-producing adrenaline or under producing serotonin. Intensity is balanced with recovery during a thirty to sixty minute workout. This may explain why schools that have adopted the Sportwall programs are noticing a significant reduction in aggression and out-of-school suspensions.¹³

Interval training is now well documented to hold the key to maximizing performance. Also called compensation, the body must rest following a period of activity in order to replenish its biochemical sources of energy. Too much stress without recovery increases risk of injury and burnout. Too much rest without stress will lead to atrophy and weakness. Balancing stress and recovery is essential to increasing performance and adherence.

All Sportwall training programs utilize this method of training, a key to its superior adherence and performance results, especially among at risk populations. Inactive people often report that pain is the greatest barrier to adopting an exercise regime. Sportwall's format of short/intense games, followed by short rest in preparation for the next turn, is believed to be a key factor in successfully encouraging individuals to conquer this "pain barrier".

The thrill of play and competition, balanced with intermittent rest, holds the player's focus on the game and not the length of time spent exercising. Add the neurochemical release of "happy hormones" and the drudgery of regular exercise is replaced with the pleasure that play brings.

Summarizing Sportwall's Value

While it can be argued that many of the components discussed in this document can be fulfilled with other programs and training equipment, there is nothing that compares with the Sportwall XerPro and XerTrainer in several areas, which should be critical to consumers.

First, the programming is extremely diverse. It can be tailored to all population groups from children with special needs, both boys and girls, elite athletes, and seniors. Sportwall has the support of educators and researchers for every cohort group mentioned.

Second, 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.

The "Energy Cost of Exergaming" study described here shows that Sportwall's programs can provide appropriate levels of exercise, and more importantly the level of appeal required, for children who traditionally do not want to exercise or are repelled by competitive sports.

Because the structure of the programming involves multiple short games played in teams, there are no permanent winners. Instead, the chance for everyone to succeed is repeated every couple of minutes, which incentivizes continual play. Often, educators have to "pull the plug" to end play.



Since groups can play together or one team can play against another, a high level of camaraderie is quickly built. The combination of rapid skill development along with social connection leaves players inspired with a sense of belonging after each class.

Installation convenience: Since the programming is so diverse, facilities have preferred to install the systems in general purpose rooms where everyone can have access to them, rather than placing them in a room dedicated to a particular group. For example, seniors can use them in the mornings, youth in the afternoons, and adults and athletes

in the evenings. An added advantage is that when not in use the systems take up only 4" of depth on a wall, which also helps alleviate the need for a dedicated room.

Instructional growth: When instructors fully engage with the wide range of programming available, they begin to create their own routines and programs. This is when a level of excitement ignites and true believers are born as they discover the limitless possibilities of Sportwall programming. Passive supervisors often become inspired physical educators.

We have developed a wide variety of program manuals designed to get instructors started in their own field of interest, whether for sports training, group exercise classes, or personal training sessions. Using our drills initially provides a feel for how the process and results come together.

Score Tracking: An effective way to ensure sustained use is to incorporate score tracking and team competitions. This can be done in two ways: by using the score tracking charts or by encouraging players to post their scores on a social networking site (such as Facebook) along with a video clip of the play to validate the authenticity of the score.

Facilities can either dedicate their own page to tracking scores or they can use the company's official score tracking site. Some facilities also hold competition days where teams challenge each other for the high score of the day in a particular game. Since games average sixty seconds, it is easy to get a lot of action happening quickly.

"In our research, the Sportwall did everything else the other exergames could do, but the intensity level from the interval training, camaraderie, and team work stood out. Even those who were waiting for a turn were jumping up and down yelling and encouraging the others. Fit and less fit children played together." (personal communication, Bruce Bailey, Ph.D., Assistant Professor, Exercise Sciences, Brigham Young University. July 2011.)

In our experience new ideas quickly emerge as instructors find themselves easily adapting drills to achieve their desired results. We encourage instructors to share ideas on our blog, <http://www.xergames.com/blog/> or on Facebook, <http://www.facebook.com> on Sportwall XerGames. This way, resources available to both new and experienced users will grow continually.

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

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