



# OLYMPIC COACH

## SPORT PERFORMANCE DIVISION

TeamUSA.org

Winter 2013



**Revising the Definition  
of Periodization: Merging  
Historical Principles with  
Modern Concern**

**Team USA Athletes in  
Action**

**The FMS and its  
Relevance within Elite  
Sport Performance**

**The Role of Deliberate  
Practice in Becoming an  
Expert Coach: Part 2 –  
Reflection**

**Focus**

**A Glimpse into Dave  
Wagner's Training  
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## Contents

### 5.... Revising the Definition of Periodization: Merging Historical Principles with Modern Concern

Brad H. DeWeese, United States  
Olympic Committee,  
Howard S. Gray, Florida State University  
Matthew L. Sams, East Tennessee State University  
Steven K. Scruggs, Lake Placid  
Olympic Training Center  
Ambrose J. Serrano, Lake Placid  
Olympic Training Center

### 19.... A Glimpse into Dave Wagner's Training Regimen

Eric Lawson, United States Olympic Committee

### 23...Focus

Wendy Borlabi, United States Olympic Committee

### 24.... Team USA Athletes in Action!

Sherry VonRiesen, United States Olympic Committee

### 26... The FMS Screen and its Relevance within Elite Sport Performance

Tim Pelot and Anthony Darmiento,  
United States Olympic Committee

### 32.....The Role of Deliberate Practice in Becoming and Expert Coach: Part 2 - Reflection

Wade Gilbert, Ph.D., Fresno State University, USA  
Pierre Trudel, Ph.D., University of Ottawa, Canada

## Message from the Chief of Sport Performance

Alan Ashley



Greetings and welcome to our first edition of 2013! With a successful 2012 behind us, we are in the midst of the Winter Sport competitive season including World Championships in most of the Olympic sports. With less than a year left before Sochi, everyone is focused on fine-tuning preparations to make sure our efforts to support the athletes are solid and effective. Team USA Olympic and Paralympic athletes continue to train and compete at high levels around the world and our role is to support the athletes in their pursuit of podium finishes in Sochi, Rio, and beyond. We're ready, and our athletes have shown they are as well!

This issue of *Olympic Coach* will include the second installment of the Gilbert and Trudel Deliberate Coaching piece. We are excited to explore how reflection can assist coaches in being better prepared themselves which, in turn, assists them in being a better coach to their athletes. This issue also includes a feature on Paralympic medalist Dave Wagner and his preparations for London, and contributions from a number of our USOC Sport Performance service providers. In addition, we wanted to share how some of the athletes here in Colorado Springs activated to support the victims of the Sandy Hook Elementary School tragedy.

We are enjoying watching our winter NGBs compete this season, particularly the historic finish for the women's Cross Country Ski Team of Kikkan Randall and Jessie Diggins - atop the podium in the US World Cup team sprint competition earlier this year (a first) - and who just won the *first-ever* gold by an American team in a World Championship in Italy. Two firsts for our fantastic athletes who are blazing toward Sochi! In addition, US Biathlon's Tim Burke podiumed for the first time at the World Championships in Nove Mesto (Czechoslovakia) with only the second World Championship medal in US Biathlon history.

I'm excited to announce a new initiative the Coaching Education Department is taking on – activating our new mobile application for coaches that will be available to NGB members as an additional benefit. We will pilot a few NGBs in early Spring to engage their coaches in this new mobile resource, sharing the NGB-specific information along with USOC sport science-related information to put this information directly into the hands of the coaches. We will be expanding the pool of NGBs later this summer and hope to contribute significantly to the distribution of coaching information to the NGB member coaches. Stay tuned for more information on this.

We hope you are planning to join us for the 2013 National Coaching Conference that the USOC will host in Colorado Springs this June 19 – 21. Programming will include practical application of research and information from many well-known researchers and sport scientists. We are also preparing to honor the 2012 Coaches of the Year on June 21st as part of this event. Finalists in the categories of developmental, Doc Counsilman science and technology, national, Paralympic national, and volunteer will be brought to the Springs to be honored at the USOC Coach of the Year Awards Dinner. National award winners will be announced that evening. We look forward to sharing their stories and recognizing all of the great coaches and their accomplishments for the 2012 competitive season. We hope you can join us in the Springs this summer!

Please enjoy this issue of *Olympic Coach*! We've been pleased with the response on recent issues and look to expand the delivery of this free resource. Best of luck in 2013 and Go Team USA!





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## Revising the Definition of Periodization: Merging Historical Principles with Modern Concern

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### The Power of Sport

Building and sustaining excellence is arguably a primary objective for any country competing in international elite sport. While Araujo and colleagues (Araujo, 2007) state the concept of sporting excellence is not clearly defined, it can be posited that excellence within high-performance sport is the ability of a nation to chronically produce an abundance of podium-ranking performances as the result of a multi-faceted, elite-athlete development program. This is significant as many nations consider athletic success a marker of their country's political, economic, and militaristic position on the global scale. Yessis reminds us that some nations have considered international sport a war without employing the tools of war (Yessis & Trubo, 1988). This particular attitude and belief is amplified during the Olympic Games, where nations vie for dominance of the medal count over a two-week period of competition across a variety of sporting disciplines.

Within the Olympic Movement, the primary goal of the United States Olympic Committee is to help American athletes achieve sustained, competitive, excellence and increase medal opportunities for Team USA. This objective is only achievable through competitive success in a vast array of sporting disciplines. As such, the athletes representing the U.S. must be sent into Olympic competition at peak physical readiness. For this reason, sport performance professionals and coaches alike must adopt training theories and practices that will optimize competitive preparedness.

Performance professionals in the field of high-level competitive sports, such as the Olympic setting, are faced with the challenge of enhancing the preparedness of athletes who are already considered the "best" in their respective sport. However, small improvements in an elite athlete's performance capabilities are vital for the continuation of competitive success. Even in the Olympic Games, these marginal improvements are considered valuable, as the difference between a podium finish or not can be less than one percent in sports such swimming, track & field, weightlifting, and bobsled (Mujika & Padilla, 2003).

### The Periodization Paradox

In order to ensure athlete preparedness in the high performance sport setting, strength and conditioning professionals employ many types of periodization. To date, periodization has evolved in practice, while the current pool of definitions has maintained traditional constructs. Even though an abundance of literature emphasizing the utilization of periodization training models in the development of athletic performance exists, some sport science professionals have called for extensive research to determine which methods are most appropriate for elite athletes given updated knowledge in regards to individualized, physiological responses to training (Bompa, 1999, Bompa & Haff, 2009, Fleck, 1999, Haff & Haff, 2012, Kraemer & Fleck, 2007,

Kraemer & Hakkinen, 2002, Plisk & Stone, 2003, Schiötz et al, 2002, Stone, O'Bryant & Garhammer, 1981, Stone et al., 1999, Stone et al., 1999, Stone & Stone, 2008, Wathen, Baechle & Earle, 2000, Zatsiorsky & Kraemer, 2006).

Specifically, John Kiely challenges our current thoughts on periodization in his article *Periodization Paradigms in the 21st Century: Evidence-led or Tradition-driven*. Within this thought-provoking piece, the author questions periodization philosophies' assimilation of advances in scientific insight – do practitioners understand the role of individual variation in response to training, or do they assume that biological adaptations to training are predictable and determinable without regard to scientific rigor (Kiely, 2012)? As Kiely states, the field is becoming “disconnected from contemporary scientific practice.” The article suggests it is essential for practitioners within this field to maintain knowledge of current scientific literature in order to continue the evolution of training theory as it relates to athletic development.

Second, there is a call for a clear and unbiased assessment of what biological adaptations occur throughout the training process, in addition to a description of the science behind choices made in the planning stages. Kiely advocates unbiased analysis of a program that considers both performance successes and failures. The author indicates the assessment of a periodized training program can only be done through the employment of critical thinking. This reflective process should be clear of feelings and assumptions and should be guided by “evidence contextualized against conceptual understanding.”

Finally, Kiely asks if we – as sport performance professionals – employ training systems based upon presumptions, or if we reinforce our planning choices with updated scientific understanding of biological processes? While the question posed to the field of sport science is timely and valid, the author points out most of the current research and literature continues to focus on the efficacy of one training plan over another (Apel, Lacey & Kell, 2011, Brown, 2001, Buford et al., 2007, Fleck, 1999, Fröhlich, Emrich & Schmidbleicher, 2010, Bowerman & Freeman, 1991, Hoffman et al., 2009, Issurin, 2008, Issurin, 2010, Jiménez, 2009, Johnson et al, 2011, Kerksick et al., 2007, Lewing et al., 2010, Mann, Thyfault, Ivey & Sayers, 2010, McNamara & Stearne, 2010, Miranda et. al., 2011, Monteiro et. al., 2009, Painter et. al., 2011, Painter et. al., 2012, Prestes et al., 2009, Prestes et al., 2009, Rhea et al., 2002, Rhea et al., 2003, Rhea et al., 2002, Simão et al., 2012). While evaluation of various training protocols is important, the purpose of this article is not to add to the ongoing discussion on various periodization strategies, but to propose an updated definition of periodization that fills in the gaps apparent made by Kiely.

Although a portion of the sport performance profession may disagree with Kiely on his assertion that many of the periodization studies to date are based on dogma or archaic beliefs regarding the implementation of periodization strategies, we can acknowledge that Kiely may be correct in his statement that a universally accepted definition of periodization does not exist. Furthermore, no currently accepted definition of periodization implicitly states the planning process should be guided by scientific rigor and based on individual responses made apparent through athlete monitoring. While some sport performance professionals can argue that this goes without saying, it should not be inferred or assumed that practitioners are up-to-date on – or base their decisions on – the ever-evolving scientific literature. For this reason, a revised definition of periodization should concretely state the need for consistent monitoring and reevaluation of the scientific literature to ensure optimal adaptation and progress in development of an athlete in the high-performance setting.

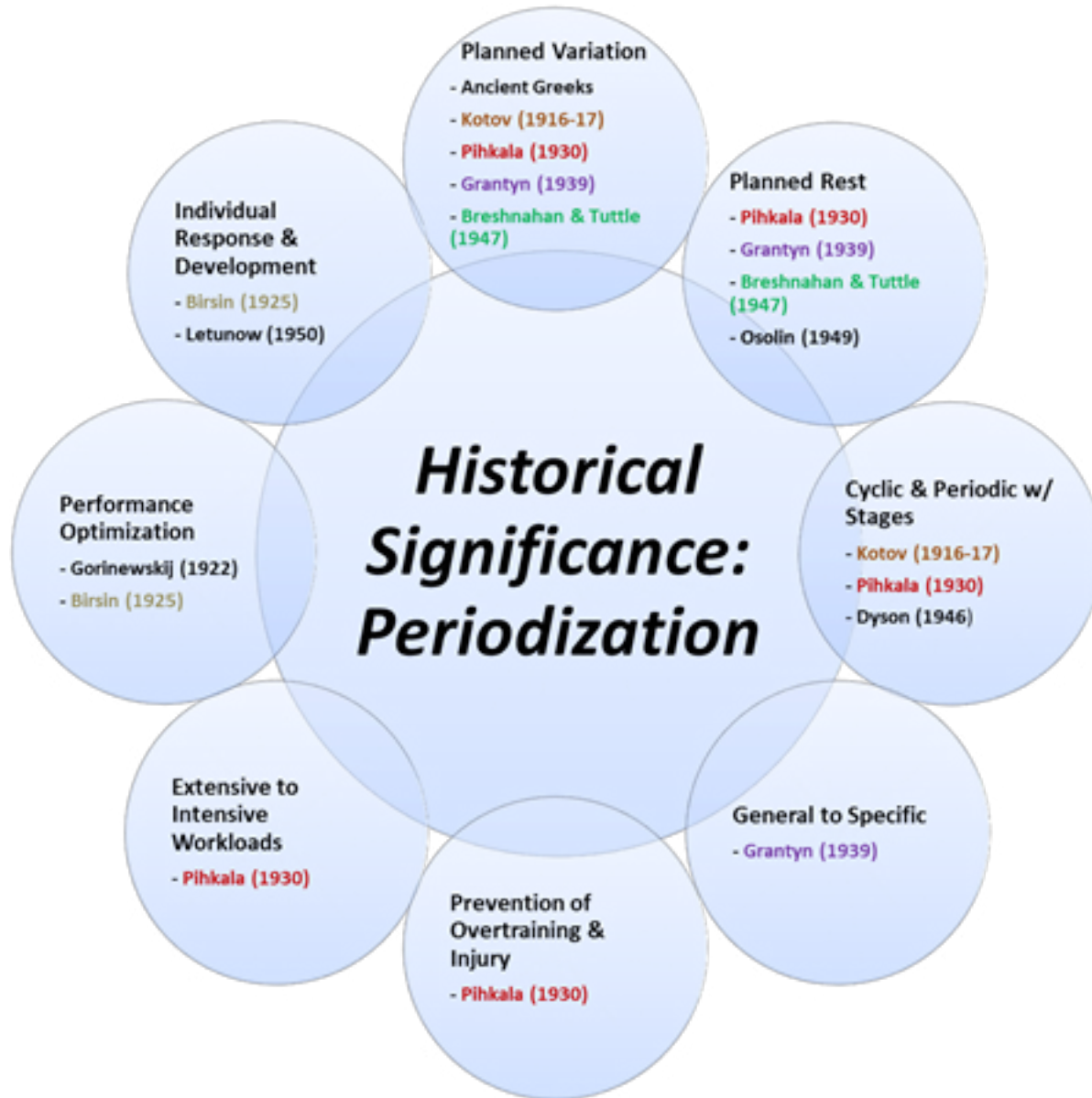
### Periodization: A Stagnant Definition

The founding constructs of periodization can be traced back to ancient Greece (Konig, 2005). As Pedemonte explains however, periodization of training plans did not become important until the early 20th century. This sudden shift in program design was the result of an increased number of athletes taking part in year-long training (Pedemonte, 1986a). Of note, one of the first documented texts regarding long-term, segmented training was Kotov's 1916-1917 publication, *Olympic Sport*. Specifically, Kotov introduced the strategy of dividing a training period into general, preparatory, and specific stages (Pedemonte, 1986a). This was a landmark deviation from the previously accepted opinion that athletes should limit training to eight to ten weeks prior to competition in order to prevent burnout or physical harm. For the next few decades, the underpinnings of modern periodization developed through the work of sport-focused authors such as Pihkala, Mang, Dyson, and Osolin. While a detailed, historical account of periodization is beyond the scope of this article, Diagram 1 provides insight into the contributions made by the aforementioned authors. Specifically, Diagram 1 is a generalized overview of how the originating thoughts of periodization developed to become a single definition. Of interest, this diagram demonstrates how each author's individual examinations and "laws" of training manifested into what are now considered "modern-day tenets."



*Paige McPherson of Team USA celebrates Bronze medal Taekwondo win in London. Photographer: Hannah Johnston, Getty Images*

Diagram 1. Founding Constructs of Modern-Day Periodization



To date, many of the current thoughts on periodization strategies and practices are based on the work of Leo Pavlovic Matveyev, who is considered the father of modern-training periodization. Within his text, *Fundamentals of Sports Training*, Matveyev provides detailed insight into how periodization is the process of governing the training process through objective laws and principles (Pedemonte, 1986b). Specifically, Matveyev (1977) states:

*“The integrity of the training process is ensured on the basis of a definite structure which is a relatively stable order of uniting its components (parts, aspects, and links), their regular correlation with each other, and their general consequent character.*

*“If we concretise this definition with the help of the notions discussed earlier, we can say that the structure of the training session is characterised in particular by the following: a rational order of the interaction of various aspects of the content of an athlete’s training (components of the general and special physical training, physical and technical training, etc.); the necessary correlations of parameters of the training loads (quantitative characteristics of the volume and intensity of training work), as well as by the training and competitive loads; a definite sequence of different links of the training process (separate sessions and their parts, stages, periods, and cycles) which are the phases or stages of the given process, expressing regular changes in time” (p. 245).*

In addition, Matveyev noted that early adopters of periodization based their training decisions on both the competition calendar and the climatic conditions. He rejects this initial dogma, however, and asserts that the periodization of the training process must be attributed to the development of sporting form. Matveyev (1977) supports this shift in ideology by establishing a concrete definition of sporting form, that reads:

*“A state of optimum (best) readiness of the athlete for achieving sporting result which is acquired under definite conditions in each big training cycle (annual or semiannual). It is characterized by a complex of physiological, medical-control, and psychological indices. On the whole, sporting form is a harmonious unity of all the aspects (components) of the athlete’s optimum readiness: physical, psychic, technical, and tactical” (p. 260).*

While Matveyev provided great insight into the intricate details of the training process, most of the currently accepted definitions of periodization continue to follow the principles set forth in his text, regardless of recent infusion of science and technology in the development of the modern athlete. Moreover, many of these definitions are strikingly similar to those proposed by earlier adopters of periodization such as Pihkala (Pedemonte, 1986a). To date, one of the most comprehensive definitions of periodization is that of Plisk & Stone (2003), which is detailed in Table 1. While this detailed definition proposes that planning choices be based on an athlete’s biological responses to training stimuli, developmental status and the specific demands of his or her sport, it does not represent modern concerns made apparent by Kiely and others. Specifically, the definitions listed in Table 1 lack the explicit terminology that emphasizes periodization strategies be based on an individual’s physiological, biochemical, and psychological responses made apparent through the utilization of an athlete-monitoring program and ongoing study of scientific literature. This missing component to the definition of periodization is not a failure of modern-day sport scientists, but rather a demonstration of how quickly sport has evolved. In other words, we as practitioners are having to keep up-to-date with the sudden influx of valid and useful technology and evolving scientific evidence that has entered the sporting arena. As a result, the definition of periodization should be revised in order to align historical principles with modern advances. This fundamental shift in how we define periodization

**Table 1. Proposed definitions of periodization following the work of Matveyev.**

<b>Authors</b>	<b>Year</b>	<b>Definition</b>
Doherty, K.	1980	Within all time segments – periods, phases, and cycles and sub-cycles; high levels of stress should be balanced by active rest – physically recuperative, mentally enjoyable, emotionally relaxed and the monotony of year-round training avoided by use of variety in every form.
Stone, MH., O'Bryant, HS., & Garhammer, J.	1981	The basic tenet of periodization is a shift from high volume and low intensity of training during the early season (preparation phase) to an emphasis on high intensity, but low volume of training (competition phase) during the late season. Technique training also increases during this latter part of the season. The competition phase is followed by a period of “active rest” during which the volume and intensity are both low and the athlete trains at a recreational level.
Stone, MH., & O'Bryant, HS.	1987	The concept of periodization, originally proposed by Matveyev in 1961, embodies and manipulates these basic training principles (frequency, duration, intensity, variation, specificity) in a manner that reduces the potential for overtraining and brings performance to optimum or peak levels.
Bowerman, WJ. & Freeman, WH.	1991	Dividing the training process into periods of time with different training emphases, goals, and lengths. Each period prepares the athlete for the next, a more advanced training period, until the athlete peaks at the most important competition of the year.
Kibler, WB., & Chandler, TJ.	1994	A plan for conditioning based on manipulation of the volume (frequency times duration) and intensity of the work an athlete does during various periods of an athletic season.
Zatsiorsky, VM	1995	A division of the training season into smaller and more manageable intervals (periods of training, mesocycles and microcycles) with the ultimate goal of reaching the best performance results during the primary competition(s) of the season.
Martin, DE. & Coe, PN.	1997	The specific time scale and format for all the various parts of a training plan. The training life of an athlete is a constant cycle of hard work, recovery, improvement in performance and brief layoff to permit another cycle to repeat.
Siff, MC. & Verkoshansky, YV.	1998	The overall long-term cyclic structuring of training and practice to maximize performance to coincide with important competitions.
Schiotz, MK., Potteiger, JA., Huntsinger, PG., & Denmark, DC.	1998	Periodization utilizes the theories of General Adaptation Syndrome, organizing training into cycles of undulating volume and intensity to achieve training objectives, prevent overtraining, and optimize performance.

<b>Authors</b>	<b>Year</b>	<b>Definition</b>
Bompa, TO	1999	A process of structuring training into phases.
Stone, MH., O'Bryant, HS., Schilling, BK., Johnson, RL., Piece, KC., Haff, GG., & Stone, M.	1999	A logical phasic method of manipulating training variables in order to increase the potential for achieving specific performance goals.
Fleck, SJ.	1999	Periodized strength training refers to varying the training program at regular time intervals in an attempt to bring about optimal gains in strength, power, motor performance, and/ or muscle hypertrophy.
Wathen, D., Baechle, TR. & Earle, RW.	2000	The varying or cycling of training specificity, intensity, and volume to achieve peak levels of conditioning. Planned variations of the program design variables associated with exercise help athletes avoid staleness and overtraining while encouraging continuous adaptations to progressively more demanding training stimuli.
Graham, J.	2002	The cycling of specificity, intensity, and volume of training to achieve peak levels of performance for the most important competitions.
Kraemer, W., & Hakkinen, K.	2002	Programmed variation in the training stimuli with the use of planned rest periods to augment recovery and restoration of an athlete's potential.
Plisk, SS. & Stone, MH.	2003	Planned distribution or variation in training methods and means on a cyclic or periodic basis. The basic goals are to exploit complementary training effects at optimal times, manage fatigue, and prevent stagnation or overtraining. This involves long-term, intermediate and short-term planning. Accordingly, periodized training programs are typically structured into macro-, meso-, and micro-cycles that progress from extensive to intensive workloads as well as general to specific tasks. Corresponding decisions should be made with respect to several factors, including the biological responses to training stimuli, the athlete's developmental status, and the specific demands of his or her sport.
Zatsiorsky, VM. & Kraemer, WJ.	2006	A division of the training season into smaller and more manageable intervals (periods of training, mesocycles and microcycles) with the ultimate goal of reaching the best performance results during the primary competition(s) of the season.
Sharkey, BJ. & Gaskill, SE.	2006	The process of incorporating systematic variation into the training plan. This variation is programmed at several levels: daily, weekly, seasonal, and career.

Authors	Year	Definition
Buford, TW., Rossi, SJ., Smith, DB., & Warren, AJ.	2007	The planned manipulation of training variables in order to maximize training adaptations and to prevent the onset of overtraining syndrome.
Baechle, TR. & Earle, RW.	2008	The planned distribution or variation in training means and methods on a periodic or cyclic basis.
Issurin, V.	2008	A division of the entire seasonal program into smaller periods and training units.
Hartmann, H., Bob, A., Wirth, K., & Schmidbleicher, D.	2009	The primary underlying concept of periodization in general is to transfer a variety of performance variables (power, strength or local musculature endurance) to their highest rate of development with the aim of peaking at a precise time and avoiding any stagnation, injury, and overtraining.
Bompa, TO. & Haff, GG.	2009	A method by which training is divided into smaller, easy-to-manage segments that are typically referred to as phases of training.
Issurin, V.	2010	The purposeful sequencing of different training units (long duration, medium duration, and short-term training cycles and sessions) so that athletes could attain the desired state and planned results.
Turner, A.	2011	A training plan, whereby peak performance is brought about through the potentiation of bio-motors and the management of fatigue and accommodation. This is principally achieved through the logical yet creative variation of training methods and volume loads.
Haff, GG. & Haff, EE.	2012	The logical, integrative, sequential manipulation of training factors (i.e., volume, intensity, training density, training frequency, training focus, and exercise selection) in order to optimize training outcomes at predetermined set points.
USATF	Not listed	The process of planning training in order to produce high levels of performance at designated times.

highlights the need for coaches to stay abreast on the evolving scientific literature, as well as adopt athlete-monitoring strategies. Combined, this information can improve a coach's ability to "forecast" an individual athlete's future training needs and responses.

### Thinking Outside the "Black Box"

As previously mentioned, the argument is not whether periodization strategies are effective tools in the development of athletic preparedness, but whether the training agenda is built upon assumptions or evidence. While the question may be difficult to answer in the short term, a more effective method of determining how a practitioner assesses the development and effectiveness of their periodization strategy can be utilized. Specifically, a coach can critically reflect on their planning process by revisiting the "Black Box versus White Box" analogy.

Within sport, a coach's performance is typically assessed by their win-loss record or their ability to improve the competitive rank of the athletes under their supervision (Cote et al., 2007, Erickson et al., 2007). For instance, a coach may be deemed successful if their athlete improves from a sixth-place finish in last year's championship match to a third-place finish in the current championship season. In other words, the coach knows the "input" (sixth place) and "output" (third place), but the internal process which led to this improvement goes largely unknown or investigated. This "Black-Box" approach is commonly referred to as "Performance-Based" coaching where an improvement in the competitive arena largely determines the success of the program used along the way. The adoption of this method can provide practitioners false security in their periodization strategies, as the improvement in athletic performance resulting from the training plan cannot be distinguished from confounding factors such as the athlete's maturation or a decrease in external stressors. As a result, it is unclear whether the athlete realized their true competitive abilities, as the training program was not optimized to their individual needs.

In contrast, a coach can increase their insight into the training process by adopting the "White-Box" approach. Within this context, the coach understands the input (preseason rank) and output (postseason rank), but they also understand the individual athlete's physiological and psychological responses to training via scientific monitoring. This ongoing reflective process can be termed an "Evidence-Based" approach as the sport performance professional is equipped with objective, reliable feedback that can demonstrate a training plan's effectiveness and ultimately ensure preparedness. The overall goal of an evidence-based approach is to acquire a snapshot of an athlete's adaptations to training and, in turn, apply these findings to future program development. In short, this can be considered the act of optimizing periodization choices and the training plan in order to meet the needs of the individual athlete.

### **A Call for Monitoring**

The aforementioned monitoring process involves frequent measures of performance with consistency and reliability. Once this performance information (or data) is collected, a thorough and swift analysis of the results follows. The speed of this process should be emphasized as the returned information will allow the supervising coach to plan accordingly for future training blocks. When returned quickly, relevant feedback from the monitoring process can empower coaches and sport performance professionals to make more informed, evidence-based decisions regarding the structure and periodization of a training plan.

As discussed, periodization should involve the development of designing a training protocol that is based on sound evidence. This plan must successfully operate within a framework that is dictated by numerous external variables, including the competition schedule, the level of competition, training camps, hours available for training, the athlete's personal obligations and financial constraints. During the generation of the periodized plan, monitoring adds individual and situational-specific evidence to the process. Unlike research and formal scientific inquiry that provide the practitioner with knowledge of group responses to controlled stimuli, one cannot infer individual athletes – especially in the high-performance setting – will respond to training in the same manner.

How, then, do we determine an athlete's unique circumstance in relation to training choices and resultant adaptations? The answer to this question lies in the monitoring process. Practically speaking, each athlete is tracked individually as if they are participating in a case study. This allows the athlete to serve as their own criterion, as statistical significance is usually difficult or impossible to obtain in a clinical setting with a small sample population. Further, change (or lack of change) may be meaningful and significant

to the direction of future training choices in the sport setting. Therefore, as Stone, Stone, and Sands have advised, formalized athlete monitoring programs should be longitudinal in nature and employ several testing sessions. Through continued analysis, the investigator is guided to the most appropriate variables (Stone, O'Bryant & Garhammer, 1981).

### **Renewing the Definition of Periodization**

Considering the scientific and technological advancements in sport, the current pool of acceptable definitions regarding periodization have become stagnant. Specifically, this collection of definitions does not concretely state the need for periodization strategies to be based on individual responses made apparent through the utilization of an athlete-monitoring program. Regardless of the stance a coaching professional may have on a specific periodization strategy, one must not allow unfounded dogma or assumptions to underpin planning decisions. Therefore, a proposed definition for periodization is:

*“The strategic manipulation of an athlete’s preparedness through the employment of sequenced training phases defined by cycles and stages of workload. These workloads are varied in order to facilitate the integration of planned programming tactics that will harmonize the relationship between training-induced fatigue and accommodation. Further, the process of balancing stress stimuli and recovery periods should be based on advanced knowledge regarding the physiological, biochemical, and psychological principles related to human performance. Thus, an individual’s response to training can more effectively be measured and be made apparent through the execution of a comprehensive athlete-monitoring program and ongoing scientific study.”*

### **Moving Periodization into the 21st Century and Beyond**

Periodization has been, and will continue to be, an integral part of athlete development. Both empirical and anecdotal evidence suggests athletes adhering to a tactfully-planned program demonstrate consistent improvements in physical preparedness and are less likely to sustain over-training or overuse injuries (Monteiro, et al., 2009). As a result, coaches employ various periodization strategies with the overarching goal being a bolstering of an athlete’s competitive success.

While periodization may continue to be a recommended strategy in program design, recent advancements in the scientific understanding of human development cannot be dismissed. Specifically, the increased use of technology and monitoring systems in the sport setting will allow coaches and performance professionals to become more aware of how individual athletes respond to a given training stimulus. As coaches become more astute in the monitoring process and subsequent data interpretation, periodization strategies can be tailored to meet the needs of each individual athlete under their supervision. This evidence-based approach to the sequentially-staged planning process will continue to refine and optimize an athlete’s opportunity for success when they showcase their physical and mental capabilities against similarly-equipped competition.

The revised definition of periodization proposed in this article calls us all to take further steps in the process of determining program design strategies for the athletes under our supervision. In addition, this definition not only answers the question posed by Kiely, but more importantly supports Pedemonte (1986b), who decrees, “We can take full advantage of periodization only when we know the objective basic laws of this process and when we really know the man who is in front of us”(p. 27).

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*Elaxis Gillette and guide Wesley Williams in the Men's 200m T11. Photograph by Gareth Copley, Getty Images*

## A Glimpse into Dave Wagner's Training Regimen

Eric Lawson, Strength and Conditioning Physiologist, Colorado Springs OTC

David Wagner is the United States' most decorated wheelchair tennis athlete. Wagner already has six Paralympic medals to his credit, including three consecutive golds in quad doubles. Individually, Wagner claimed the silver medal at both the Athens and London Games, along with the bronze medal at the Beijing Games.

Wagner competes in the quadriplegic open division as sanctioned and regulated by the International Tennis Federation. He sustained a cervical spine injury several years ago and has virtually no sensation or voluntary muscular activity below high torso. He has use of his arms with very limited grip ability in both hands. He must painstakingly tape his tennis racket to his right hand for every practice and match. Prior to his injury, Wagner played one year of community college tennis and was also an accomplished high school basketball player.

The wheelchair tennis circuit, for the most part, follows the able-bodied ATP schedule, with tournament play beginning in January and running through November. The offseason runs from mid-November through December. During his offseason, Wagner spends four to six hours per day on the tennis court, breaking his time up into different training segments. On-court time consists of specific tennis court drills, match play and pushing (conditioning drills in the chair that are analogous to able-bodied foot work drills). Every other day, in addition to the court work, Wagner spends 30 to 45 minutes in the weight room performing a mixture of core exercises, conditioning, and weight training exercises. The major objectives of the off-court training are to maintain or improve play stamina, decrease severity and incidence of injury, optimize recovery, and improve pushing power. Wagner has a menu of seven different workouts from which to choose on any given day. We try to choose workouts that augment or, in some cases, supplement the day's court work.

For instance, if he tells me he's had a particularly grueling day on the court, we may choose to do workout No. 1, as this workout is less intense and is more of a cool down, pre-habilitation shoulder routine. For more of a shoulder explosive plyometric routine, we will choose workout No. 2. For workouts that are more well-rounded, i.e., those that combine strength building exercise with agility conditioning and core work, we would choose workouts No. 3, 4, or 5. During the offseason time frame, Wagner attempts to work in at least two weight-training workouts per week with the optimal being three workouts per week. Wagner is always mindful of the fact that his shoulders and arms are his primary movers and fatigue quickly, so recovery and workout variability are always in the forefront of his planning process. He regularly attends CVAC Pod (portable hyperbaric chamber) sessions, which he maintains accelerates muscular recovery. In addition, there is a great deal of variability within the workout menu that serves to stave off neural and muscular fatigue.

**Workout 1**

<b>Exercise</b>	<b>Rest</b>	<b>Weight</b>	<b>Sets/Reps</b>	<b>Comments</b>
Theraband Wheel Chair Sprint	Full Recovery	Orange Band	10 yards 10 yards 10 yards 10 yards	
Chest Supported Incline Dumbbell Row	60 seconds	20 lb. dumbbells 25 20	8 8 8	
Hammer Curls	30 seconds	10 lb. dumbbells 12.5 15	10 10 10	
Theraband Pull Aparts	30 seconds	Red band	8 8 8 8	
Theraband Over head Pull Aparts	30 seconds	Red band	12 12	
Medicine ball toss	30 seconds	6 lb ball	12 12 12 12	
TRX Roll outs	30 seconds	TRX	12 12 12	

**Workout 2**

<b>Exercise</b>	<b>Rest</b>	<b>Weight</b>	<b>Sets/Reps</b>	<b>Comments</b>
Plate pulls with weight in front of chair	Full recovery	10 lb plate	10 yards 10 10	Explosive
Medicine ball reverse wall taps, facing away from wall	Full recovery	4 lb ball	8 taps 8 8	4 taps to right, 4 taps to left
Medicine ball ballistic forward throw into wall, catch ball at chest so as not to bend forward. Try to maintain upright posture.	Full recovery	4 lb ball	12 12	
Theraband shoulder , internal, external rotation	:10 seconds	Red band	10 10 10	5 internal rotations, 5 external rotations per arm per set. Attach theraband to chest level.

**Workout 3**

Exercise	Rest	Weight	Sets/Reps	Comments
Theraband agility drills	:40 seconds between reps	Grey band	20 seconds 20 20 20 20	Change direction, explosive effort
Bench press	:30 seconds	75 lbs. 95 105	8 8 8	
Medicine ball T's	:10 seconds	4 lb medicine ball	8 8 8	1 ball in each hand. Slow and controlled movement
Body Weight Extensions	:15 seconds	Theraband	8 8 8	
1 arm cable rows	:20 seconds	40 lbs	8 each arm 8 8	

**Workout 4**

Exercise	Rest	Weight	Sets/Reps	Comments
Dips	:20 seconds	Body Weight	10 10 10	
High cable row, low to high	:30 seconds	20 lbs	8 each arm 8 8	
Ballistic medicine ball throw down and catch, unilateral	:30 seconds	6 lb ball	6 each arm 6 6	
Medicine ball flexion throw, out of chair	:15 seconds	8 lb medicine ball	10 10 10	
Lat Pull Down	:20 seconds	75 lbs. 90 105	8 8 8	

**Workout 5**

Exercise	Rest	Weight	Sets/Reps	Comments
Plat drag	:30 seconds	10 lb plate 15	10 yards 10 10	Attach plate behind wheel chair with belt and chain. Drag plate explosively
Shoulder Front-lateral raise	:30 seconds	2.5 lb plates	8 8 8	
Dowel Shoulder Stretch	:10 seconds	Wooden Dowel	20 seconds 20 20 20	
Theraband Rows	:15 seconds	Red Band	12 12 12 12	Attach theraband to stationary object. Row, keep hands at mid-chest level
Arm Ergometer	:20 seconds	Ergometer	15 minutes	Continuous arm crank

*Arm ergometer: use RPE and heart rate to get a barometer on your intensity level. I suggest you stay at about 6 RPE and heart rate reserve of 65-70%. A good steady state cardiovascular workout.*

In-season, Dave shifts his focus to what he terms “games mode”: court practices generally increase in intensity to mimic match play while decreasing in duration; the tournament schedules usually allow for more rest and recovery between matches; weight training workouts diminish in frequency while the emphasis turns to shoulder pre-habilitation and maintenance work (workout No. 1); and frequency of CVAC sessions increase during tournament play.

Dave has confided in me on many occasions that the partnership and the support from all parties involved at the Chula Vista Olympic Training Center has contributed to his continued success. We look forward to further collaboration as his career evolves and as he sets his sights on Rio 2016.

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## Focus

Wendy Borlabi, Senior Sport Psychologist, United States Olympic Committee

We've all seen it—the athlete who does fine in practice, but struggles in big competitions. What gets in the way? One answer is the athlete's ability to focus. Focus has been defined as, "the ability to attend to appropriate stimuli" (Cox, 1998).

There are two main types of attention focus:

- *Broad vs. narrow* - focusing on a large or small number of stimuli
- *Internal vs. external* - focusing on internal stimuli (feelings, thoughts) or on external stimuli (the ball, teammates)

The type of focus required varies by sport, by position, and by situation.

### Common Focus Errors:

There are several common errors to good focus:

1. Failing to focus all attention on the essential elements of a task (focusing on too many things at once)
2. Being distracted from important information by unimportant information
3. Being unable to properly divide attention between all the important information

### Distractions:

Lots of things can get in the way of focus—crowd noise, weather, visual distractions, trash-talking opponents, anxiety, fatigue, and negative thoughts, just to name a few. With all of these factors coming into play, what can you do to improve your concentration? One strategy is to develop performance routines.

### Routines:

Performance routines are, "planned sequences of mental or physical steps designed to assist the athlete in focusing attention on relevant stimuli" (Cox, 1998). These can be broken down into pre-shot routines, between-play routines, and post-shot routines. Routines are unique to each athlete, but they usually include the following parts:

- Imagery to visualize the proper technique
- Positive self-talk
- Thinking about previous successful performances

Routines may also include things like breathing exercises, relaxation techniques, or listening to motivating music. The key to a good routine is practicing it until it becomes automatic—this means at practice too. Lots of athletes don't take full advantage of practice, but it's called "practice" for a reason. It's the time to develop good habits so performance becomes automatic and you don't have to think about everything during competition. Successful athletes learn how to avoid overthinking their performance. Think about when you learned to play your sport and how much you had to think about every little detail – details that now just happen. Experienced soccer players don't think about dribbling the ball; they just do it. The reason they can? It's become automatic, and the best way to make a skill automatic is to develop a good routine and stick with it!

*"In spite of all the distractions, remain focused on the job."* –Reggie Jackson

## Team USA Athletes in Action!

Sherry Von Riesen, Resident Athlete Dorm Lead, Colorado Springs Olympic Training Center, United States Olympic Committee

In working with athletes, I find that when something of national concern happens, it affects all Americans. The athletes want to make a difference, and they realize it is important for the healing process of a nation.

After Sept. 11, athletes wrote support letters to firemen, policemen, and first responders. During the wars in Afghanistan and Iraq, athletes sent support letters and gifts to the soldiers. This last tragedy at Sandy Hook Elementary in Newtown, Connecticut was no different. The athletes were affected as the nation was affected. We found an excellent website that outlined how the athletes could get involved and support the victims: making individual cut-out snowflakes for the teachers to hang in the school, so that when the children returned they would know a nation was behind them.



*Berkeley Swim Club members at the Colorado Springs Olympic Training Center*

The Olympic Training Complex in Colorado Springs purchased scrapbooking paper with the themes of little girls, little boys, sports and, of course, Disney characters. Every athlete wanted to participate. It was such a positive experience watching the athletes make the snowflakes – some actually could not even open – but it was the thought that counted.

The snowflakes came in all shapes and sizes. What was really moving were the notes of encouragement, care, and support each and every athlete wrote on their snowflake. As you can tell by the smiles on their faces in the pictures, they felt they were now part of the healing process.

I had called the PTO that was organizing this event and found out they received three semi-trucks full of snowflakes, and that the website closed down due to sheer volume and they were not receiving additional donations. The family of sport has a way of working together, and nothing gets in the way of our mission. These athletes had given their love and support and these snowflakes needed to get to Newtown.

Thankfully, Olympian Anthony Ervin – who was training at the CSOTC – was headed to Newtown to do a fundraiser with the town and meet their swim team. The Olympian from Berkley, California, took with him a box full of over 200 personalized snowflakes: mission accomplished! This is a story of the family of sport coming together for the family of a nation!



*Nike Oregon Track Team at the Colorado Springs Olympic Training Center*

## The FMS Screen and its Relevance within Elite Sport Performance

Tim Pelot MS, CSCS, Strength and Conditioning Sport Physiologist, United States Olympic Committee

Anthony Darmiento BS, CSCS, Assistant Strength and Conditioning Coach

The Functional Movement Screen (FMS) has recently become a popular subject for discussion in the sport performance community. The FMS consists of seven tests and it was created to evaluate movement pattern quality for all individuals. The question that remains to be answered is: does the FMS have a place in screening and assessing elite athletes? Currently, available research looks at the relationship between FMS and predicting injury and FMS and performance. The purpose of this article is to overview some of the peer reviewed literature regarding FMS and further relate commonly accepted scientific principles to the FMS tests to determine if FMS has a place in performance training of elite athletes.

### FMS as a test to predict or assess athletic performance

The first topic of interest is the relationship between FMS and Performance. Searching the terms “functional movement screen AND performance” using the Web of Science database resulted in a total of nine studies. Of the studies found, only two actually investigated the relationship between performance and FMS scores (Okada et al., 2011, Parchmann & McBride, 2011). Of the remaining seven studies, three found the FMS studies reliable because scores were reproducible (Minick et al., 2010, Onate et al., 2012, Teyhen et al., 2012), two explored biomechanical qualities of the deep squat test (Butler et al., 2010, Lynn & Noffal, 2010), and one attempted to use the FMS to measure the effectiveness of a training program (Frost et al., 2012). Of the two studies looking directly at performance, neither was able to find a relationship between FMS scores and performance. Although McGill et al. were not able to relate FMS score to performance variables of basketball players over a two-year timespan, there did seem to be something regarding injury and FMS, but more data and studies were necessary (McGill, Andersen & Horne, 2012). In conclusion, the FMS is not an accurate way to measure athletic performance.

### FMS as a test to predict the likelihood of injury

McGill's findings did, however, relate to the second topic of interest: the ability of FMS to predict injury. In some cases it could be argued that reducing injury is an indirect way of improving performance. If a coach or practitioner is able to reduce injury, then performance will inherently be better than if an athlete were to become injured. Of the studies looking at predicting injury, three were chosen because of their specific findings. In a study looking at 46 professional football players, those with an FMS score of  $\leq 14$  were eleven times more likely to experience injury during one competitive season than those who scored 15 or greater (Kiesel, Plisky & Voight, 2007). Chorba et al. found that female collegiate athletes with a score of  $\leq 14$  had a 4-fold increase risk of injury (Chorba et al., 2010). Furthermore, of the female athletes in the study, 69% of those with a score of  $\leq 14$  sustained an injury over the course of the study. Lastly, in a study of 874 marine officer candidates a score of  $\leq 14$  doubled a candidate's risk of injury (O'Connor et al., 2011). However, it is important to note that unlike the other aforementioned studies, this study also looked at physical test scores (consisting of pull up test, 1.5 mile test, etc.) and found that these scores were just as predictive of injury as the FMS test. Another thought from the FMS community is that FMS could be used as a baseline. For example, having a video of an athlete performing specific movements in a healthy condition could be valuable during rehabilitation post-injury. In fact, video of any commonly used exercises in training could prove valuable in such a scenario. Therefore, it seems that FMS may have practical applic-

ation within sports medicine, but practitioners should review scores with caution, especially considering that the seven tests are hardly telling of an athlete's overall movement competency, ability, and potential.

### **The role of stiffness in elite sport**

To define elite sport, we will refer to Anders Ericsson's research on expert level performance. Ericsson's research has found that expert level performance can be closely associated with length of time an individual participates in deliberate practice. His research has found that ten years or 10,000 hours of deliberate practice leads to expert performance (Ericsson, 2004).

There are a number of performance-impacting factors that have been researched and some of these factors may have a negative impact on an athlete's ability to perform well in an FMS. Two specific examples are: 1) the effect of joint stiffness, and 2) musculotendon tightness. There are plenty of well documented studies that have investigated the relationship of muscle stiffness and performance (Kuitunen et al., 2002, Brughelli & Cronin, 2008, Arampatzis et al., 2001, Blickhan & Full, 1993). From the literature in this area, it is concluded that muscle and tendon stiffness can have a positive influence on dynamic and explosive movement (Blickhan & Full, 1993). It has been well established that when there is high level of tightness, there is an increase in the ability to store more elastic energy. This increase in energy storage (similar to how a rubber band gets pulled back prior to snapping back to its original shape) leads to an increase in peak force output, resulting in more rapid and powerful movements. This is crucial in elite competitive environments where the difference between first and fourth place lies within .16 seconds, as was the case for the Olympic final for the men's 100m sprint. To briefly summarize, research in the area of muscle and joint stiffness and its relationship to performance has demonstrated that muscle and joint stiffness becomes a necessary characteristic for success in most elite athletic environments since it can help improve running velocity, jumping ability, and movement economy (Butler et al., 2003, Brughelli & Cronin, 2008, Chelly et al., 2001, Arampatzis et al., 2001).

### **Does the test provide a true measure within the elite athlete population?**

An ideal amount of stiffness could be mistaken for lack of flexibility or result in a poor FMS score, which could lead to an emphasis on trying to change or correct a positive athletic quality. Furthermore, it is widely accepted that strength and motor control are velocity dependent. Because almost all athletic performance occurs at high velocities or under high forces, it is hard to relate the scores of a slow moving test and characterized by low forces (such as the FMS to qualities of athletic movement) especially when such movements may be foreign to an athlete or an athlete has developed specific movement patterns that allow them to perform optimally in sport.

### **Specificity of the FMS for Elite Athletes**

It is also important to mention how the neuro-muscular system operates in relation to movement and speed. Depending on speed and resistance of a movement, the body will either increase or decrease the number of muscles needed to perform a task. In order to prevent this article from diving into an in-depth write-up on the nervous system, let's just refer to the activation of muscle fibers as either being fast twitch or slow twitch. When speeds are slow and when resistances are low, the body recruits the slow twitch fibers to perform the task. When movements are dynamic, fast, and take place under greater force, the nervous system recruits fast twitch fibers. In addition, some fibers are more resilient to being activated and it may take higher speeds and higher resistances for them to be recruited (Masi & Hannon, 2008). The activation patterns at these speeds and intensities are difficult to measure and assess, but based on the speed and intensity of sport, we know explosive movements recruit muscles completely different than

the activation patterns required to perform slow and controlled movements. Being aware of these concepts leads to a few important questions: is the FMS an accurate tool to evaluate elite athletes? Does the FMS measure an elite athlete's level of "functional ability", as it relates to speeds and forces experienced in sport and training?

### **Tonicity and the elite athlete**

Understanding muscle tone (tonicity) and the body's adaptation response to daily stress is another important concept to take into consideration when investigating the rationale of the FMS test in the elite athlete population. Tonicity is described as normal elastic tension of living muscles. For everyday movement actions, there is a neuromuscular response that is responsible for one's level of tonicity: man's adaptations to gravitational forces and erect postures are evolved mechanisms in skeletal muscle tissues that help to improve economy and enhance stability. For the average human being, normal passive muscle tone helps to maintain relaxed standing body posture with minimally increased energy costs and often for prolonged durations without fatigue (Masi & Hannon, 2008). The activation of these daily stabilizing muscles is done involuntarily. Since the average person does not introduce their body to additional resistance other than everyday movements in a gravity-rich environment, the level of tonicity is fairly low in comparison to the tonicity within the elite athlete. Elite athletes are required to withstand and overcome high resistance stressors for hours each day and these stresses lead to neural adaptations that create an increase in tonicity. Further research needs to be done on the impact of training history and tonicity. In a training environment, training history (length of time spent training for sport) has a significant impact on how successful an athlete becomes in sport. It is common knowledge that elite athlete's possess the highest of all training histories. These large volumes of training over long periods of time have resulted in neural adaptations (sport-specific) that have helped lead to the success of the athlete. Lastly, it could be hypothesized that athletes with longer training histories could have a higher level of tonicity. It is important not to confuse tonicity with hypertonicity. Hypertonicity is a when a muscle is in a state of abnormally high tension. For example, elite athletes often experience some sort of hypertonicity following training sessions.

### **Voluntary and involuntary muscle contractions**

As we understand neural function and tonicity, it provides us with a more approachable understanding of what specific adaptations athletes acquire from their training and helps us learn the differences in how their bodies operate in comparison to the average person. What we know about low threshold and high threshold muscle contractions can be carried over into muscle flexibility and joint mobility (fast twitch and slow twitch activation patterns). If a muscle is involuntarily contracted, it may not be able to fully relax on its own. In order to help release this tonic state, it may require the voluntary activation of higher threshold motor units to allow the muscle to relax from a partial and involuntary contraction. If the applied external resistance is high enough to meet the involuntary contraction threshold, the contraction then switches from an involuntary muscle contraction to a voluntary contraction. This override of the nervous system is one of the premises that supports PNF (Proprioceptive Neuromuscular Facilitation) stretching. Once a muscle is voluntarily contracted, typically there is a reduction in the tonic state of the muscle at rest, thus improving joint range of motion and muscle flexibility. How does this apply to the elite athlete? If an athlete is asked to perform a movement under low resistance, they may test poorly due to tightness (tonicity), but when placed in an environment where resistances simulate that of their sport, they may have a completely different testing score (due to an increased level of neural

activation). This outcome provides evidence that the sport-specific adaptations that athletes possess is likely to positively impact their abilities in sport, but may lead to a poor FMS score and inaccurate assessment of an athlete's movement quality. What this tells us is that a muscle may have flexibility and that joints may have an ideal amount of range of motion, but these characteristics only show when movements speeds increase or when load is added to a movement. This phenomenon could be the result of the activating and deactivating (overriding) of the motor units responsible for the increased tonicity within the athlete.

### **Does the FMS test sport specificity?**

For example, when digging (low squat position) in a volleyball match or the deep squat position that a baseball catcher assumes is not what an FMS test would dictate as correct or good quality resulting in a poor score. For this reason, FMS itself does not have enough scientific support to justify changing an effective movement pattern to a less effective one. This leads us to question what "functional" means as it relates to sport-specific positions within each sport discipline. Although FMS may claim to use "functional", everyday movements that relate to what athletes may experience in sport and training, FMS should not be considered an accurate way to measure physical preparedness for sport involvement. In fact, the use of FMS to prepare an athlete for sport and training may not be valid either. It is commonly known that there are specific adaptations to imposed demands (SAID principle). Therefore, the SAID principle does not justify the use of FMS movements to prepare athletes for anything other than an FMS test.

It is important to note that a spectrum of athletes exist that range in age from youth to adult, and level of play from weekend warriors to professional and elite. FMS is likely more relevant for the younger or less experienced athletes and could be a mode of improving body awareness and control. However, some believe that FMS loses application and practicality when moving across the spectrum to more advanced athletes with a longer training history.

The FMS is nothing new. Physical therapists, athletic trainers, and experienced strength and conditioning coaches are fully aware of the movement qualities tested by FMS in every day training sessions. Therefore, experienced professionals are aware of specific techniques and form during all exercises in training. Additionally, these experts are capable of recognizing movement deficiencies and making proper adjustments through cueing and coaching while implementing long-term modifications to mobility and flexibility if necessary. With this in mind, FMS seems to have more practical application for less knowledgeable coaches and less experienced athletes.

### **Could warm-up have an impact on testing scores?**

With all the above being said, in the case that one were to choose to implement the FMS, it is critical that the clients or athletes being tested undergo a thorough warm-up. Like any other sort of performance test, a proper warm-up must be implemented. A simple metaphor to better understand this would be a surgeon who attempts to perform a surgery while asleep; if the body is not warm and not activated, movement capabilities will be severely limited and it will not provide an accurate measure of an athlete's functional movement. Typically when the FMS test is administered, athletes are cold and are asked to perform specific movement tasks and are graded on the control and freedom of movement. Not only does the body need to be warm, but the central nervous system must be alert and adequately prepared. Imagine a pitcher or a batter entering the game without warming up or taking any practice swings or pitches. Imagine a long jumper competing with an insufficient warm-up. Finally, imagine a gymnast

approaching the balance beam cold. What type of performance would one expect to see from any of these examples? These specific warm-ups, like any warm-up, need to be implemented before training sessions and should be methodically devised and properly implemented. A thorough warm-up may have significant impact on reducing the likelihood of invalid scores. Below is a brief description and support for specific aspects of a proper warm-up (although there are numerous ways to properly prepare the body for movement, we will cover one specific method that can impact testing scores).

### **Some sort of massage/rolling**

The first portion of a proper warm-up is implementation of some type of quick (2-5 min) soft tissue massage or other method of attacking adhesions (micro-damage to fibrils and inflammation) and trigger points that develop from previous training sessions. Adhesions, for the sake of simplicity of this article, can be considered as the absence of slipperiness between tissues. Adhesions stem from micro-tears within fibrils or other tissue and reduce glide between tissues decreasing the extensibility of muscle and joint range of motion. Intensive training may lead to increased adhesions in athletes and these adhesions can impair flexibility and joint movements. These trigger points or “muscle knots” may be caused by acute or chronic muscle overload or trauma, which can be encountered in training environments. Trigger points consist of a small number of motor units and are under sustained depolarization or contraction, thus restricting the overall extensibility of the larger muscle as a whole.

### **Increase tissue temperature**

The second portion of a proper warm-up should focus on actively increasing the temperature of the athlete or client’s muscles, tendons, and joints. By increasing temperature, muscle becomes more pliable, tendon more elastic, and synovial fluid within joints can become less viscous. This can be accomplished by activation of large muscles that are able to produce greater heat. The movements involved with these type of activities will also create a catecholamine response. This provides increased oxygen to the body and brain (e.g., light cycling on a spin bike, jogging, or rowing). It is important to recognize that the cooler the environment in which an athlete is warming up, the more time it may take to accomplish. By increasing body temperature an athlete will have more freedom of movement, especially for older athletes or athletes with stiff joints, or those with some sort of arthritic-type symptoms.

### **Specific Movement**

The final portion of the warm-up should be to move the body and its joints through specific active ranges of motion. For example, starting with stationary active ranges of motion that focus movements of joints of the shoulders, hips, torso, ankles, or neck, then moving into transit active ranges of motion that are movements that take place while the body is in motion. The benefits of this type of active dynamic warm-up is the ability to activate low threshold stabilizing muscles and work through stiffness in particular ranges of motion, all while maintaining muscle spindle sensitivity. Additionally, this allows the athlete to prime his or her motor control qualities as they carry out common movements. After a sufficient amount of time (5-15 minutes) is spent on addressing slow to moderate movement speeds, it can also be beneficial to increase the speed and intensity of movements. Increasing speed and intensity of movements can have a positive effect on activating dormant motor units (muscles) and will result in a positive impact on overriding the nervous system. Activating both the agonist muscles and antagonist muscle groups responsible for a specific movement can positively impact the functional mobility of joints. This is one of the basic ideas behind the reciprocal inhibition principle. In addition to helping muscles loosen but activating them, there is a force-coupling relationship between opposing and supporting muscles and is important during any

performance. All of these factors need to be addressed any time an athlete's body is being tested for functional restrictions and capacities if the administrator is looking for a true and accurate assessment of an athlete's functional movement.

Lastly, it is important that the athlete or client be familiar with the tests that he or she will perform. For this reason it seems that allowing the athlete to practice each of the tests or fundamental movements of the test during a warm-up would increase the validity of such a test. This could reduce the chance of learning error being the reason for a lower score.

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*Team USA 1-2, Silver medalists Jennifer Kessy and April Ross and Gold medalists Misty May-Treanor and Kerri Walsh Jennings during the medal ceremony in London. Photograph by Ryan Piere, Getty Images.*

## The Role of Deliberate Practice in Becoming an Expert Coach: Part 2 – Reflection

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Tucking your children into bed at night is one of life's beautiful moments. We have found this typically is a time when children are especially reflective and ask some of the most amazing – and strangest – questions. A recent bed-time conversation with my (Wade) 5-year old son, went as follows:

“Dad, what is your favorite food?”

*“I like fish.”*

“Dad, what is your favorite protein?”

*“Steak.”*

“I thought it was chicken?”

*“I like chicken, too.”*

“Dad, is chicken made of turkey?”

After turning out the lights, I found myself walking down the hallway smiling and reflecting on the moment. I didn't make the connection at first, but several days later – while we were writing this paper – it hit me: my son was exhibiting the essence of reflection. You could almost see the wheels turning in his mind, grappling with thoughts and words that were yet to be properly integrated into his emerging mental model of the world. In that moment, the scaffolding was being assembled, laying the foundation for new levels of awareness and more questioning.

What does this have to do with deliberate practice and developing expertise in sport coaching? Everything. Three-time Olympic diving coach Jeffrey Huber (2013) summed it up this way: “In many ways, coaching is a reflective activity” (p. 8). In the last issue of *Olympic Coach Magazine*, we shared the first of a three-part series on applying principles of deliberate practice to becoming an expert sport coach (Gilbert & Trudel, 2012). In that first article, we used the Integrated Definition of Coaching Expertise (Côté & Gilbert, 2009) and the Pyramid of Teaching Success in Sport (Gilbert, Nater, Siwik, & Gallimore, 2010) to define coaching expertise and briefly reviewed three principles of deliberate practice. Recall that although deliberate practice has been widely adopted across disciplines, the sport coaching profession has been slow to use deliberate practice principles for the development of coaches themselves. The focus of the present article – Part 2 in the series – is on providing suggestions for how to close the gap between deliberate practice principles and coach development.

In the current article, we turn our attention to reflection as the primary representative deliberate practice task for sport coaches. Much has been written – both across disciplines and within the field of sport coaching – on reflection as a driver of learning. In fact, entire books, journals and annual conferences are now dedicated to reflection and its role in human development. To our knowledge, we completed one of the earliest studies on the process of reflection and how it relates to coach development (Gilbert & Trudel, 2001; 2004; 2005). In the interim, we have continued to “reflect on reflection” – how it is defined, the role it plays in learning and how we can use reflection most effectively to nurture the development of coaching expertise. We believe two approaches to reflection in particular are highly relevant – and practical – for developing expertise in sport coaching: reflective practice (Schön, 1983) and critical reflection (Hickson, 2011).

Reflecting on everyday events that occur as part of your coaching is referred to as reflective practice. The goal of reflective practice is to step back from an event – momentarily – and think about causes and potential consequences of the event on performance, athlete development and/or coaching goals. This may be considered a surface-level approach to reflection; a type of “noticing” used to contemplate the next best step in dealing with a situation. For example, it is common for coaches to make mental – or written – notes of performance issues they notice during competition. A successful collegiate and national team ice hockey coach we once studied articulated this type of reflective practice nicely when we questioned him about his in-game behaviors. He said, “During a game, I try to notice things that we are doing that need to be adjusted, and I try to notice some things that the other team is doing so that in between periods I can make adjustments” (Gilbert & Trudel, 2000, p. 125). Jones and colleagues (2013) recently provided a powerful discussion on the role that noticing plays in coaching effectiveness, by adapting the concept from Mason’s *The Discipline of Noticing* (2002). They argue “noticing” for coaches must extend beyond athlete-performance cues to include observations about athlete emotions and assumptions about coaching. Jones and colleagues also contend that our emphasis should not be placed on increased noticing, but instead on more efficient noticing. We believe that more efficient noticing (reflective practice) is achieved through regular critical reflection. We certainly are not the first to make this claim. It has been a decade since Cushion and colleagues (2003) made a pioneering argument for integrating critical reflection into formal coach education, although they acknowledged that our collective understanding of how to actually do this was severely undeveloped at the time. Critical reflection typically is very personal and driven by the need to understand why events occur as they do, our assumptions about why they occur this way, and how these assumptions influence our behaviors and attitudes toward others. Cushion and colleagues described critical reflection as a tool for providing “coaches with a mirror in which they can see their own programs and practices” (p. 223).

In the remainder of this article we delve deeper into describing critical reflection, share examples of critical reflection and provide suggestions for how coaches can more formally integrate critical reflection – and the underpinning reflective practice – into their coaching.

### **The Case for Critical Reflection as a Primary Deliberate Practice Task for Sport Coaches**

The ancient Greek philosopher Socrates famously concluded that “the unexamined life is not worth living” (Wikiquote, 2013). Surely we all engage in contemplation at various times in our lives – some much more so than others. In our experience, we have found that sport coaches are notorious contemplators, reporting to us that they are “always thinking” about their coaching (Werthner & Trudel, 2009). While preparing this article, a young collegiate tennis coach stopped by my (Wade) office to share his excitement over a book he was reading about championship boxing coach Enzo Calzaghe (Calzaghe & Pearlman, 2012). In an effort to stimulate critical reflection, I pressed him to summarize what he learned from Enzo’s incredible journey that could be applied to his own quest to become an effective coach. The coach paused and struggled to make a connection from Enzo’s biography to his own coaching. He was, in a word, confused.

Confusion is typically viewed as a weakness in our society, particularly for someone who is charged with leading others, such as a high performance sport coach. However, self-induced periodic confusion is a launching pad for critical reflection. One of us (Pierre) has written extensively about this idea drawing on constructivist views of learning, noting that self-induced confusion might also be described as intellectual disharmony (Trudel, Culver, & Werthner, 2013), disjuncture (Jarvis, 2006) or cognitive dissonance (Moon,

2004; Schön, 1983). Now, you may be thinking to yourself, “So I need to be confused in order to become a better coach?” Yes – at least sometimes. Leadership guru Margaret Wheatley wrote extensively about periodic self-induced confusion as a healthy – and essential – way of learning how to learn. Wheatley concludes that confusion is healthy if it is part of the process of moving on and reconfiguring your ideas (London, 2012). The need to regularly challenge ourselves to reflect on how we coach, and the impact of our coaching on others, is also consistent with current views on coaching expertise. In fact, some have argued that coaching expertise should be viewed as a process of redevelopment (Turner, Nelson, & Potrac, 2012). If we ascribe to the view that coaching expertise is a constant journey and not a stable state or destination, then clearly we will regularly find ourselves in states of confusion. The only way out of the confusion – and to grow as a coach – is to question assumptions about what is causing the confusion. These assumptions are the basis for how we view coaching – our mental models of coaching if you will.

Much has been written across disciplines about mental models, including our work where we have drawn heavily from Moon’s parallel concept of cognitive structure (Trudel et al., 2013). In the present article, we pull mostly from the writings of Peter Senge, who has written extensively about the central role that mental models play in developing expertise and continuous improvement. Senge (2006) defines mental models as “deeply ingrained assumptions, generalizations or even pictures or images that influence how we understand the world and how we take action” (p. 8). He asserts that seldom are we conscious of these mental models or how they directly influence our decision making and everyday behaviors. Recall, the primary goal of deliberate practice is to help learners develop more elaborate mental models that results in more efficient decision making. Ericsson (2003) describes mental models as “acquired mental representations that allow the experts to anticipate, plan and reason alternative courses of action” (p. 63). The direct connection between critical reflection, deliberate practice and mental models is clear. Regular critical reflection is the deliberate practice task needed to make adjustments in our coaching mental models.

You may still be asking yourself, “Why is it so important that I make regular time in my coaching practice to challenge my mental model? I barely have time to keep up with my coaching responsibilities, let alone finding time to just sit around and think about coaching.” In an excellent summary of the research on instruction principles, Rosenshine (2012) made the observation that real learning does not occur without regular time set aside to “check-in” on our assumptions and views about what we are experiencing and trying to learn. Rosenshine also notes that regular “checks for understanding” with students is a common characteristic of effective teachers – and effective coaches are surely no different with their athletes – yet teachers (and coaches) seldom apply this same logic to their own development. We believe a direct benefit for coaches of setting aside regular time to check their understanding of a situation is an improved connection with athletes. The ability to accurately sense the needs of athletes, and how these needs impact performance, has repeatedly been identified as a prerequisite for effective coaching. Most recently, this has been discussed using the concepts of emotional intelligence (Chan & Mallett, 2011; Gilbert & Côté, 2013) and empathic understanding (Lorimer & Jowett, 2013). It is believed critical reflection focused on understanding athlete needs will lead to shared understanding, and it is recommended, “coaches and athletes should also be encouraged to give time over to actively considering themselves and each other, both during and outside of training sessions” (Lorimer & Jowett, 2013, p. 330). Then it is clear that coaches who claim they don’t have time to engage in critical reflection are essentially saying they don’t have time to learn, or, in the words of Turner et al. (2012), “redevelop their expertise.”

## How to Integrate Reflection into Your Coaching Practice

Several years ago we summarized suggestions for creating what we referred to as a “reflective practicum” for sport coaches (Gilbert & Trudel, 2006). Drawing on literature mainly from education and coaching – which at that point was quite limited in regards to critical reflection – we identified strategies such as reflecting on typical coaching issues and critical incidents, self-analysis using video and systematic observation techniques, and increasing access to mentors and peers. We now offer three more specific reflection activities for coaches to consider integrating into their coaching practice. The first one is designed to stimulate and nurture reflective practice – the surface level reflection that sets the foundation for critical reflection. The second and third strategies are critical reflection exercises.

### *Reflective Practice Exercise*

Some of you may have heard of After Action Reviews. This exercise, widely claimed to have been most formally developed by the U.S. Army (Senge, 2006), consists of asking three questions after important events: (1) What happened? (2) What did we expect to happen? and (3) What can we learn from the gap? Margaret Wheatley argues the U.S. Army developed After Action Reviews so extensively because – unlike many other environments – continuous learning literally is a matter of life and death. “As one colonel said, ‘we realized a while ago that it’s better to learn than be dead’” (London, 2012). When and how often should coaches complete this type of reflective practice exercise? As for when, most would argue as close to the end of the event as possible. Coyle in his *Little Book of Talent* (2012) notes this in Tip #39 (Practice Immediately After Performance) and shares the example of golf legend Jack Nicklaus, who claims to have had his most productive practices immediately following a competitive round of golf. As for how, there have been numerous attempts to formalize and support this type of post-event reflective practice with sport coaches. Although reflective journals are repeatedly cited as an effective tool for stimulating reflective practice (Mallett, 2004; Moon, 2004, 2006), the limited coaching research on this topic shows that adherence to reflective journaling is extremely low to nonexistent after coaches leave an intervention and return to the field (Trudel, Gilbert, & Werthner, 2010). Nevertheless, when coaches do engage in reflective journaling they typically acknowledge its importance (Werthner & Trudel, 2009).

One way we have tried to integrate the After Action Review concept with some form of reflective journaling with coaches is through event-reflection cards. Several years ago, Hughes and colleagues (2009) tested the feasibility of having equestrian coaches document their reflections during and after practices using what they referred to as r-cards. Although r-cards required minimal time to complete, and the coaches believed the process helped increase their self-awareness, the coaches also reported that it was a distraction to try and complete the cards during actual training sessions. Hughes and colleagues concluded with proper training during coach-education experiences, coaches could be taught how to efficiently use r-cards while in the midst of coaching.

Building on the After Action Review and r-card literature, we each have experimented with simple procedures for integrating reflective practice into coaches’ normal routines. My (Pierre) recent attempt to integrate r-cards into coaching was part of a supervised graduate-student project titled, “Helping Coaches to Develop Their Knowledge.” R-cards were given to two coaches and the graduate students met regularly with the coaches over a six-week period. Both of the coaches reported that r-cards helped them reflect on their practice. However, coaches also reported they wanted more input into the content of the r-cards and flexibility in when to use the r-cards (during or after practices/games). Lastly, coaches highlighted the importance of having someone (in our case the graduate students) available to discuss the notes they

recorded on the r-cards. The role of that person is mainly to act as a sounding board and help the coach engage in critical reflection.

I (Wade) decided to experiment with an adaptation of the r-card idea in an ongoing, continuous improvement project in a high school varsity sport setting. After consulting with the high school athletics director and a graduate student collaborating on the project, we created a simple double-sided reflection card each head coach completes immediately following every competition. The card, the size of a large index card, takes no more than two minutes to complete and is returned to the athletic director within 24 hours of the event. The r-cards vary slightly for each team, because it includes their unique achievement targets for the season. On one side of the card, the coach is asked to record competition outcome information, check progress toward target outcomes and note any significant events of which the athletic director should be aware. On the other side of the card, the coach is asked to reflect on (a) how their previous training sessions may have contributed to the competition outcome, and (b) what they learned from the competition that should guide the design of upcoming training sessions. A sample r-card completed by a varsity soccer coach after a match is included on the next page. Although the r-cards have only been tested for a few months, we have received overwhelmingly positive feedback from the coaches and 100 percent adherence. In addition to creating immediate self-awareness for the coaches, we intend to use the r-cards as a source of dialogue in each coach's offseason development meeting.

### *Critical Reflection Exercises*

Although there certainly are many ways – formally and informally – to engage in critical reflection, we have selected two critical reflection exercises that are recommended for use in high-performance settings. The first one we'd like to share comes from Joe Erhmann's recent book "InsideOut Coaching" (2011). This book came to me (Wade) highly recommended by a successful collegiate basketball coach. Although Erhmann never uses terms like "mental model" or "critical reflection," his book is essentially a portrait of one coach's critical-reflection journey resulting in a major adjustment of his mental model of coaching. Erhmann advocates for using a personal-coaching narrative activity to surface and adjust mental models that rests on answering four questions: (1) Why do I coach?, (2) Why do I coach the way I do?, (3) What does it feel like to be coached by me? and (4) How do I define success? He refers to this process as the "interior work" of coaching. Interestingly, Erhmann identifies legendary collegiate basketball coach John Wooden as one of his most influential guideposts in shaping his answers to these critical-reflection questions. Recall in the first article in our series, we also drew heavily from Coach Wooden's mental model of coaching to define coaching expertise (Gilbert & Trudel, 2012). Erhmann describes many critical-reflection activities he and his colleagues have created for use with their athletes, ranging from time set aside during practices for meditation/silent contemplation, reflective writing exercises, ceremonies and "moments of greatness." For "moments of greatness," players were asked periodically to share with the team specific examples of teammates acting with empathy. These "moments of greatness" are then recognized with decals placed on the football player's helmet. This is a prime example of a strategy that forces coach and athlete alike to critically reflect, leading to adjustments in their mental models.

Kidman's (2005) *Athlete-Centred Coaching* and Cassidy and colleagues' (2009) *Understanding Sports Coaching* are excellent research-based complements to Erhmann's book for coaches who want to explore the process of critical reflection in greater detail. Kidman's work includes examples from numerous high performance sport coaches and a brief section on self-reflection with dozens of sample reflection questions, whereas Cassidy and colleagues devote an entire chapter to the topic of coach reflection.

R-Card Example

## Girls Soccer

Game Day Card

League  
 NON-League  
 Tournament

Please return card to A.D within 24hrs of game or on Monday following a weekend game.

Opponent: McLane Location: Home / Away \_\_\_\_\_ Date: 1/15/13

Results: Win / Loss / Tie      Score: FHS 2 Opponent 1

Overall Record: 6-2-3      League Record: 2-1-0

Target Outcome Achieved:

Shots on Goal (6):	<input checked="" type="checkbox"/> Yes	No <u>Us-17 Opp-8</u>
Corners (Opp.-2 Us-4):	Yes	<input checked="" type="checkbox"/> No <u>Us-1 opp-6</u>
Off Sides (Opp.-5 Us-5):	Yes	<input checked="" type="checkbox"/> No
Saves (Opp.-5 Us-10):	Yes	<input checked="" type="checkbox"/> No <u>Us-6 opp-4</u>
Goals in a Game (Us-2):	<input checked="" type="checkbox"/> Yes	No
On track for Season Wins (10):	<input checked="" type="checkbox"/> Yes	No

Anything AD should be aware of? N/A

\*\*Complete "Athlete of the Week" and "Competition Reflections" form on back\*\*

## Athlete of the Week

Nomination Form

Name: \_\_\_\_\_ I.D. #: \_\_\_\_\_ Gender:  Male  Female Grade: 11

Reason for Nomination: Played in amazing game against McLane. shut down their #1 player ☺

### Competition Reflections

Lead-up Practices:

What did you notice in the practices leading-up to this competition that most likely contributed to today's results?

We practiced crosses all day Monday. That's how we scored our 1st goal ☺

Follow-up Practices:

What did you notice from the competition that should be addressed in the next practice sessions?

We need to keep doing what we're doing

The second critical reflection exercise we'd like to share with you is drawn from Peter Senge's *The Fifth Discipline* (2006). One of the critical-reflection strategies Senge describes is referred to as the 'left-hand column' exercise. For this exercise you select a specific situation that is not leading to the desired outcome – perhaps a training activity or an interaction with an athlete. Using a recent example of the situation, you write out a transcript of the event or exchange on the right side of your file or sheet of paper. Senge (p. 181) gives the following example:

ME: How did the presentation go?

BILL: Well, I don't know. It's really too early to say. Besides, we're breaking new ground here.

ME: Well, what do you think we should do? I believe that the issues you were raising are important.

BILL: I'm not so sure. Let's just wait and see what happens.

ME: You may be right, but I think we may need to do more than just wait.

The second step in the critical reflection exercise requires you use the left-hand column of your file or sheet of paper to write what you were thinking, but didn't say, during the exchange. The purpose of the left-hand column exercise is to bring hidden assumptions to the surface and then take steps to openly share personal views – and the data upon which those views are based – to move dialogue and learning forward. In Senge's example his left-hand column includes assumptions about Bill's work ethic (lacks initiative) and confidence (lacking), because from Senge's perspective the presentation was a bomb. Unless these assumptions are critically challenged and discussed, no real learning will occur. In other words, we maintain our mental models instead of adjust them, and the situation is never genuinely addressed.

## Conclusion

When asked about his coaching philosophy (e.g., his mental model), coach of three Olympic wrestling teams and 16 national championship teams at the University of Iowa, Dan Gable responded that it was in constant flux. He said, "as soon as I write it down, there's some change being made or there's something being discovered or I'm learning something else ... and now I've got to go back and rearrange it" (Packer & Lazenby, 1998, p. 249). Coach Gable is direct evidence that frequent critical reflection focused on adjusting our mental models – based on the "noticing" that occurs through reflective practice – are critical deliberate practice tasks for developing coaching expertise. We believe regular critical reflection will lead to more efficient noticing for sport coaches as they increase their awareness of what matters – to them in their particular coaching context and to their athletes at their particular stage of development – or what Jones and colleagues (2013) refer to as "the nuance of the context" (p. 277). In the third and final article in this series on the role of deliberate practice in developing coaching expertise, we turn our attention to the role of others and support systems. In the meantime, we encourage you to experiment with the reflection activities suggested in the present article. We believe they are prime examples of deliberate practice tasks that will lead to more effective and enjoyable coaching experiences.

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