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Jason Brown celebrates after winning the Championship Men's Free Skate Program Competition during day 4 of the 2015 Prudential U.S. Figure Skating Championships at Greensboro Coliseum in Greensboro, North Carolina. (Photo by Jared C. Tilton/ Getty Images)

Olympic Coach is a publication of the United States Olympic Committee Sport Performance Division/Coaching Education Department. Readers are encouraged to submit items of interest for possible inclusion. Submitted materials will be acknowledged, but cannot be returned and inclusion is not guaranteed. Materials should be sent to Christine Bolger at Christine.Bolger@USOC.org.

Message from the Chief of Sport Performance

Alan Ashley

Welcome back to Olympic Coach! Over the last twelve months, the USOC's Coaching Education Department has been working with the NGBs to investigate concepts of Long Term Athlete Development (LTAD) and establishing a plan of action for improving the sport experience for young athletes in the United States. While many countries have been executing LTAD in their respective countries, we feel that the U.S. is well positioned to lead in the area of LTAD through the development and establishment of the American Development Model.

Taking the lead from USA Hockey who modified their philosophy on participation with their clubs – and found much success in doing so – the USOC and NGBs created a statement on ADM principles. It outlines the importance of a quality youth sport experience for America's young athletes – why it's important for them to master fundamental movement skills (physical literacy), the value of playing multiple sports including having great success in sport later in life, and how critical it is for kids to participate in settings conducive to skill development and learning. The ADM concepts focus on creating developmentally appropriate settings in hopes of improving the youth sport experience while keeping kids active and engaged in sport. And ultimately, how the Olympic and Paralympic movements can be positively affected by growing the number of young people in elite athlete pools, giving more kids the opportunity to realize their Olympic and Paralympic dreams. You can learn more about ADM by visiting Team USA's American Development Model resource pages.

With the recent launch of this initiative, we thought it appropriate to dedicate an issue of Olympic Coach to ADM and LTAD information. We're excited to share perspectives on these concepts from skill development, to overuse injuries and prevention, and the value of dedicating your club system to foundational skill development and fun.

We hope you enjoy this issue. Please contact us with any feedback – we'd love to hear from you. We'll look for you this Spring with our next Olympic Coach.

The Changed Landscape

Matthew J. Robinson and Jeffrey Schneider, University of Delaware

"*The world has caught up to the U.S. in sport*."

While this symptom is often diagnosed and discussed, the root causes often remain unexamined rather than being identified and remedied.

De Bosscher, Bingham, Shibli, van Bottenburg, and DeKnop (2008) cited that there are widely accepted factors which contribute to elite sport success and that these factors can be classified on three levels: the social and cultural context in which people live (macro-level), the athlete and their close environment (micro-level), and sport policies and politics (meso-level).
Past research has attributed a good part of the elite sport success for a country to macro-level variables such as gross domestic product (GDP), population, geography, and climate. U.S. sport has clearly benefited from these macro variables with one of the world largest populations and Gross Domestic Products (GDP) and multiple climates. The U.S. has also benefited from micro-variables such as the strength of the sport culture in the United States as well as the American cultural characteristics of competiveness, individualism, willingness to take risk and challenging authority (Hofstede, Hofstede & Minkov, 2010).

De Bosscher et al. (2008) identified nine meso-level variables associated with international sport success that include: financial support, integrated approach to policy development, foundation and participation in sport, talent identification and development system, athletic and post career support, training facilities, coaching provision and development, international competition and scientific research.

Recently, the macro-type variables from which the U.S. has benefited have been neutralized to some degree by smaller countries being more strategic in addressing the meso-level variables. Along with this, the micro-variable of strength of sport culture, which may be positive, can become counterproductive to growth and development. These realities have enabled competitor countries to close the competitive gap and in some instances pass the U.S.

Albert Einstein once stated that "everything has changed, but the way we think." Thus, the U.S. must change the way we think to find the remedy to the symptom mentioned above.

What is being said is neither new to the leaders of the United States Olympic Committee (USOC) nor the National Governing Bodies (NGBs). The challenge for them is communicating the message to those most responsible for the recruitment, development and training of athletes: the leaders and coaches coaching in the youth sport environment. While all of the nine variables are important, the responsibility for participation and talent identification and development falls to these professionals and organizations.

The focus of this four-part series is on the foundation, participation, talent identification, and athlete development pillars and the increased importance that sports clubs have in strengthening those pillars. It is at the sport club level that future elite athletes are recruited, trained, and developed. If the sport club environment is flawed, so will the athletes being produced from the environment. The series will focus on the changed sport landscape, the role and functions of the club, using the Athlete Development Model (ADM) to guide the vision and structure of the club and the future of the sport club in the U.S.

The Changed Landscape

Referring back to Einstein's quote, things have changed, and the way sport leaders, parents and participants think needs to change as well. While there are timeless lessons, values and principles that drive success, the environment and methods that produced the athletes for the "Miracle on Ice" in 1980; the "Dream Team" of 1992 or individual athletes such as speedskater Dan Janson; swimmer Janet Events or sprinter Michael Johnson may not achieve the same desired result today.

These athletes were products of their times and those times have changed. Today's environment has seen a decrease in volunteerism, an increase in parental engagement and expectations, an increase in professional sport coach and clubs, increased pressure for athletes to specialize at younger ages, a decline in education-based sport opportunities, and the need to provide a safe environment to prevent the mental, physical, and sexual abuse of sport participants. Sport leaders must recognize and be responsive to these changed aspects of the sport environment in order for the U.S. and its athletes to excel against its competitors now and in the future.

Volunteerism in Youth Sport

In the past for many sports, athlete development at the younger ages was the responsibility of volunteer coaches. The volunteers were mostly parents, some with playing experience in the sport and others not, who were well intentioned and willing to devote their time to coach their son's and daughter's sport interests.

Times have changed. The traditional five-day work week and nine-to-five work day no longer exist. Parents' time is stretched thin and the time, energy, and interest to volunteer that were once there have waned. It is not only the lack of volunteer coaches, but the lack of volunteers to oversee the other responsibilities within the traditional youth sport organization. Tasks such as serving as team manager, running the concession stand or serving on an organizational board are all important to the athlete experience and also lack volunteers.

Along with this, Bayli, Way and Higgins (2013) reported that the younger ages are the most critical stages in an athlete's development. In competitor countries it is common that trained coaches work with athletes at these critical stages. It is also common in some countries that a coach must have a coaching license in order to coach at any developmental stage. In contrast, in the U.S. it is common that youth athletes in those same critical developmental stages may have untrained

coaches who unintentionally may be inhibiting a young athlete's development by not implementing appropriate playing-to-training ratios, not emphasizing fundamental skills over tactics, and using drills that are not age or skill appropriate. These are all important aspects of player development that an untrained coach may not appreciate.

The reason that many people volunteer to coach is so they can coach their own child and plan on moving through the different stages. While the intention is good, does the volunteer coach adjust their coaching to the needs of the stage of development and it is even the best interest for that coach's son or daughter? Heinrich and Robinson (2014) found that only 20 percent of U.S. women's soccer team pool players had been coached by either their father or mother.

There are still those individuals who find fulfillment and enjoyment in volunteer coaching and make the effort to develop by attending clinics and seminars, surfing the web, reading books and acquiring coaching licenses. There is also a place for the well-intentioned volunteer within the organizations, but the environment has changed and competitor nations are doing things differently.

Professional Clubs and Coaches

The decrease in volunteerism has created a void that is being filled by the rise of the professional club. While this model has been common for some sports, such as gymnastics and swimming, they are increasing in team sports such as soccer, basketball, volleyball, and lacrosse. These clubs are run by fulltime employees and staffed by licensed professional coaches, some who do it part-time while others view themselves as full-time educators and business people.

The scope of youth sport has grown in recent years and to effective clubs must provide the services parents want and need. Maintaining websites, managing registrations, recruiting, conducting background checks and training staff and coaches, implementing SAFESPORT policies, maintaining facilities, arranging for travel to tournaments or cup competitions and overseeing the revenues and expenses that in some cases can exceed $1 million are part of the current youth sport environment. The reality is that parents can and are willing to pay for their son or daughter to have a quality experience and in turn parents and athletes become customers.

While some are critical of those who coach youth for pay, the reality is that the quality clubs and coaches view themselves as professionals who have taken the initiative to get licenses and experiences and treat it as their profession and career. It is interesting that still there is a mindset in the U.S. that a coach who coaches at the college and professional levels can get paid, and very handsomely in most cases, but those who are responsible for developing the players those elite level coaches get to coach should not and are judged for not being in coaching for the right reasons.

It is important to note that there are still amateur coaches in the youth ranks. Unfortunately, the term amateur often has a negative connotation in our society. An amateur is one who does an activity for the pure love of it and seeks not to be compensated. There are many talented individuals in sport who strive to be the best they can be as a coach purely for the love of it. These individuals should not be overlooked but rather applauded and engaged. Often these are individuals who have careers in other areas and find fulfillment in working with youth or giving back to a sport they love.

In a later article we will discuss developing a coaching framework based off the ADM, where a coach becomes a specialist within in age group and stays with that age group much like a teacher in the school system. This ADM coaching model replaces the volunteer model where you would see a parent move through the stages with their child.

Clubs still rely upon volunteers and can offer opportunities for parents to engage in their children's activities. The club can provide an inexperienced volunteer coach with the guidance and practice plans and can offer opportunities to serve as team managers, and assist with fundraising or the hosting of tournaments or events. The ideal scenario is one where the volunteers and professionals work together to create an environment where athletes have a positive experience and achieve their full potential. In the end, the market will speak. Those clubs that develop athletes and meet the parents and athletes wants and needs will thrive and those that do not will be exposed.

Parental Engagement and Expectations

While in a previous section we addressed the decline of volunteerism, the next aspect of the changed landscape is the increased level of parental involvement in their children's athletic activities. Being an athlete in the 1970s's and 1980's, I can remember coming home to tell my parents about the scores of the games and how I thought I had played. In today's environment, it's the parents who are telling the kids the scores and how they played. In previous generations the child took ownership of his or her sport participation. In the current environment, the modern parent is far more engaged and sometimes with greater expectations.

Because of this, the term "helicopter parent," a parent who hovers over their child, was created and since has been replaced by the term "bulldozer parent", the parent who clears the path of any hardship or adversity for the child. While some parents may not be not volunteering, they are holding those who do volunteer or those who are being paid to coach accountable for their children's development and identification as an elite athlete.

In his book The Talent Code, author Dan Coyle looked at the variables that were consistently present in talent hotbeds. One of the variables was what Coyle termed primal cues. Coyle defined them as "a distinct signal from something in their family, their homes, their teachers, the set of images, and people they encountered in their short lives. That signal sparked an intense, nearly unconscious response that manifested itself as an idea. Perhaps the idea came about purely by accident, but accidents have consequences and the consequences of this one were that they started out ignited and that made the difference." Primal cues can take the form of adversity and/or failure. These primal cues are the reason that some athletes achieve his or her full potential, while others, even though they have the natural ability, physical traits and access to the best coaches and facilities, do not.

It can be argued that it is often the parents who most want to see their son or daughter succeed and who spend countless hours and money in this pursuit, but in the process sometimes they may be shielding the child from being ignited by a primal cue. Would Michael Jordan have become Mi-

chael Jordan if his mother had demanded that Michael be placed on the varsity team from which he was cut or she was going to sue the school? Would Michael Phelps have become Michael Phelps if his mom was recording his practice times and asking why he did not get a personal best in his last race?

While parent interest is a good thing, a healthy approach where a parent allows the child to own the activity, holds the child accountable and is responsive to the child's needs is in fact the best approach. Robinson and Heinrich (2014) found that the U.S. Soccer team pool parents' level of engagement was best described as supportive. They attended games, only sometimes attended practices and the large of majority of parents did not coach their daughter.

Increased Pressure to Specialize Athletes

The pressure for an athlete to focus on one sport has increased and the pressure comes from the sport organization and, in some cases, the parents. Sport clubs, especially those that are for profit, have a vested interest in the specialized athlete for registration in youth sport can account for over 70 percent of the revenue for a sport organization. A child playing another sport with another organization impacts that club's revenues.

Along with these parents who want to see their child succeed in a sport at a young age also don't want to see the child fall behind by doing another activity. While there is a great deal of anecdotal evidence and research that promotes the benefits of multi-sport participation, athletes are often directed to specialize and many times to the athletes detriment. The benefits of multi-sport participation can be seen in a study that included former players for the University of North Carolina at Chapel Hill women's soccer, a program that has won 21 NCAA National championships and produced over 70 All-Americans. Of the 121 former players who participated in a research study, 92 percent were multi-sport athletes. Similar results found by Heinrichs and Robinson (2014) showed 90 percent of 192 players who were identified as U.S. women's soccer team pool players had played another sport. In both studies, the most reported sport was basketball.

Decline of Education-Based Sport Opportunities

Education-based programs have and still do play an integral role in the U.S. athlete development platform. The incentive of earning a college scholarship has been the dream of many an athlete and a motive to pursue excellence. In years past, high school and intercollegiate athletic programs were well-funded and comprehensive. High school teams were primarily coached by teachers who also coached and volunteer sport organizations were the feeder programs for the high schools.

In recent years, high school athletic budgets have decreased and sport programs have been cut, many schools have seen the percentage of their coaches who are teachers at the school drop to below 50 percent and for some sports, schools struggle to hire qualified coaches for the part-time coaching positions. In the intercollegiate environment Olympic sports such as wrestling, fencing, track and field, gymnastics, and swimming have been dropped or are at risk of being dropped by major universities who direct their resources to the high profile sports of basketball and football. A further concern is that NCAA Division I institutions are currently required to offer eight sports for

both men and women, but there are discussion to drop those requirements to six.

While there are still vibrant and successful high school programs, it is becoming more common that a sports club remains engaged with athletes during the high school years where in the past youth sport organizations were considered the pipeline into the high school programs. This has created competition between the two environments that sometimes leads to an athlete having to choose one or the other. Along with this, there are often high school state association rules preventing high school coaches from coaching athletes in the club environment or there are adversarial relations between the sport clubs and the high school programs that lead to ultimatum being put to the athletes to choose one or the other. In some cases it is accepted that the club is developing and training the athletes who then represent the school. An indication of the growth of the impact of the club environment found by Heinrich and Robinson (2012) reported that U.S. women's soccer team pool participants rated participation in high school soccer as being the least important experience in their development as a player. They rated national team experience, club training and individual training as most important.

Providing a Safe Environment to Prevent the Mental, Physical and Sexual Abuse of Sport Participants

There has been an increased awareness for the well-being of youth sport participants in recent years due to the highly publicized cases of physical, mental and sexual abuse of athletes by coaches. In the current environment there are more means and opportunities for individuals interacting with youth athletes to abuse them. Text messaging, video and camera phones, social media, overnight travel, gender coaching opposite gender and clubs with participants ranging from seven to 17 years old all present potential problems to protecting the well-being of youth sport participants.

Sport clubs must establish clear policies and guidelines on appropriate behavior and communication between coaches and athletes and even more importantly enforce them. Policies related to electronic communication and social media, appropriate touching and celebration, appropriate interaction between coaches and athletes of opposite genders and policies on travel and lodging are all now essential elements for a clubs policy manual. The changed environment makes these concerns paramount and the well-being of the athlete must be at the fore front of every decision made by the sport organizations. To meet the standard of care that is required by law means added hours and efforts to address concerns and potential abuses that were not even imaginable even a decade ago.

The USOC and NGBs have taken steps to address these issues and provide valuable information free of charge on their respective websites.

Closing

The landscape has changed and the remaining parts of this series will look at the methods, strategies, and theories that can be implemented by clubs and professionals to ensure that participants have positive and safe experiences and have the opportunity to achieve their full potential.

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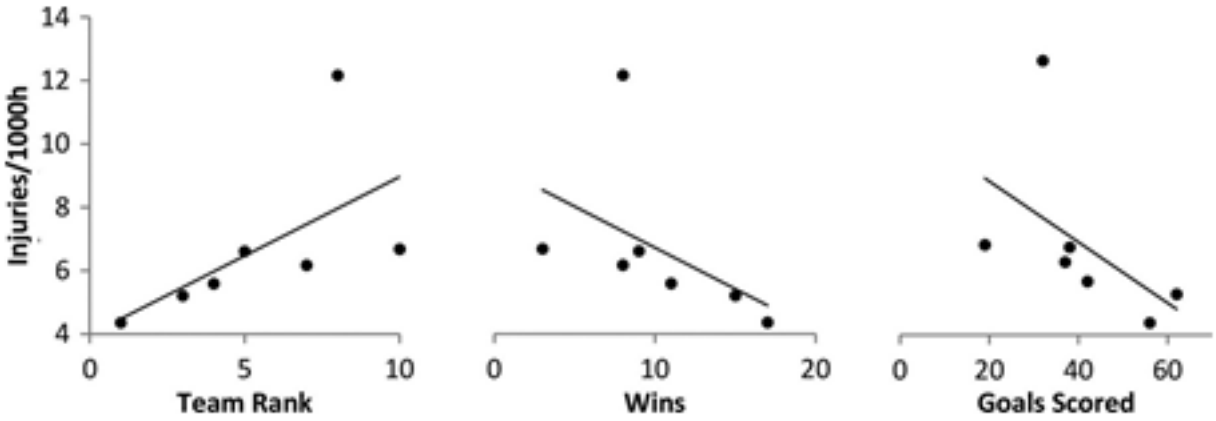
Building Injury Resilience with the American Development Model

Dr. Dustin Nabhan, Associate Director of Clinical Research and Multidisciplinary Care, United States Olympic Committee

Introduction

Injury is the bane of the athlete, coach and fan. It has been estimated that 60 million Americans between the ages of 6 and 18 participate in some form of organized sport (Brenner, 2007). Three and one-half million of these children are injured during their sport participation in any given year, and roughly half of these young athletes suffer an overuse injury(DiFiori et al, 2014). As a result, the number of losses in competition increases (Figure 1) and many young athletes drop out of sport due to serious or repetitive injury(DiFiori et al, 2014) (Eirale et al., 2012).

Injury incidence correlation with team ranking, total wins and goal scored (r: Spearman's rank correlation).



Eirale C et al. Br J Sports Med doi:10.1136/bjsports-2012-091040

Organizations such as the International Olympic Committee's Medical Commission and the United States Olympic Committee's Sports Medicine Division have taken great strides to better understand the causes and impact of sports injuries. Through epidemiological monitoring, risk factor identification studies and clinical trials, sports medicine researchers have been able to identify common traits associated with injury risk and create effective models for injury prevention.

Fortunately, these efforts have proven that many injuries are preventable. Overuse injury, by its very definition, can be mitigated with appropriate athlete preparation, recovery and training planning. Some acute injuries, such as non-contact ACL ruptures and hamstring strains, can be reduced in frequency with appropriate warm-ups and strength and conditioning programs. In this article, principles of sports injury prevention will be introduced and the mechanisms and mitigation strategies for several types of sports injuries will be discussed.

Principles for Building Resilient Athletes

The American Development Model's key principles of 1) "Developmentally appropriate activities that emphasize on motor and foundational skill development" and 2) "Encourage multisport participation" lay the foundation for injury resilience in the youth sport participation. The most effective injury prevention models include building fundamental movement skills, developing robust metabolic and neuromuscular capacity through variation in training mode, and minimizing repetitive strain to bones, ligaments and musculotendinous units by varying the training stimulus.

Develop & Maintain Movement Competency

Movement competency is the ability to perform fundamental movement skills. Fundamental movements have been described to include running, jumping, hopping, squatting, lunging, throwing, catching and striking. The attributes required to perform these tasks include coordination, strength, balance, flexibility and endurance. As athletes begin to focus their efforts on one sport, it is common to see them lose the ability to perform basic fundamental movement capabilities due to the structural adaptation and muscle imbalances associated with high volumes of specialized sport training.

Movement competency can be evaluated by administering movement screenings, such as the Functional Movement Screen, National Academy of Sports Medicine's Movement Assessment or the Movement Dynamics Physical Competence Assessment. Screening young athletes regularly may help identify individuals who can benefit from additional strength training or increased emphasis on cross training to address strength deficits or muscle imbalances. General tips to maintain movement skills across a team of athletes include:

- Perform movement screening yearly to assess movement skill
- Add full range of motion movements into the daily warm up
- Encourage multisport participation until the "High-Performance" ages (15-19)
- Cross-train with different exercise modalities to build metabolic power

Monitor Training Stimulus

Repetitive use injury and overtraining frequently occur when the biomechanically similar movements are performed at the same level of intensity and volume day after day. This has been coined "monotonous training." Introducing variation in training stimulus can be effective for reducing injury risk and improving performance by creating metabolic or neuromuscular stress that are similar to that needed to perform the athlete's sport but with less stress to the body.

Many coaches have learned that cross-training can be used to gain fitness while minimizing tissue breakdown. The use of swimming, rowing, biking or interval-based resistance exercise for metabolic conditioning can be used to gain cardiovascular power without stressing the same soft tissues that are taxed day after day in sport-specific training. New unloading technology, such as the Alter G treadmill and SwimEx underwater treadmill, allow for running to be performed with less force, sparing joint and soft tissue stress.

At the youth level, games and non-sport-specific training drills can help to improve conditioning and develop athleticism by using movement skills that athletes are unaccustomed to. At the Colorado Springs Olympic Training Center, it is not unusual to see a wrestling team playing indoor soccer or basketball as a conditioning game, offsetting the need for running conditioning drills. Creating a fun, spontaneous and unpredictable environment for metabolic conditioning training can help improve compliance to the training program and keep athletes mentally engaged in high-intensity training.

Monitoring Training Volume

Careful monitoring of training load has held up as one of the most effective methods of injury prevention. There are several methods of monitoring training load, including sport-specific techniques (Table 1).

Sport	**Measurement**
Archery	Arrow Count
Baseball	Pitch Count
Jumping Events	Ground Contacts
Running Events	Miles per week
Swimming	Yards per week
Weightlifting	Tons per week
Wrestling	Hours live wrestling per week

General measures of training can be used to measure training stress across any sport. The amount of time spent training (volume) and the intensity of the training as graded by the athlete on a scale of 0-10 (rate of perceived exertion or RPE) can provide useful information on the total load of training on the body. These calculations, as described by sport physiologist Carl Foster, are valid predictors of injury risk due to training variables(Foster, 1998).

Measurement	Calculation
Load	Time in minutes x RPE
Monotony	Load/E (Load)
Strain	Load x Monotony

Sport epidemiologists have found some interesting trends in training volume research:

- Taking one day of full rest from training every week appears to be important for maintaining health (Valovich McLeod et al, 2011).
- Increasing training volume by no more than ten percent each week helps decrease injury occurrence(Brenner, 2007).
- High monotony and strain of training can predict approximately 80 percent of illnesses encountered during the training season(Foster, 1998).

Prevention Strategies for Specific Injury Types

Non-Contact Ligament Injury

Ligaments attach bone to bone, creating joint stability. Many ligament injuries occur without any trauma. Examples include non-contact ankle sprains, ACL tears and ulnar collateral ligament tears of the elbow. Risk factors for non-contact ligament injury include poor exercise technique, strength, coordination, balance and endurance deficits, and overuse.

The most thoroughly studied ligament injury is the ACL tear. The IOC Medical Commission has called ACL injury “the largest single problem in orthopedic sports medicine.” The annual incidence is 34 per 100,000 citizens, and female athletes are four to six times more likely to tear their ACL than their male counterparts (Myer, Chu, Brent, Hewett, 2008). The socioeconomic cost of ACL injury is approximately $100,000 per injury and the time lost from sport is usually six to twelve months. Fortunately, with proper exercise prevention programming the incidence of this injury can be reduced significantly.

Exercise-based injury prevention programs are effective for preventing ACL injury if they are performed more than once per week, incorporate balance, strengthening and plyometric exercise, and the program runs for a minimum of six weeks (Hewett, Ford, Myer, 2006). Programs should be monitored by an experienced coach or strength and conditioning specialist for maximum preventative effect. There are several open access training programs available for coaches online, some of which provide video instruction. For more information on ACL injury prevention programs, their implementation and specific exercise techniques, the FIFA 11+ website is an excellent research for the coach or health care provider.

Tendon Injury

Tendons are the rope-like soft tissues that anchor muscle to bone. Tendon injury may include tendonitis, chronic tendon overuse (tendinosis) or tendon tears. Tendons have a poor vascular sup-

ply and take several days to recover from a bout of high intensity or high volume loading and several weeks to become accustomed to a new training stimulus. If a tendon is rested for too long (weeks), it can atrophy and lose the capacity to handle a high training load. The secret to maintaining tendon health is to carefully monitor training schedules so that tendons are allowed to work within their structural capacity.

When evaluating training programs for consideration of tendon health it is important to avoid any drastic increases in tendon loading over a short (one to two week) period of time. For example, a change from flat ground running to hill sprints would dramatically increase Achilles tendon stress. Any change in surface, incline or technique that increases tendon strain should be slowly introduced. Because it takes 48 to 72 hours for a tendon to heal from an exercise session, new exercises should be dispersed through the training plan every few days.

Although athletes need frequent rest to recover properly from exercise, tendons respond poorly to taking extended time off. Encouraging athletes to take “active vacations” from sport helps maintain constant low intensity tendon loading, decreasing the likelihood of acute tendonitis when the athlete returns to sport training. In the first few weeks of training after a long break, workouts should include a variety of different movements and avoid high tendon loading, such as hill work or sand running.

Muscle Strains

Muscle strains occur when there is stretch of a muscle beyond its functional range. Mechanisms for muscle strain may include a shortened length tension relationship due to repeated use in a limited range of motion, poor strength ratio between the active muscle and its antagonist, insufficient maximal strength or fatigue. The secret to muscle injury prevention is variation in training stimulus.

Muscles adapt to the training stimulus they encounter. For example, let’s consider a marathon runner. Long distance runners have relatively short running strides and their muscles perform at a low relative intensity of their maximal strength. Over a typical training week, an elite marathon runner will run well over 100 miles, all at a short stride length and low level of contraction. In response, although the muscle develops phenomenal endurance in response to high mileage running, its effective length shortens and its maximal strength potential plateaus or even decreases. As a result, the capacity of the muscle to perform work at length or with intensity is diminished. Hamstring strains, which in runners occur during fast stretch during the swing (lengthening) phase of running, can then easily develop from what would normally be routine workload.

By incorporating full range of motion exercises into their weekly training program, the runner could negate the shortening of their muscular length tension relationship while improving connective tissue strength and central nervous system contribution to strength and power output. One exercise that has been demonstrated to be effective for creating long, strong hamstrings and prevent hamstring strains is the Nordic hamstring exercise. Other exercises that could be considered include Romanian deadlift variations, full depth squatting, single leg squats, razor hamstring curls and back extensions.

Take-Home Points

Building resilient athletes is attainable with careful performance planning, athlete monitoring, and

through the use of well-designed daily warm up routines and strength and conditioning programs. The American Development Model incorporates many key principles in injury prevention programs, including delaying sport specialization and incorporating developmentally appropriate activities that emphasize on motor and foundational skill development.

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Performance Nutrition and the Adolescent Athlete

Susie Parker-Simmons, Senior Sport Dietitian, United States Olympic Committee

Adolescence is the stage of physical, cognitive and psychological development, from puberty to the onset of adulthood. Competitive adolescent athletes are children between 12 and18 years of age who demonstrate talent in high performance sport. During this phase, adolescents need adults (parents, coaches, and teachers) to help nurture, teach, guide and protect them on their journey to adulthood.

Throughout adolescence, the athlete experiences many changes, and these include physical growth and maturation, cognitive development and emotional maturity. Growth and maturation occur in a set sequence and are sensitive to both genetics and the environment. Common factors that can affect the onset and progression of puberty are genetics, stress, socioeconomic status, nutrition, training and illness. It is important to teach our athletes the progression of physical, mental and emotional development, and for them to be educated on the potential influences of their family history. This helps them identify that growth and maturation is a normal process of life.

For most sports, physique plays a role in competition success. Changes in body height, weight, shape and composition can affect:

- Coordination
- Balance
- Skill acquisition
- Energy efficiency
- Power-to-weight ratio
- Center of gravity
- Injury risk
- Self-esteem and body image

These factors can cause a short-term decline in performance as the athlete learns to train and compete with his or her new body size and shape. For others, this is the end of their career in their selected sport. These individuals should be encouraged to transfer their talent to another sport. For weight class and aesthetic sports, the pursuit of attaining ideals in body composition may be challenging due to the influence of genetics and the timing of puberty. In general, athletes either experience genetic selection or require behavior adaptation to attain this goal. Genetic selection is when the athlete naturally possesses optimal body composition for the sport they perform. Behavior adaptation is when the athlete did not inherit ideal body composition for their sport and physique needs to be modified by training and diet. Managing energy requirements in competitive adolescent athletes in weight class or aesthetic sports is complex. Long periods of restricted energy intake can

compromise long term health such as delayed puberty, menstrual irregularity, poor bone health, short stature, increased risk of injury and disordered eating behaviors. Therefore, weight loss diets that attempt to reverse normal pubertal development are not an acceptable practice for athletes. Physique management in adolescent athletes is not to be taken lightly, and should only be managed by professionals in the field.
During adolescence, there is an increase in nutrient requirements. This includes up to 20 percent additional energy intake during peak growth. There is also an increase need in micronutrients such as:

- Calcium & vitamin D: an increase in requirements due to a 50 percent increase in bone mass during this phase
- Iron: an increase in requirements due to the expanding red cell mass and a 15 percent increase for females due to menstrual blood loss

For athletic adolescents, there are also increased requirements for macronutrients (carbohydrate, protein, fat) and micronutrients (B vitamins, iron, calcium) to cater for the increased metabolism, oxygen transport and muscle function, respectively.

During adolescence, the developing brain encompasses new cognitive skills that enhance the athlete's ability to reason and think abstractly. They become more capable of:

- Reasoning effectively
- Utilizing problem solving skills
- Thinking abstractly and reflect
- Planning for the future
- Developing good decision making skills

Also during this time period, athletes mature emotionally, establishing a sense of who they are and who they want to become. During the process they may:

- Become self-conscious, sensitive and worry about their body changes
- Separate from their parents and establish their own identity
- Seek peer approval
- Develop romantic friendships and establish their own sexual identity

The impact of the cognitive and emotional development on the athletes nutritional practices include:

- Risk of restricted and/or controlled eating patterns, and supplement abuse
- Turning to successful athletes and peers for information on nutrition
- Adoption of nutrition myths from friends or social media

Remember, adolescents need adults to help nurture, teach, guide and protect them on their journey to adulthood. Some tips for parents and coaches to assist their athlete during adolescence include:

- Do not tease the physical, cognitive and emotional changes;.educate them early on the whole growth and development process
- Do not try and reverse normal pubertal development
- Ensure you have enough time together
- Implement non-judgmental listening
- Keep open lines of communication
- Develop and maintain mutual trust
- Help the athlete to learn the skill of problem-solving
- Ensure they have privacy
- Don't take their behaviors personally

Adolescent athletes have unique nutrition requirements as a consequence of growth and development and the demands of training and competition. Consideration needs to be given to energy intake, dietary calcium, vitamin D and iron intake. It is also an important time in the athlete's life to acquire knowledge and skills to establish a lifelong relationship with food and develop a healthy physical self-image.

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American World Championship medallists and World Cup globe winners Mikaela Shiffrin and Lindsey Vonn pose for a photo shoot during the Audi FIS Alpine Ski World Cup Finals on March 22, 2015 in Meribel, France. (Photo by Alexis Boichard/Agence Zoom/Getty Images)

Taking a Long-Term View of Youth Physical Development: A Summary of an Invited Review of Long Term Athletic Development (LTAD)

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The purpose of this article is to inform the reader of key findings and recommendations from a recent review authored by a group of leading international experts on youth physical development. The two-part article, which was published in the National Strength and Conditioning Association's *Journal of Strength and Conditioning Research*, was an invited review on Long-Term Athletic Development (LTAD). The first part delineated and compared existing LTAD models and examined the evidence for and against LTAD (Lloyd et al., 2015a). The second part summarized barriers to, and recommendations for the successful implementation of LTAD programs for all youth (Lloyd et al., 2015b).

Sometimes Words Have Two Meanings

The words included in the phrase Long-Term Athletic Development have different interpretations to various stakeholders. For some, "long-term" may be the time span that includes childhood and adolescence, whereas for others it may be only for this season or year. The term "athlete" has led some to dismiss the entire phrase, believing the model is only appropriate for the small percentage of the population engaged in sports, while for others, "athlete" refers to the contextual athleticism of the individual at that particular point in time, based on his/her opportunity and endowment. "Development" may be viewed as the approach to improve specific attributes for a particular sport or activity, or may be viewed as a holistic term outlining the development of the total person within the context of the sport or activity.

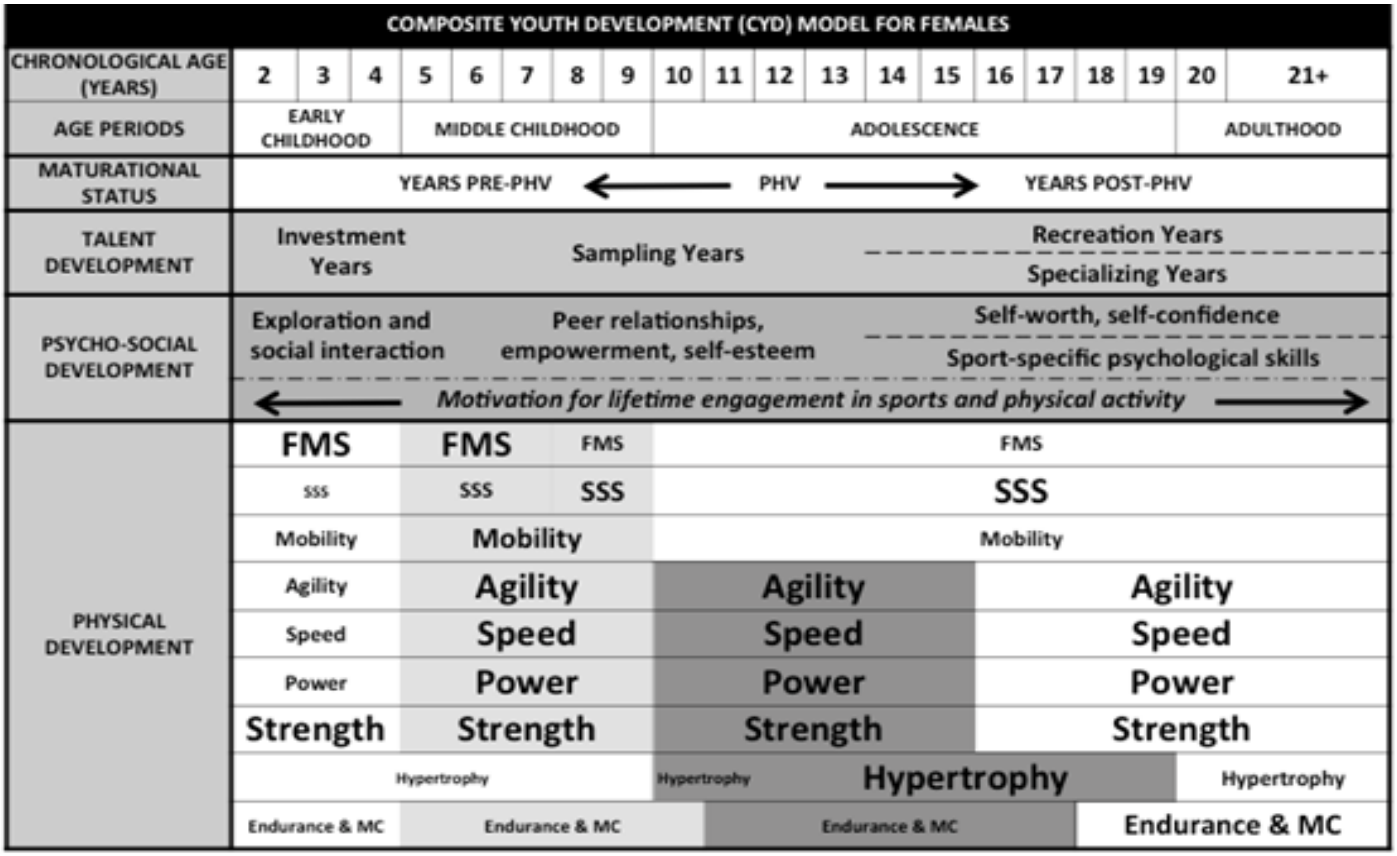
All LTAD Models Should Promote Positive Youth Development

Since differences of perspective exist as to the intent of LTAD and questions abound as to whether there exists sufficient evidence for its rapid rise in implementation. One of the goals of the process was to identify key elements of positive youth development — not only within the sports arena, but for purposefully integrating the building blocks of healthy development in youth that lead to lifelong physical activity and positive contributions to society (Search Institute, 2006). Developmental assets include the physical, social and psychological attributes that need to be purposefully coached in all youth. The evidence suggests that for sports to contribute to positive youth development for all children and adolescents, sport needs to be more inclusive of all youth of all abilities, with the intent to develop a wide range of fitness components (Lloyd and Oliver, 2012), and mindfully nurture psychosocial attributes to complement the physical attributes. Unfortunately, most LTAD models focus on one of the developmental assets rather than developing the whole child. LTAD models tend to

emphasize physical development or pro- psychosocial behaviors. The main interest of the physical development models is either talent identification and talent development or training of fitness

attributes. One of the key recommendations, therefore, was the creation of a blended LTAD model (Composite Youth Development Model – see Figure 1 and Figure 2) that incorporates the physical and psychosocial domains.

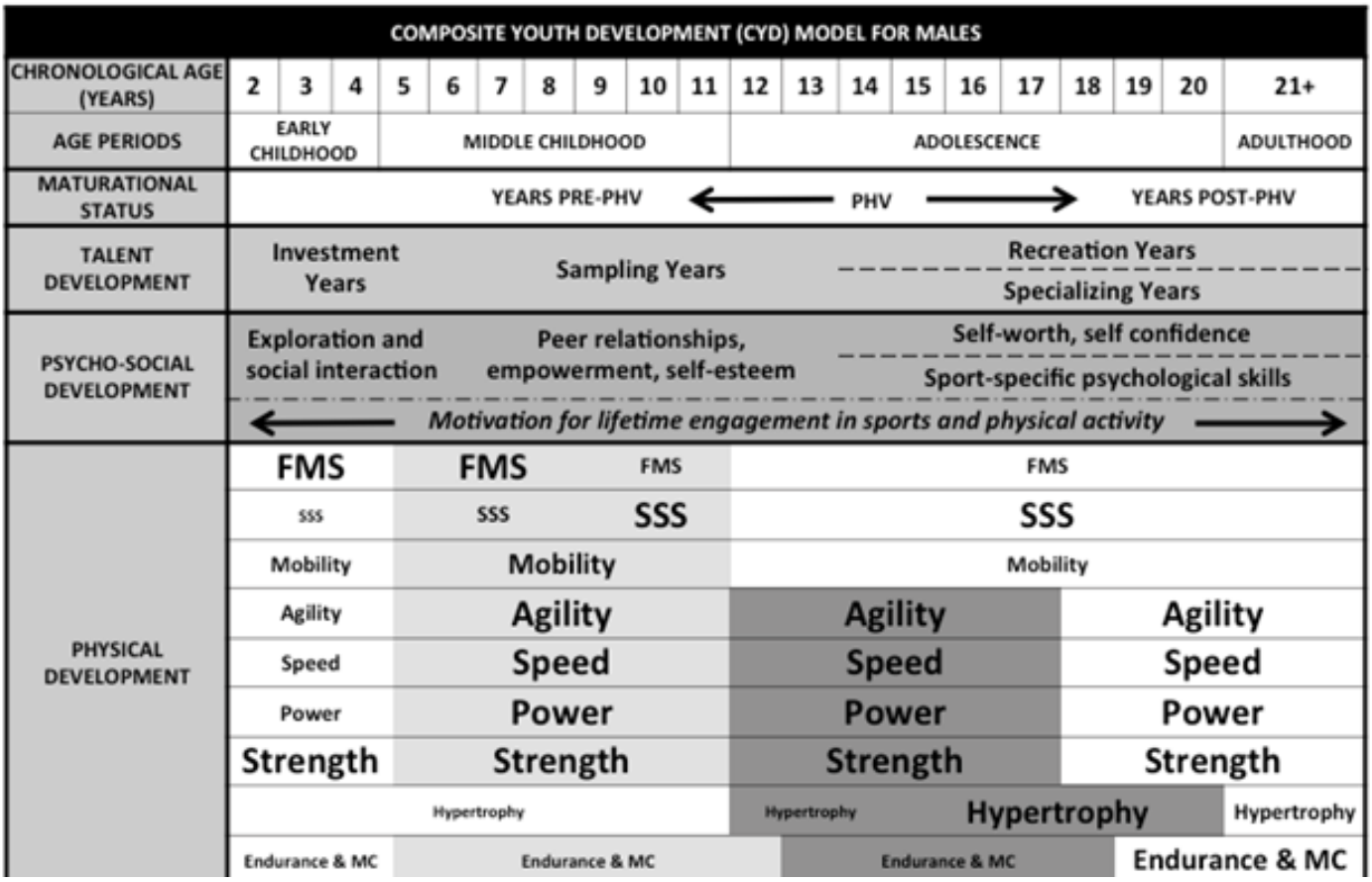
Figure 1. Composite Youth Development Model for Females



Coaches at All Levels Need to Emphasize All Fitness Attributes

Sport in and of itself does not necessarily lead to improvement in overall athleticism or fitness (Myer et al., 2011). In fact, one of the limiting factors of youth physical development is when a child specializes in a single sport or a specific positional role within a sport, as this can promote muscle imbalance and increase injury risk because they often lack fundamental motor skill competency and acceptable fitness levels. Purposeful practice sessions that include the ongoing development and mastery of motor skills and fitness attributes – especially muscle strength – provide young athletes at all levels of sport with the skills they need to be able to perform to their potential, given their athletic endowment. This is in keeping with the outcome of physical literacy of every child as part of their daily physical education and sports experience (Whitehead, 2001).

Figure 2. Composite Youth Development Model for Males



Motor Skills and Muscle Strength Need Focused Attention

An international consensus statement on youth resistance training underscored the importance of including youth resistance training as a means to improve muscle strength, motor skills and athletic performance (Lloyd et al., 2014). Coaches are advised to follow the Integrative Neuromuscular Training (INT) paradigm that provides opportunities for youth to participate in intermittent burst of activity with appropriate rest periods (Myer et al., 2011). INT is a method of conditioning that enhances health fitness – especially muscle strength activities – and skills fitness and also promotes mastery of fundamental motor skills, improves movement mechanics and increases confidence in performing physical activity. The recommendation of the Lloyd et al. invited review (2015a, 2015b) to ensure that opportunities for youth to develop all health fitness and skills fitness attributes across childhood and adolescence is substantiated by INT.

The Importance of Physical Education as a Vehicle for Youth Physical Development

Physical education is an excellent vehicle to promote and develop physical, social, and psychological developmental for all youth. As such, there is an increased awareness to the potential benefits of long term athletic development as a pathway in physical education to improve health, fitness

and performance for every child. Physical education teachers should be trained in the complex interactions of growth, maturation and training to lead all students towards a competent level of physical literacy. Motor skill training as part of the physical education curriculum is a critical component of developing physical literacy. An integrative training system that incorporates motor skill training, strength training, speed/agility, etc., is needed in schools (Bukowsky, Faigenbaum, and Myer, 2014). These programs need to be delivered and monitored by appropriately qualified personnel.

The Critical Need for Appropriately Qualified Personnel

In order to successfully develop physical and psychosocial attributes in all youth, it is recommended that those that teach and/or coach youth should possess the following competencies (Lloyd et al, 2014):

- Training in the unique physiological, physical and psychosocial needs of children and adolescents
- Possess a relevant and nationally accredited strength and conditioning qualification
- Strong pedagogical background of the styles of communication and interaction appropriate to effectively teach or coach youth
- Knowledge and expertise to plan, teach and progress age-related strength and conditioning programs for youth

The success of the training program, whether it is for strength and conditioning or sport-specific coaching, is contingent on the knowledge, skills and abilities of the practitioner responsible for the program. The aforementioned guidelines provide a suitable starting point in which to develop quality coaching education opportunities. As the invited review has shown, the neuroplastic period of childhood is a critical period in which to develop motor skills, and to initiate INT. An internationally-recognized youth training certification was strongly recommended in order to ensure that all youth are afforded every opportunity to become physically literate and to ensure that the philosophies and practices of LTAD ensure the holistic development of all youth (Lloyd et al., 2015b).

The Emergence of the Composite Youth Development (CYD) Model

Based on the findings and recommendations, the Composite Youth Development model was proposed as a flexible blueprint that coaches can use to provide a holistic approach to positive youth development for all children and adolescents. Physical conditioning programs should emphasize general physical preparation and the development of gross movement skills with inexperienced and poorly skilled youth. A comprehensive approach for multi-sport participation, physical activity, fun activities and structured play must be emphasized by all practitioners. Properly implemented, the CYD model will enhance all developmental assets leading to holistic development for all aspiring young athletes.

Table 1. Key findings and recommendations from Lloyd et al. (2015a, 2015b)

Indicator	Finding	Recommendation(s)
Holistic Development	• Varying levels of understanding • Lack of coordinated planning amongst youth-serving organizations	• Create a CYD model that combines elements of existing developmental theory. • Coaching education that addresses the unique physical and psychosocial needs of youth should be required at all levels.
Talent Development	• Focus on short-term sports performance • Lack of evidence to support early specialization and early selection of talent	• Sampling and deliberate play are necessary for all youth. • Free play, guided play and structured play are all necessary for physical literacy.
LTAD Models	• Aligned with developing sports performance rather than participation • Limited research support	• Within an integrative training program, LTAD models place a high importance on developing movement competency and muscular strength at all stages of development. • The CYD model provides developmentally appropriate guidelines for all youth.
Issues Affecting Physical Development	• Physical inactivity • Obese and overweight • Injury risk due to early specialization • High workloads • Limitations of curricula	• Incorporate appropriate levels of physical activity, integrative neuromuscular training and pedagogy into CYD model. • There is a critical need for qualified professionals who understand the multidisciplinary approach to youth development, where all practitioners are communicating effectively to drive a program that has the athlete's best interests at the forefront. • Implement coaching education and national youth certification programs to attain minimum levels of competency.

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Rhodri S. Lloyd, is currently a senior lecturer in Physiology and Health at Cardiff Metropolitan University. His research interests surround the impact of growth and maturation on long-term athletic development, and the neuromuscular mechanisms underpinning resistance training adaptations in youth. He is a member of the Executive Council for the NSCA Youth Training Special Interest Group and is a Board Director for the UK Strength and Conditioning Association. Rhodri was lead author for the 2014 International Consensus Statement on Youth Resistance Training and co-edited the textbook entitled Strength and Conditioning for Young Athletes: Science and Applications.

Self Myofascial Release as Tool to Improve Athletic Readiness?

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Every coach has a toolbox. Every great coach knows which tool to use for each of his or her athletes at any given time. Self Myofascial Release (SMR) has become a tool that most strength and conditioning professionals have started to embrace in some manner.

In pursuit of the ultimate athletic performance, the highest quality of training, improved recovery time between trainings and fewer overuse injuries, over the last ten years strength coaches and trainers have been finding more ways to integrate SMR techniques into training sessions. Specifically, coaches have utilized a foam roller, PVC pipe or similar device, designed to allow an athlete to use their body weight or manual resistance to apply external pressure to various areas of the body. Over the last several years, research has emerged in support of the potential benefits of SMR. A few areas that seem to benefit from SMR include joint range of motion, blood flow, perception of reduced muscle soreness, and a reduction in resting muscle tone. Each of these areas alone could serve as a reason to use SMR, but when taken together with a proper warm-up and other resistance training principles, SMR can be a difference-maker in the performance on the battlefield or within the walls of the weight room.

Increased Joint Range of Motion

The research is beginning to show that utilizing SMR will cause an increase in range of motion of the joints (Halpern et al., 2014; Kuruma et al., 2013; MacDonald et al., 2014; Sullivan et al., 2013). Each study utilized foam rolling or a variation of self-massage as a version of SMR. These studies have shown results in favor of SMR as a way to increase joint range of motion. Knowing this, the question is no longer does SMR contribute to greater joint range of motion, but how?

One potential answer lies within the connective tissue. Connective tissue is often ignored until an issue arises. Connective tissue weaves its way through the body in a three-dimensional web that has several functions. One of its most important functions is to transmit force. However, when connective tissue is damaged, through trauma or training, it becomes taught, less viscous, and therefore less effective at transmitting the force that is generated by the muscle (Threlkeld, 1992). The pressure and friction from the SMR device causes a change in the state of the connective tissue. Similar to Silly Putty, connective tissue starts off cold, dense and difficult to change shape. However, after time is spent applying pressure and increasing heat from friction the connective tissue warms, becomes less dense and is more malleable. It is when connective tissue reaches this state that it allows the joints to reach greater end ranges of motion. Greater joint range of motion can lead to several positive outcomes, such as greater length-tension relationship in the muscle. There is some concern in the field of strength and conditioning that SMR shuts down the nervous system

by desensitizing the neuromuscular system and its neural reflexes, leading to lessened ability to generate force quickly. However, several studies have shown that the use of SMR can increase the range of motion of joints without tampering or decreasing force production or reaction time (Halperin et al., 2014; Kuruma et al., 2013; MacDonald et al., 2013;Sullivan et al., 2013).

Increased Blood Flow

One of the easiest benefits of SMR to understand and conceptualize is the increase in blood flow that SMR causes to the area being treated. As noted previously, the friction and pressure created by the SMR device on the treated area causes an increase in blood flow to the region. This has all the obvious benefits associated with an increase in blood flow to any tissue of the body. An increase in blood flow is characterized by an increase of nutrients such as oxygen and nitric oxide (a known vasodilator) to the tissue, removal of waste products in the area, and if hydration is properly managed, an increase in the viscosity of the tissue. According to a study conducted by Okamoto 2014, the use of SMR reduces arterial stiffness and improves endothelial function. While smooth muscle and skeletal muscle differ in some of their characteristics, it is hypothesized that the decrease in arterial smooth muscle increases the blood flow to the muscle, regardless of the differences between the two tissue types.

Furthermore, there is the potential to break up any connective tissue adhesions that may form when a less than hydrated tissue sticks to or adheres to other adjacent tissues and SMR may help break muscle tissue adhesions that may be a result of tissue damage.

Specifically, the three types of adhesions that can be broken up with SMR are dermal, or skin to muscle, myo, or muscle-to-muscle, and fascial, or muscle to fascia.

Lower Perceived Muscle Soreness

Everyone perceives soreness in his or her own way. More often than not, it is based on the athlete's training history and individual pain tolerance. However, research has shown that the use of SMR, or other similar treatments, is an effective tool in reducing perceived muscle soreness (Jay et al., 2014; MacDonald et al., 2014). How does SMR reduce perceived muscle soreness? The pressure and friction created by SMR activate various nerves in the body. A concept known as diffuse noxious inhibitory control plays a key role in understanding how SMR can reduce perceived soreness – in other words, pain overrides pain. The brain prioritizes pain sensed by the nerves. Imagine an athlete is experiencing "pain"; i.e., soreness. The athlete would then use a SMR device to produce temporary pain of a higher intensity than general muscle soreness for a short time. Then, when the stimulus is removed, the pain threshold is raised and general soreness no longer takes precedent in the pain centers of the brain. This is the idea of a release that is felt in the muscle when using SMR. The muscle suddenly relaxes as the brain realizes the pain is not harmful to the body. Essentially, if the athlete can withstand the temporary, sometimes tear jerking pain that can come with SMR, they can reduce their general soreness by tricking the brain. While nothing is physically done to the tissues to help them repair, the perceived decrease in soreness may allow for a more intense practice or training session than would otherwise be possible without this decrease in perceived muscle soreness. This same concept can serve as the rationale for why it can

be important to strength train through muscle soreness and also the importance of going through a thorough warm-up session prior to assessing one's perception from pain associated from muscle soreness.

Reduction in Resting Muscle Tone

Separately, human resting muscle, or myofascial, tone is the passive tonus, or tension, of skeletal muscle that derives from its intrinsic (EMG-silent) molecular viscoelastic properties (Masi & Hannon, 2008). Resting muscle tone works independently of the central nervous system, and is the result of intrinsic molecular interactions of the actomyosin filaments in sarcomeric units of skeletal muscle and myofibroblast cells (Masi & Hannon, 2008). All types of strenuous activity can cause an increase in resting muscle tone, known as hypertonicity. This can be advantageous to some degree, when considering rates of force development, but a hypertonic muscle can lead to compensations and injury. Therefore, it is important to be able to release the tonic muscle in this passively contracted state by using SMR. Along the lines of hypertonicity, there are also hyperactive nerve bundles known as trigger points. While hypertonicity is a mechanical property of muscle tissue, trigger points are a product of the spasm-pain-spasm cycles of the central nervous system. This is characterized by an overactive nerve holding a muscle, or a concentrated band of muscle, in a contracted state. Only through direct pressure can these trigger points be released (Prudden, 1980).

Understanding that joint motion, fascial friction, nervous system activity, and resting muscle tone can all cause limitations in muscle and joint performance, and that SMR has been shown to improve each of these factors, it is therefore logical to assume that SMR may have a positive impact on Rate of Force Development . This positive impact on RFD may enhance peak power output, as a result of less muscular tension and decreased resistance, to allow for more efficient movement. The use of SMR is becoming more widespread, as foam rollers, tiger tails and PVC pipes are appearing in health clubs, weight rooms, athletic training facilities and physical therapy clinics. Strength coaches and trainers seem to agree that SMR is a beneficial tool for an active person. However, not much has been written about why these tools seem to be effective. This article discussed four proposed reasons for why SMR may be beneficial. Increasing joint range of motion, increased blood flow, lower perceived muscle soreness, and reduction in resting muscle tone are four areas that researchers are beginning to look into as reasons why SMR may be a beneficial tool. Every piece of equipment has a purpose. If it is used for its proper purpose at the proper time, each piece of equipment becomes a tool that can be used to shape, build and mold athletes into better versions of themselves.

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Matthew Antoine of USA competes in his third run of the men's skeleton competition during the FIBT Bob & Skeleton World Cup at Bobbahn Winterberg on March 6, 2015 in Winterberg, Germany. (Photo by Martin Rose/Bongarts/Getty Images)

Activating the American Development Model

Dave McCann, Sport Development Concepts

"That's one small step for a man. One giant leap for mankind"
Neil Armstrong, Mare Tranquillitatis, July 20, 1969

Although not on the same magnitude as the moon landing, the recent achievement of the United States Olympic Committee Sport Performance Division and the National Governing Bodies development of the American Development Model (ADM) is an incredibly significant milestone in taking a major step in improving the sports system in the U.S. By taking the principles of Long Term Athlete Development (LTAD) and expertly applying them to the American sport system, we now have a framework that will "help Americans realize their full athletic potential and utilize sport as a path toward an active and healthy lifestyle. The ultimate goal is to create positive experiences for American athletes at every level. By using ADM, clubs, coaches, and parents can help maximize potential for future elite athletes, and improve the health and well-being for future generations in the United States."

The true value of the ADM is that we can now develop comprehensive, integrated, strategic programs that provide tools and services for use by athletes, parents, coaches, and sports organizations. By using the ADM's five stages in order, one can provide a fun, safe and effective sport experience for children.

Key Principles

There are ten key principles of the ADM that need to be understood, promoted, and utilized in order to improve the sport experience for kids, parents, coaches and all who support healthy lifestyles and youth development.

1. Long term planning of individual physical literacy and sport skill development
2. Allowing for and facilitating free play in conjunction with adult-organized youth sports
3. Re-focusing on high participation recreation leagues instead of exclusionary elite competitive travel teams for U12
4. Allowing for developmentally appropriate play in most sports until Peak Height Velocity
5. Fostering co-operation between organizations to promote multi-sport sampling, including non-traditional sports and activities
6. Delivering developmentally appropriate skill instruction and activities
7. Integrating developmentally appropriate competition structure and talent identification programs
8. Mandating and requiring sport and athlete protection programs (sexual molestation, bullying, harassment prevention, concussion prevention and management, sportsmanship education)
9. Mandating and providing standardized national coach and volunteer trainings and certifica-

tions
10. Supporting engagement programs for athletes to continue participation in sport as coaches, officials, and administrators

The Challenge

The big challenge is how we take this structure and these principles and implement them. Having been involved in the development of numerous coach and sport education programs over the past 20 years, I have developed a great appreciation for the hard work that sport organizations and their staff do to provide the best training and programs possible in order for their athletes to have the opportunity to play their sports in a fun, safe, and rewarding manner. There is never enough money, time or resources to get the job done at the level you wish. Over the years, one of the most pressing challenges my colleagues and I have faced is discovering the best practices and finding or creating the best resources to use in programs. All of this made more difficult by the chaotic and divergent nature of the sport system, and it's been up to the individual NGBs, college, high school and youth organizations to try to piece together a development system where the needs of the athletes and coaches are met.

One key problem that we are usually too polite to bring up is that many of the people and organizations involved in youth sport in the U.S. are not in it to promote a meaningful youth sports experience, successful development of athletic potential, or improvement in the health and well-being of the American population. We have to realize that in order to make change we have to face the fact that youth sports has strayed from what its real mission should be by becoming a very large, profitable industry. There have been many good books highlighting this situation - Farrey, Bigelow, Hyman, O'Sullivan are just a few of the excellent authors who have examined the problems facing youth sports today and call for reform and change. We need to meet the challenge head on and aggressively advocate and deliver programs that will achieve the results that athletes, parents, coaches, and sports organizations really want - healthy happy people, achieving long term, consistent success on and off the field.

Strategic Initiatives

There are five main strategic areas of focus in order to meet these challenges and get youth sports back on course.

Leadership and Advocacy
We need to showcase, raise awareness of current issues, and research in sport and advocate for use of best sport development and organizational practices. We must support efforts to upgrade and improve organizational policies and programs by delivering state-of-the-art presentations to boards, staff, and members that address the concerns of an organization and provide clear approaches and solutions.

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Sport Education Programming
A renewed emphasis on developing, identifying, and delivering educational sport programming and requirements for coaches, officials, athletes, parents and administrators is a critical area. By thoroughly analyzing present programs and researching the needs and wants of an organization's membership, we can create comprehensive sport education programs for coaches, players, parents, and administrators that will be economical and efficient to integrate into and deliver through existing organizations programs, including many of the free resources currently available.

Organizational Strategic Planning and Sport Program Development
Strategic and effective use of resources is essential for long-term success. Designing and implementing organizational structures (such as youth and high school departments within an NGB) to strategically integrate sports programming in accordance with the direction and principles (co-ed play, restricted contact, appropriate competition schedules) of the ADM can significantly improve the sports experience of athletes, coaches, parents, and administrators. We need to undertake comprehensive "strategic plan" development, as well as operational budget development to assist organizations in achieving optimal effectiveness.

Research Project Management
Academic institutions working in sports science and sports management need to engage with youth,

interscholastic, and elite sports organizations to conduct research studies aimed at improving the understanding athlete and sports development issues and developing solutions to address them. A preliminary needs assessment can be conducted to determine the best course of action and make recommendations on potential partnerships.

Facilitating Collaborative Development
We need to continue to facilitate partnerships and collaborative efforts between researchers, sport education providers, and sport delivery and programming organizations. A coordinated effort is required to create, plan, and deliver conferences, seminars, workshops and practical tools and protocols that can provide organizations with forums for improving communication and cooperation among their stakeholders that lead to significant improvement in the functioning and success of their programs.

Sport Success Programming

To address this issue, we are developing the concept of Sport Success Programming (SSP), an athletic development program that combines the latest digital technology and existing sport development programs to improve the sport experience for kids, parents, and organizations. The aim of SSP is to help kids enjoy sport, become physically literate, develop fundamental skills, and build a love for being active and fit that will last a lifetime. SSP is aimed at providing a guide for parents to use to as a reference and make informed decisions concerning their child's physical and athletic development.

For Kids:
Organized youth sports provide a great opportunity for kids to have fun and be active through sport, but it cannot provide the whole answer in terms of supporting a child's athletic, social, emotional, and mental development. By engaging in "free play" or unstructured play, kids can have fun, practice independent decision making, develop social skills, expand their creativity, and increase their activity and fitness levels and skill development without adult judgment or oversight (including parents). Components of SSP for kids include tracking their physical activity across all sports, integrating physical activity with on-line gaming, encouraging them to invent and share games and activities with friends, assisting them in finding safe places to meet friends and arranging free play activities.

For Parents:
By using a holistic approach to athletic development, parents can support the growth and well-being of their child. It will allow them to be well-informed and determine if the sports organizations in which their kids are enrolling are safe and will provide the best opportunities for their child to develop their athletic potential. It will help parents to develop a practical plan that will allow them to make the best choices for the athletic development of their kids. The SSP will provide them with tools to evaluate and share their evaluations of sports clubs, teams, organizations with other parents, plan and track their kids physical activity and sports development, determine the most effective use of financial and time resources to support their kids athletic development, access to cutting edge resources on sports development and performance, and support from top sports experts.

For Coaches:
Better coaching means a better and safer sports experience for kids and their parents. The elements in the SSP facilitate better communication and sharing of information with their players, parents, club

or league administration and, tools to assist coaches in preparing for practices and competitions. Coaches will become better by identifying areas in which they need to provide support to their athletes.

For Youth Sports Organizations/Clubs, National Governing Bodies, Schools:
SSP will allow sport organizations to improve the success of their athletes and teams by providing a structured framework based on best principles of athletic development. SSP will allow them to engage the parents, kids, and coaches in their programs and improve the retention rate and skill development. SSP provides sports organizations with the system and tools to track their programs effectiveness and upgrade the quality of their services.

A New Attitude

As important as the concepts, initiatives, and programming are, the most essential element is the attitude that we embrace as we move ADM forward. The existing paradigm of youth sports being adult-driven by adult interests has to change. We need to address the short-sighted, immediate gratification culture and approach that is causing future generations to miss out on the joys and benefits of sport and physical activity.

The ADM is a great advancement in thinking and the approach to sport development in this country. We now have a fantastic opportunity to change the way we do sports in the U.S. Audacity and courage will be required to make things better for future generations. If you are a parent, coach, club administrator, or NGB staff, I urge you to learn more about how to put the ADM to work and make youth sports better for this generation and those to come. We need to take a giant leap, so let's take that first step together.

David McCann is the Founder of Sport Development Concepts which provides consulting on all matters having to do with the development of sport, including recruitment, retention, and advancement of athletes. To learn more, visit sportdevelopmentconcepts.com or email David at david@sportdevelopmentconcepts.com.

LTAD: What About the Coaches?

Matthew P. Lehrer, M.A and Bruce H. Smith, P.G.C.

Visionary, thoughtful, strategic, critical – these are the words that sport administrators use to describe the importance of a long-term athlete development model (LTAD). However, the same thought and effort has yet to be widely applied to the learning trajectory of coaches. Community Rowing Inc.'s Institute for Rowing Leadership (IRL) is using the LTAD model along with applied research concepts to reinvent the model for coaching education in sport.

Few would disagree that the single most important element for the healthy growth of sport is coaching leadership. It is not enough to just have a long-term development plan for athletes; long-term coach development ("LTCD") must be a priority to achieve both performance goals for athletes and overall societal goals for sport. The developmental pathway for coaches has a highly leveraged impact on the overall direction of sport and on individual athletes, and the LTCD model must be valued and given the same detailed and proactive attention as the LTAD model.

Many sports have coaching education programs that improve the specific skill set of coaches at any given point in time, but these efforts do not provide the systematic, immersive, and sport-specific education curriculum necessary to bring coaches along the developmental pathway from novice to expert. Typically, coaching education efforts administered by National Governing Bodies (NGBs) must serve a wide range of coaches, from newcomer to Olympic level, and as such they use resources to develop coaches spread over a wide range of abilities and locations. Some universities offer a degree program in sports leadership, and there are several programs that offer a broad-based sports education program. All of these efforts do not pay enough attention to the lifetime trajectory of coaches and the necessity for in-depth, long-term development for coaches in a sport-specific context.

To answer a need for strong leadership, Community Rowing Inc. in Boston created an intensive sport-specific curriculum that addresses the educational needs of coaches who will be leaders in the sport of rowing for the next four or five decades of their lives. These coaching fellows make up the backbone of our sport; they are the contact point for athletes all along the LTAD spectrum. More importantly, they are the cornerstones that embody a passionate commitment to rowing in the communities they work in as the most highly leveraged influencers in the re-development of rowing in the United States. The investment in a sport-specific educational program that focuses on lifetime development prepares coaches to share the life-changing aspects of sport with multiple generations of athletes and ensures the future growth and success of rowing in the U.S. for decades to come.

A Critical Need: Leadership

Community Rowing, Inc., the largest rowing club in the world, moved into the new $17 million Harry Parker Boathouse in October 2008 and immediately encountered a critical issue: a serious shortage of qualified coaches to serve the enormous demand for rowing in Boston. The lack of professional educational opportunities for career coaches resulted in a staff with widely disparate ability levels, and in turn, a widely various experience for our rowers. As a club with a coaching staff of 50-75 full- and part-time coaches, we recognized that a new approach was needed if we were to meet the potential of our mission of "Rowing for All." However, we did not have a way to provide support or guidance to improve coaches' skills beyond occasional conferences that provided tips or fragments of new information; there was no opportunity for systematic improvement. Without very strong coaching leadership, CRI's capacity to serve would be forever limited by small, incremental improvements as coaches gained experience through the practice of their craft.

To respond to this gap in our operations, we established the Institute for Rowing Leadership (IRL) at Community Rowing, Inc. (CRI) (http://www.IRLatCRI.org) in the fall of 2010. The IRL was created with a three-pronged approach to develop coaches: a monthly coaching education series, an annual coaching conference, and a full-time, yearlong, post-graduate level rowing-specific coaching education curriculum. The paradigm we constructed to inform all three levels of the IRL was based on reflective practice and applied research, terms that have gained traction in recent years in fields that benefit from the interaction of professional and academic research with daily practice in real-world situations.

The Existing Models for Coaching Education

In the realm of professional education, there have been three primary models – craft, applied science and reflective learning – over the past century, and these models can be applied to sports education with some accuracy. The traditional model of apprenticeship, where student coaches learn from a master coach by emulating the demonstrated/instructed skills, has served in most sports for the past century (Stones & Morris, 1972). This bespoke method of education depends on many circumstances coming together for the coach to gain knowledge, and is limited by the number and quality of masters. There is considerable value in this method but the gaps – inability to scale, limitations on the uptake of new information, and lack of cross-pollination in the community – make this model less than desirable.

Applied science offers a second model for coach education, in which coaches practicing on the front lines are informed periodically by experts on the latest scientific research (Wallace, 1991). While the expert knowledge is valuable, this methodology leaves the coach continually behind the research on a daily basis. Without a mechanism to impact the learning equation from their position within a dynamic environment as coach, there is a built-in lag in the system until expert researchers vet knowledge. In addition, as Wallace notes, this model does not provide coaches with an experienced professional currently practicing to guide the practical application of research in the field.

The third model, reflective practice, actively integrates the learning process with the daily practice of coaching. The reflective practice approach is based on the integration of acquired knowledge

and implementation of this knowledge immediately into practice. Newly gained applied knowledge actively informs the learning process. The reflective model integrates aspects of the craft model and applied science model. In this model, a master oversees the application of knowledge in the field and topical experts provide information on a daily basis from the leading edge of academic research. The process of reflective learning encourages coaches to acquire new knowledge from scientific study to be guided by current best practices of master coaches, and to encode and apply their knowledge as they develop a deeper understanding on the road to a personal and creative expression of their profession.

Engagement with reflective practice, both during and after an event, is important in the development of expertise in coaches (Gilbert & Trudel, 2001). Farres identifies the five key elements of reflective practice as issue identification, self-awareness, critical assessment, experimentation and evaluation (2004). All five of these elements should be incorporated into the feedback loop of daily coaching practice to actively engage the coach as an active contributor in developing his/her coaching expertise. Further, there is a large body of research demonstrating that incorporating this process into a learning community is essential for long-term retention and coach engagement (Gilbert, Gallimore, & Trudel, 2009). The application of coaching knowledge in complex situation-specific problems that are the reality of a coach's daily life is the dividing line between knowledgeable and effective coaches (Côté & Gilbert, 2009). The greatest impact on athletes and a sport is felt when the education of the coaching community is informed by knowledge contributed to the community from both subject experts and coaches in the field working with athletes across the LTAD spectrum on a daily basis.

Effective coaches working with a community of peers equipped with a reflective skill set in real time application is key to the development of a robust coaching community. Through the intentional design of a community of practice (CoP), with all coaches sharing the same passion to deepen their knowledge of a specific subject matter, a network reinforcing and contributing to the overall pool of knowledge by all members is created (Wegner, McDermott, & Snyder, 2002). Leadership is key in developing these types of communities, as coaches have traditionally tended to view their knowledge as a competitive advantage, and this perspective overrides the development of a CoP unless intentionally built and shaped by a skilled moderator (Gilbert, Gallimore, & Trudel, 2009).

The IRL Model of Coaching Education in Practice

With a mission to inspire, instruct, and equip coaches to achieve excellence in the sport of rowing, the year-long Advanced Certificate in Rowing Leadership program was designed to provide coaching fellows both a robust theoretical framework and a substantial volume of experiential learning guided by the reflective practice model. The IRL curriculum is a multi-disciplinary approach to coaching education with three major academic learning tracks and a coaching practicum to apply the classroom knowledge:

- Coaching Methods – Leadership, communication, and the pedagogy of teaching, focused on the teaching/learning interface necessary to be an extraordinary coach.
- Sports Science – A comprehensive review of the science and application of the physiological

and neurological components of performance specifically focused on athletic development of rowers.
- Rowing Administration – A detailed education about off-the-water non-rowing responsibilities critical to being a successful leader.
- Coaching Practicum - A structured internship, which includes mentoring and on-water coaching experience, to implement classroom knowledge in real time.

The year-long program is divided into four academic quarters with classes from each of the academic content streams throughout the year. The Coaching Methods and Sports Science domains make up 33 percent and 34 percent of contact hours in the program, with the Rowing Administration domain encompassing 14 percent of the total hours. For each class, instructors are selected based on their specific expertise in the subject matter, with the majority also possessing sport-specific knowledge of rowing.

IRL COURSE CATALOGUE MATRIX 2015

	Term 1: Summer		Term 2: Fall		Term 3: Winter		Term 4: Spring	
	COURSE TITLE	HRS	COURSE TITLE	HRS	COURSE TITLE	HRS	COURSE TITLE	HRS
Coaching Methods	**CM 505** Leadership in Coaching	2	**CM 500** Education: Coach as Teacher	4	**CM 520** Training Program & Assessment	2	**CM 509** Coaching Philosophy & Ethics	2
	CM 510 Coaching Novice Atheletes & Coxswains	2					**CM 515** Coaching Advanced Athletes & Technology	3
							CM 540 Rigging & Fleet Maintenance	2
	CM 550 Critical Thinking I	1	**CM 552** Critical Thinking II	1	**CM 554** Critical Thinking III	1	**CM 556** Critical Thinking IV	1
Sports Science	**SS 500** Exercise Physiology I	4	**SS 510** Exercise Physiology II	4	**SS 525** Strength Training	2		
	SS 515 Biomechanics	2	**SS 520** Sports Nutrition	2	**SS 529** Applied Sports Medicine	2		
					SS 535 Sports Psychology	4		
					SS 540 Skill Acquisition & Movement	2		
Rowing Administration	**RA 505** Sports Marketing & Branding	2	**RA 510** Team Management	2	**RA 500** Event Management	2	**RA 515** Club Administration	2
							RA 520 Sport & Community Development	1
Practicum	**CP 500** Practicum I	3	**CP 502** Practicum II	3	**CP 504** Practicum III	3	**CP 506** Practicum IV	3
	Summer total clock hours	**16**	*Fall total clock hours*	**16**	*Winter total clock hours*	**18**	*Spring total clock hours*	**14**

Running through the entirety of the program is the Coaching Practicum component, which engag-

es fellows in the process of transferring knowledge from the classroom to practical application. While only representing 19 percent of the overall course load, it is the “straw that stirs the drink” by providing fellows a platform to reinforce, implement, and encode their newly acquired knowledge. All of the coaching fellows take knowledge into the field and apply it immediately in their coaching practicum with athletes all along the LTAD spectrum, and they then return to the classroom to share their experience with their classmates as part of a CoP. This amplifies and deepens the learning process for everyone involved.

Coaching Methods

The Coaching Methods stream focuses on leadership, communication, and technical skill development, along with critical thinking and research, and has its roots in a broad base of coaching pedagogy. Encompassing a range of courses that coalesce around relationships and interactions with athletes as well as other members of the coaching and administrative team, the overall theme throughout these courses is improving the communication and relationship between coaches and athletes.

Leadership skills are foundational for all coaches regardless of their coaching context, and are a key focus for this domain of study. In addition, fellows examine the premise that the heart of good coaching relies on the teaching/learning interface. Coaches have the ability to influence their athletes in a myriad of ways as they guide them to physical, mental, social, and emotional growth in the context of sport. The Coaching Methods courses provide fellows with the tools to gain self-knowledge around these aspects of coaching. Each coaching fellow develops a core set of values and ethics that lead to an enduring coaching philosophy they can draw upon throughout their coaching career.

Reflective practice through journaling and guided reflection is essential as fellows pursue their yearlong coaching practicum. Throughout the year, the integration of reflective practice into the entirety of the classroom curriculum and application in the practicum knits together the learning process and builds this habit into the coaching DNA of each fellow. To reinforce this learning process, each coaching fellow selects a topic of specific interest to them and explores the concept deeply throughout the process of action research. During this process, they research and then implement their findings in the final quarter of the program with their coaching practicum group. The outcome of this research is a paper shared throughout the sport that serves to advance the knowledge of the larger rowing community as a whole.

Sports Science

With a sport-specific focus on rowing, the collection of classes that comprises this domain of the program establishes and builds on a strong fundamental base of knowledge to highlight specific applications in the rowing context. Coaching fellows enter the program with a wide range of educational backgrounds. Uniting the cohort of fellows with an understanding of baseline exercise physiology through four contact hours per week over the first two quarters sets the table for rest of the courses in the domain.

For coaches, a broad understanding of the many aspects of sports science that contribute to optimal performance for their athletes requires competency in a diverse range of subjects. The Skill Acquisi-

tion and Movement, Biomechanics, and Applied Sports Medicine courses together focus on the understanding and teaching of the cognitive, mechanical, and neuromuscular processes that contribute to the learning, control, and application of skills in relationship to the rowing motion.

Three additional courses in this domain focus on specific aspects of LTAD that are not tied to the rowing motion on the water, but are nonetheless essential knowledge for a coach. Both Sports Nutrition and Sports Psychology have global impacts on how athletes perform. By tuning the course content to address specific critical aspects of performance in rowing such as 2,000-meter racing, the coaching fellows develop a strong fundamental base of knowledge. Strength Training also has a global impact on athlete performance as fellows learn about appropriate exercises and training for different levels of athletes and how to teach these movements in a safe and effective manner.

Rowing Administration

While it only accounts for 14 percent of the total classroom hours, the Rowing Administration domain is a critical aspect of a coach's job. Coaches come to their profession because they love the sport, and becoming an administrator is frequently not a part of their inherent skill set. Consequently, this domain is sometimes the most challenging and time-consuming portion of the job for the many coaches.

Rowing Administration highlights the two main aspects of the administrative side of every coach's job, internal and external communications and management. Externally, specific attention is paid to marketing of the team/sport/individual, event management, and the use of sport as a tool for community development. Internally, team and operational dynamics of rowing programs are examined to equip fellows with the necessary knowledge and skills to successfully navigate the administrative aspects of their role.

Coaching Practicum

Run throughout the entirety of the program, the Coaching Practicum domain is an important differentiator in the learning process for coaching fellows. By providing course credit for the application of knowledge gained in the classroom, this domain ensures that learning engagement extends beyond the classroom to water and land contexts with actual athletes on a daily basis. With a diverse group of coaching fellows practicing this knowledge in contexts all along the LTAD spectrum, and then sharing their insights with the group, the collective learning process is reinforced and coaches gain a depth of insight beyond their own experience as part of a CoP.

Individual coaches also have the experience of applying their knowledge in a coaching context that matches their desired career path. Within the robust rowing community of Boston, coaching fellows apply their knowledge in contexts ranging from middle school through to elite athletes that are competing internationally at the highest level of rowing. Because of the wide range of coaching experience of fellows entering the program, our location, with a diversity of placement options, is critical to finding a fit that is beneficial for both the fellow and the program in which they are placed. In each coaching practicum, a master coach mentors and guides fellows through regular and systematic feedback as a member of their coaching staff.

Further, all coaching fellows are evaluated regularly throughout the year in their coaching practicum by IRL staff to give them feedback on the implementation of their coaching knowledge on the water. Fellows are given a quantitative analysis of their observable coaching behaviors regarding time analysis, practice design/delivery, and coaching interventions, as well as a qualitative analysis of their coaching performance. With multiple opportunities over the course of the year, these systematic observations allow for continued follow-up and tracking of fellow progress and direct assistance in improving the application of their coaching skills in real time.

Structure of Classroom Activities

The IRL's Advanced Certificate in Rowing Leadership program uses a small cohort size to enhance learning during daily classroom activity. Cooperative learning is an essential element of daily pedagogical practice. As discussed by Brown & Ciuffetelli (2009), the five basic and essential elements to cooperative learning are:

1. *Positive Interdependence*
- Fellows must fully participate and put forth effort within their group.
- Each fellow has a task/role/responsibility and therefore must believe that they are responsible for both their learning and that of the group.

2. *Face-to-Face Interaction*
- Fellows promote each other's success.
- Fellows explain to one another what they have learned or are learning, and assist one another with understanding and completion of assignments.

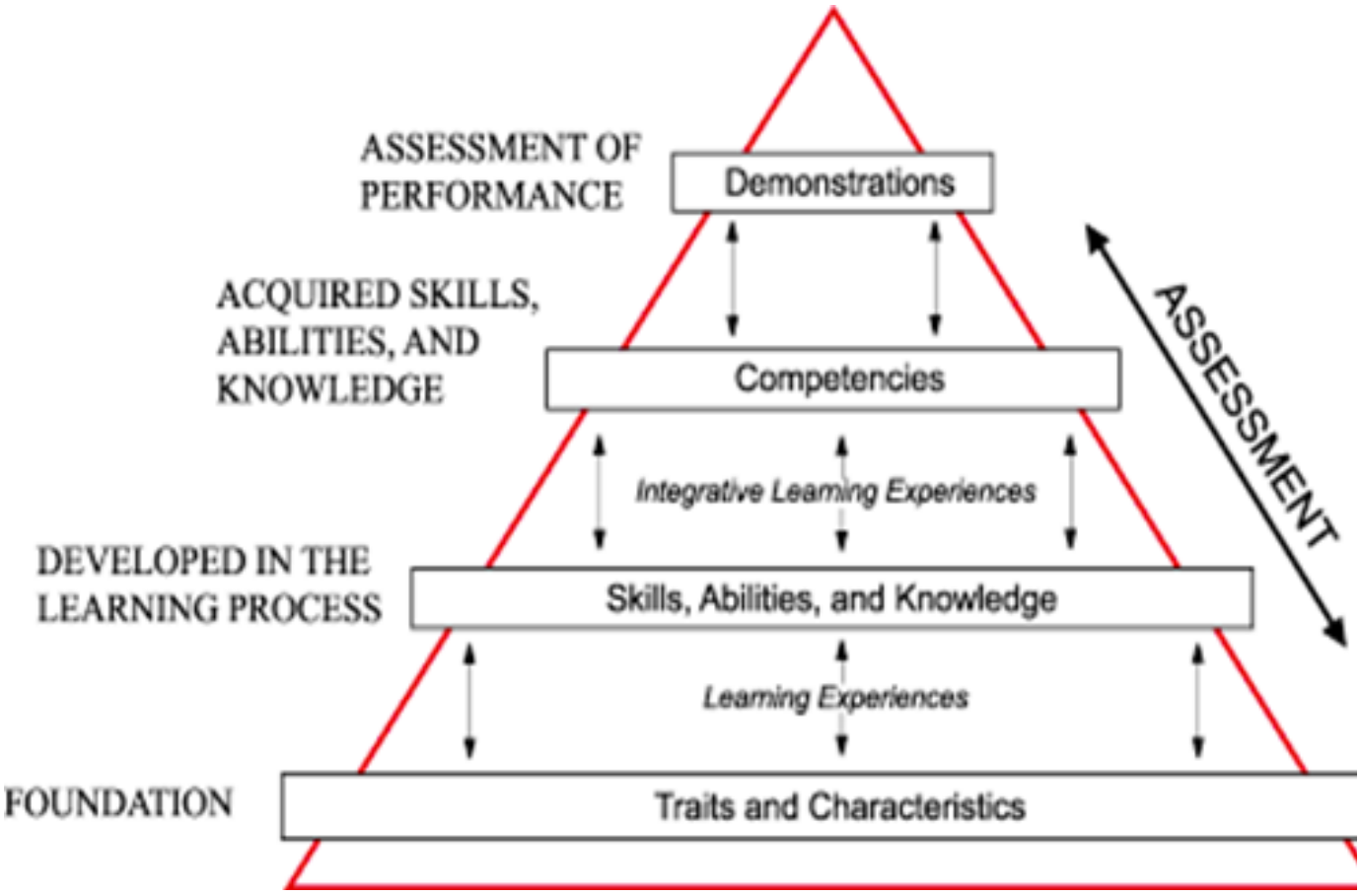
3. *Individual Accountability*
- Each fellow must demonstrate mastery of the content being studied.
- Fellows are accountable for their learning and work, therefore eliminating "social loafing."

4. *Social Skills*
- Skills include effective communication in interpersonal and group settings in:
    i. Leadership
    ii. Decision-making
    iii. Trust-building
    iv. Communication
    v. Conflict management

5. *Group Processing*
- Regularly, the group must assess their effectiveness and decide how it can be improved.

In the application of these principles, certain course curriculum elements and activities lend themselves to cooperative learning activities. By working with all IRL instructors to encourage this process, cooperative learning is built into the classroom structure across the curriculum and allows the richness of the experience of the coaching fellows to enhance the learning process for all in their CoP. In addition, when constructing assessments for their coursework, instructors are encouraged to take

principles of competency-based education into consideration. A hierarchy of outcomes as outlined and defined by the US Department of Education (2002) below is used to guide instructors as the content of courses is built and as evaluations are constructed in the classroom.



Traits and Characteristics are the foundation for learning in each individual on which further experiences are built. Differences in personal traits and characteristics help explain differences in learning experiences and how individuals acquire different levels and kinds of knowledge and skills.

Skills, Abilities, and Knowledge are developed through learning experiences, broadly defined to include school, work, participation in community affairs, etc.

Competencies are the result of integrative learning experiences in which skills, abilities, and knowledge interact to form bundles that have currency in relation to the task for which they are assembled.

Demonstrations are the results of applying competencies. It is at this level that knowledge comes to bear and performance can be assessed.

Next Steps

Maximizing the impact of coaches to have outsized value to the sport can only come through investment in a LTCD model alongside LTAD to ensure future growth and leadership in the sport. We have already seen in our three classes of alumni the ability of IRL coaching fellows to have a life-changing impact on athletes across the LTAD spectrum. The investment made through the Institute for Rowing Leadership will continue to reap benefits for both the individual graduates and for the entire sport of rowing for many years to come.

With a background in the sports industry domestically and abroad, Matt Lehrer is the current Director of Coaching Education at Community Rowing, Inc. and the Institute for Rowing Leadership. Driven by the belief that sports present a unique arena to positively impact lives, his passion for working intensively with coaches to improve their craft is rooted by the profound influence sport has had on his life. His current role provides a myriad of opportunities to engage with coaches at all stages along the pathway of learning and an opportunity to grow the sport by driving positive athlete experiences through long-term coach development.

Bruce H. Smith is a former US National Team Coach and a graduate of McGill University and the University of Chicago. Executive Director of Community Rowing, Inc. since 2008, he has almost quadrupled operating income from $900,000 to more than $4 million dollars, increased participation across all programs by more than 100%, and created several innovative initiatives to transform CRI into the largest rowing club in the world. Bruce also founded the Institute for Rowing Leadership, the country's first graduate level program designed to bring coaching to a new level of professional development. With more than 150,000 rowers in the United States, the sport needs trained, well-rounded coaches and leaders, and the IRL provides a yearlong education program to develop that leadership.

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Appendix A – Course Descriptions

Coaching Methods

CM500 – Education and Instruction: Coach as Teacher

Teaching, and the pedagogical theory that informs it, has tended to lie outside of the traditional domain of coaching. This course challenges that premise and re-conceptualizes coaching based on the notion that at the heart of good coaching lies the teaching and learning interface, and the myriad of ways through which coaches influence athletes to develop and improve. Through an analysis of essential educational pedagogy, the class will bridge the gap between the theoretical and the applied by providing fellows with the tools to necessary to become teachers of sport. 4 clock hours

CM505 – Leadership in Coaching

Development of leadership skills is foundational in becoming a successful coach. In this course, fellows will be introduced to historic and current leadership theory. Additionally, fellows will engage in critical leadership skills such as developing, defining and defending philosophies and concepts, critical self-analysis, productive criticism of others, and collaboration. Fellows will be exposed to rowing-specific leadership challenges in every class, and will be asked to apply the concepts provided in class to solving these concept problems. The most critical element this class will seek to instill in the fellows is the capacity to think more clearly and critically about leadership. 2 clock hours

CM509 – Coaching Philosophy and Ethics

Throughout this course, fellows will develop an understanding of the role sport plays in democratic culture and cultivate a set of values and ethics as it relates to their own personal coaching. Topics will pull from a variety of primary sources, such as leading texts, case studies and personal experiences, as the course examines modern beliefs about competitive sport, its relationship to academics, and the role of the coach. 2 clock hours

CM510 – Coaching Novice Athletes and Coxswains

The instruction and development of novice rowers and coxswains forms the basis of this course, which bridges the gap between theory and on-the-water coaching applications. Fellows will examine approaches to the introduction to, as well as acquisition and refinement of, basic skills and apply research-based instructional techniques related to developmentally appropriate verbal instruction and motor learning strategies,including a purposeful approach to coxswain skill development. Additionally, fellows will examine retention models and consider how the initial experience for rowers and coxswains determines their likelihood of continuing to pursue the sport. 2 clock hours

CM515 – Coaching Advanced Athletes and Technology

Building on the basic instructional methods introduced in CM510, this course leads students through an in-depth study of sophisticated techniques designed to maximize individual potential. The primary objectives of the competi-

tive athlete – team/squad selection, the improvement of sport-specific fitness, acquisition and refinement of advanced/complex skills, acquisition of advanced tactics/strategies, and meeting performance standards – provide the framework for the course content. In the course, there will be a blend of classroom-based analysis and discussion as well as on the water real time analysis of rowers in action out on the river. Additionally, this course also completes a comprehensive survey of technological resources available to coaches, including a study of the newest cutting-edge analytical and instructional tools, giving the most up-to-date coaches a distinct competitive advantage on the water. 3 clock hours

CM520 – Training Program Design and Athlete Assessment
Through this course, fellows will examine the importance of different factors in creating an annual training plan. Specific topics include aerobic, anaerobic and strength training as well as periodization and overtraining. Each fellow will develop his or her own scientifically-informed training plan designed and adapted to athlete age and skill level. This course also provides guidance in the establishment of appropriate criteria for the selection of team members, effective communication behaviors between coaches and athletes, and the art of assembling a crew. 2 clock hours

CM540 – Rigging and Fleet Maintenance
Effective preparation for on-the-water success depends on keeping your equipment in the best shape possible and knowing how to make repairs when necessary. This course will focus on four critical elements: appropriate rigging for crews, boat and oar repair, equipment trailering, and small motor maintenance and restoration. With a mix of classroom sessions and practical application workshops in rigging and repairing boats/motors as well as safe trailer preparation, operation, and maintenance in a hands-on setting, fellows gain the practical skills essential for keeping their crews and equipment in top form. 2 clock hours

Critical Thinking & Research
The Critical Thinking & Research component of the IRL prepares fellows for a professional career sustained through reflective practice. This coaching colloquium is designed as a work in progress with the dual objective of (a) assisting fellows in the development of their action research project and guiding them through the process and (b) helping fellows understand how reflective writing practice can offer a valid insight into the interpretation of sport and coaching.

CM550 – Critical Thinking & Research I
The first quarter of Critical Thinking and Research introduces fellows to various research methodologies, designs, and paradigms. Also, this course assures each fellow has the skill set necessary to utilize online resources effectively. 1 clock hour

CM552 – Critical Thinking & Research II
This course is dedicated to the deconstruction of available research and data relating to rowing. Fellows will demonstrate the ability to analyze various research studies and published articles. 1 clock hour

CM554 – Critical Thinking & Research III
The development and implementation of an action research project forms the basis of this course. Fellows will complete a survey of the relevant literature along with completing a proposal for their action research project. 1 clock hour

CM556 – Critical Thinking & Research IV
In the final course of the Critical Thinking & Research sequence, fellows will put their action research project into practice. A final presentation will be made demonstrating the fellow's findings resulting from their action research project. 1 clock hour

Coaching Practicum
The Coaching Practicum component of the IRL (CP500, 502, 504, and 506) is critical in taking the knowledge and experience gained in the classroom and translating it into direct communication with athletes to enhance their

performance. The definition of coaching should reflect the broad academic content of the IRL program. In addition to on-the-water athlete instruction, this includes experiential learning opportunities in the management of the team, overall organization of the program, study and implementation of technique and strategy, event management, fundraising, and more.

Each fellow will have the opportunity to wear the many necessary hats of the rowing coach – teacher, physiologist, personal trainer, psychologist, fundraiser, and administrator – that compose the aggregate leader the IRL seeks to develop. Through the connection with the IRL program, fellows are matched with local teams that match their eventual desired career path, whether that is to work with collegiate, elite, junior or masters athletes.

CP500 – Practicum I
The first quarter practicum is a complete immersion in the coaching of novice rowers. By learning to build the stroke from the ground up, each fellow learns the necessary skills in methodology and communication to effectively articulate their vision of the rowing stroke to the athletes they are coaching. 3 clock hours

CP502 – Practicum II
The second quarter practicum places fellows with a coaching position that matches their eventual coaching career goals. Fellows will employ both coaching and athlete recruitment skills in working within their coaching assignment to enhance the goals of their program. 3 clock hours

CP504 – Practicum III
The third quarter practicum is a guided preparation of the fellow's action research proposal along with practice in off-season training activities. Additionally, the fellows will gain event management experience in this term through their work with the C.R.A.S.H.-B Sprints Indoor World Championships. clock hours

CP506 – Practicum IV
The fourth quarter practicum is the final installment in the experiential learning component of the IRL, with a focus on instruction and performance of competitive athletes in the spring racing season. 3 clock hours

Sports Science
SS500/510 – Exercise Physiology I & II
This course, taught in two parts over the course of the summer and fall quarters, takes an in-depth approach to understanding the human body's adaptation to acute and chronic exercise. Fellows will begin with a foundational overview of exercise science concepts before exploring a wide range of topics, including the cardiovascular system and response to physiological stress, the ATP-PC, glycolytic, and oxidative energy systems, physiological variables (e.g. age, gender), exercise testing, the psychophysiological factors of health and fitness, over-training, etc. The course is structured to prepare fellows to take the National Strength and Conditioning Association's (NSCA) Certified Strength and Conditioning Specialist (CSCS) Exam. 8 clock hours

SS515 – Biomechanics
This comprehensive course emphasizes the concepts of biomechanics and their application to rowing and sculling. These concepts are numerous and complex, involving basic mechanics, the mechanics of human tissue, kinematics, kinetics, and fluid mechanics. A detailed study of these biomechanical concepts and structural kinesiology is designed to give fellows the ability to apply biomechanical information to rowing-specific movement patterns. 2 clock hours

SS520 – Sports Nutrition
The purpose of this course is to provide fellows with a basic understanding of the relationship between nutrition, health, and athletic performance. This course will apply modern nutritional science research to sports training and competition with a focus on what coaches and athletes need to know about nutrition for optimal performance, specifically in the rowing context. 2 clock hours

SS525 – Strength Training
Each fellow will receive instruction in the principles for development of pre-season, in-season and off-season strength and conditioning programs. Classroom activities in theory and strength acquisition will be taken to the weight room for application where fellows will learn (and do themselves) the proper movement patterns as well as progressions for teaching their athletes proper strength training technique. 2 clock hours

SS529 – Applied Sports Medicine and Injury Prevention
In this course, the role coaches play in appropriate application of sports medicine and injury prevention is addressed. Emergency procedures, acute injuries, overuse and overtraining, NCAA and scholastic rules, problem athletes, common injuries to rowing, and the psychology of injury are key topics discussed. As part of the course, fellows will also take coursework to receive CPR/First Aid certification. 2 clock hours

SS535 – Sports Psychology
Understanding the complex psychological processes involved in maximizing athletic performance forms the core of this course. Through the critical examination of both research and practical experience, fellows will identify the knowledge and skills necessary to a guide practice in the field of sport psychology and the administration of sport psychology interventions with their athletes and teams. 4 clock hours

SS540 – Skill Acquisition and Movement
This course addresses the principles related to learning and control of psychomotor skills through a focus on motor skill acquisition and control. Primary focus is placed on the cognitive and neuromuscular processes underlying acquisition of motor skills and neuromuscular factors related to skilled motor performance. This course converts the fundamental physical education theories and the current research into practical instructional procedures. 2 clock hours

Rowing Administration
RA500 – Event Management
The successful administration of competitions, whether it is the relative simplicity of a dual race or a multi-faceted championship regatta, is critical to providing an effective arena for athletic performance. Additionally, special events, such as fundraisers and community outreach events, are essential tools in the growth and development of the sport of rowing. The focus of the course will be understanding and developing the narrative aspects that go along with the execution of a successful event. Two critical components of this course will be the involvement of fellows in the C.R.A.S.H.-B. Sprints World Indoor Rowing Championship as well as applying their learning by running all aspects of an indoor ergometer race for members of Community Rowing, Inc. 2 clock hours

RA505 – Sports Marketing and Branding
This course examines the role that marketing and branding play in two contexts: the development of a successful rowing club/team and cultivation of each fellow's individual brand. Sports marketing topics include using a strategy-based perspective to establish an appropriate target market, brand positioning, utilization of social media and word-of-mouth, as well as developing relationships with key community partners. On the individual level, fellows will consider how the concepts of marketing and branding apply toward their individual career path. 2 clock hours

RA510 – Team Management
In this seminar-based course, the intra- and inter- personal aspects involved in the successful operation of a rowing club/team are fleshed out. The major focus of the course is administrative theory and practice that leads to more efficient coaching. Competence in administration is a critical marker of job success for coaches. Fellows will discuss the functions of effective task management, management of coach-athlete relations and mentoring, develop a plan for overall team management, address NCAA rules and policies and formulate long-range and intermediate team and individual goals. As part of this course, fellows will also become certified by the NCAA for recruiting of student-athletes. 2 clock hours

RA515 – Club Administration
This course is an in-depth study of the myriad of different practical elements that impact the successful administration of a rowing organization. Through this course, fellows will acquire the skills necessary to develop job descriptions for team personnel, communicate appropriately with personnel concerning performance, evaluate personnel and identify principles of effective time management. Additionally, fellows will discuss factors that influence aid-raising and the typical business functions of different rowing organizations (e.g., youth, club, colleges, universities) associated with athletic programming (e.g., purchasing, accounting, travel reimbursement) with specific focus on understanding best practices in budgeting and finance. 2 clock hours

RA520 – Sport and Community Development
Fellows will get a broad understanding of key concepts of community development theory and practice, as well as the emerging field of Sport for Development. Through readings, class discussion, review of best practices and model programs from the field, fellows will be able to articulate the merits of sport as a viable mode of community development by the end of the course. 1 clock hour

Jill Ellis head coach of the United States looks on prior to the Women's Friendly International match between England and USA. (Photo by Tom Dulat/Getty Images)

On the cover: Hannah Kearney of the USA win the overall globe for the FIS Freestyle Skiing Dual Moguls on March 15, 2015 in Megeve, France.

Cover photo by: Laurent Salino/Agence

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