Benefits of Multi-Sport Participation and Training

Bruce Craven
MSc, BSc(PT), Dip Sport (PT), BSPE, CSCS
Training Athletism in Kids: “Diversity is the key to Stability”

My Team: Sarah (23 mo), Max (4 mo) and Hannah (4 mo)
Nature or Nurture
On the move ...
Obesity Trends* Among U.S. Adults (n~200000)
Behavioral Risk Factor Surveillance System, 1985

(*BMI ≥30, or ~30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1986

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1987

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

2001;286:10.
Obesity Trends* Among U.S. Adults
BRFSS, 1988

(*BMI ≥30, or ~30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1989

(*BMI ≥ 30, or ~ 30 lbs overweight for 5′4″ woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1990

(*BMI $\geq$ 30, or $\sim$ 30 lbs overweight for 5'4" woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1991

(*BMI ≥30, or ~30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1992

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1993

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1994

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1995

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1996

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1997

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1998

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 1999

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 2000
(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults
BRFSS, 2001

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)

Benefits of Multi-Sport Participation and Training

Bruce Craven
MSc, BSc(PT), Dip Sport (PT), BSPE, CSCS
Jake Wetzel: Multi-Sport Development

Canada Games in Fencing
Canada Games in Cross Country Skiing
World Junior Mountain Biking
Berkley 4 year Scholarship in Rowing
2000 Olympics with U.S. in Rowing
2004 Silver Medalist in Athens
Oxford – Masters in Economics (rowing)
2008 Gold Medalist in Beijing
UBC – PhD in Economics
Saskatchewan’s : Multi-Sport Success

Colette Bourjogne
Catriana LeMay
Katlyn Kyle
Erin Cuperstone
Kelsie Hendry
Jamie Crukshank
Amy Alsop
Lisa Franks
Jacki Lavalie
Jacki Nichol
What are you coaching?

The GAME

The PLAYER

“Invest for the long range. Make today pay off tomorrow”

Pat Williams, The Magic of Team Work
Canadian Sport for Life: LTAD Model

Physical Literacy
  Active Start

FUNdamentals

Learn to Train

High Performance
  Train to Train

Train to Compete

Train to Win

Healthy Lifestyle
  Active for Life
What is the Goal?

Active Canadians
or
Canadian Olympians
or
Olympic Medalists
Influence of Maturation
Influence of maturation

Annual gain in various characteristics of performance capacity of young swimmers

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Improvement in a year (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0.5</td>
</tr>
<tr>
<td>13</td>
<td>1.0</td>
</tr>
<tr>
<td>14</td>
<td>1.5</td>
</tr>
<tr>
<td>15</td>
<td>2.0</td>
</tr>
<tr>
<td>16</td>
<td>2.5</td>
</tr>
<tr>
<td>17</td>
<td>3.0</td>
</tr>
<tr>
<td>18</td>
<td>3.5</td>
</tr>
<tr>
<td>19</td>
<td>4.0</td>
</tr>
<tr>
<td>20</td>
<td>4.5</td>
</tr>
<tr>
<td>21</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Max anaerobic power
CO₂
VO₂max
Blood Lactate post anaerobic exercise
Anaerobic Threshold

Adapted from Scammon, 1930
Influence of maturation

Different patterns of system growth during childhood

Size attained as % of postnatal growth

Age (years)

Adapted from Scammon, 1930
Influence of maturation

Contributions to muscle strength during maturation

100% Adult potential

- Lean body mass
- Theoretical fibre type differentiation
- Testosterone
- Neural myelination development

Birth | Puberty | Adult
---|---|---
Strength primarily via motor patterns | Consolidation of strength factors | Optimal strength potential

Adapted from Scammon, 1930
Training by Chronological versus Developmental Age
Adaptation to Training

“... from a practical point of view... the effect of heredity on the response to training implies that it is almost impossible to accurately predict an individual's response to a given training stimulus”

MOVEMENT...
Physics of Motion: Newton’s Laws

First Law – Law of Inertia
• An object at rest tends to stay at rest, or if it is in motion tends to stay in motion with the same speed and in the same direction unless acted upon by a sum of physical forces.

Second Law – F = ma
• A body will accelerate with acceleration proportional to the force and inversely proportional to the mass.

Third Law:
• Every action has a reaction equal in magnitude and opposite in direction
Development of Movement

• **Mobility**
  • Ensure normal structural mobility

• **Stability**
  • Proximal Stability

• **Mobility on Stability**
  • Ensure Movement control

• **Skill**
  • Exploration and manipulation
S.A.M. Principle

• STABILITY (INSTABILITY)
• ALIGNMENT (MALALIGNMENT)
• MOVEMENT (STIFFNESS & IMMOBILITY)
Movement Foundations

• Preparation
• Force Production
• Critical Instant
• Follow Through

• Ready – Set – Go
• Attain – Maintain - Displace
EXPLAIN THIS PICTURE

The image on the left shows a tennis player in action, likely during a swing or serve. The athlete's body posture and movement suggest the use of several key muscles.

The diagrams on the right provide anatomical details of the muscles involved in tennis players' movements.

1. **Latissimus dorsi** - This muscle helps in the movement of the arm and shoulder, aiding in powerful swings.
2. **Serratus anterior** - Positioned on the side of the chest, this muscle assists in the rotation of the upper body, essential for tennis serves.
3. **Pectoralis major** - Located on the chest, this muscle is crucial for the forward movement and rotation during a tennis swing.
4. **Quadratus lumborum** - Positioned on the lower back, this muscle plays a role in the rotation and stability of the spine, supporting the athlete's movement.

Understanding these muscle groups helps in optimizing performance and injury prevention during tennis activities.
Is Movement Sport Specific?

The SAM Principle
Foundation Pillars of Movement

- Physics of Motion
- Precision Movement
- Regional Interdependence
- Influence of Fatigue on Movement
- Progressive Overload
- Athlete Monitoring
- Stages of Under-Recovery
- Recovery Monitoring
- S.A.M. Principle
- Motor Learning
- Movement Efficiency
Posture follows movement like a shadow (Sherrington)

The position the body assumes in preparation for the next movement (Roaf)
Optimal Posture

• Trunk stability relates to maintaining an optimal posture
  – Neutral Spine and Pelvis
  – Neutral Spine and Shoulder Girdle
Maintaining Neutral

- Energy Conservation
- Force Generation of trunk musculature
- Injury Potential
  - Consequences of non-neutral posture
- Enhanced Co-contraction
Core Stability Definition

Core Stability is defined as dynamic musculoskeletal control which allows for production, transfer, and control of force and motion to distal segments of the kinetic chain.

Adapted from Kibler et al., Sports Med. 2006;36:189-198
Regional Interdependence Model

That each body segment’s movement is mediated and moderated by moving segments within the kinematic chain of motion that is initiated by a reflex or a motor pattern

“the knee bone’s connected to the thigh bone”
Regional Interdependence Model
Stability and Mobility

Gleno-humeral = Mobility
Scapula = Stability
Tx Spine = Mobility
Pelvis/Lx Spine = Stability
Hip = Mobility
Knee = Stability
Ankle = Mobility
Foot = Stability

A body lacking mobility somewhere will find it elsewhere

Cook and Kiesel
Path of Least Resistance

- With a given internal moment the movement will occur through the path of least resistance.
- With a given external moment the movement will occur through the path of least resistance.

Spring Example
Lumbo-Pelvic-Hip Movement

- The lumbar spine seems to be the “first line of defense” for compensatory motions; however, compensation at additional joints may occur as well.
Shoulder Mechanics: Regional Interdependence
Abdominal Multi-directional control during running
**A – ABS**
Abdominal muscles are activated by pulling the belly button up and in towards the spine. You are not “Sucking in your gut” but simply dynamically stabilizing your core. Remember to think of staying tall while maintaining a neutral spine.

**B – BUM**
The Gluteal muscles are the prime muscles responsible for dynamic control of the hip and pelvis during walking, running, jumping and landing. You should be using your glutes to slightly extend the hips and you should not be clenching your glutes.

**C – CHEST**
The chest is where every breath begins. The thoracic spine or chest is where our body rotates. The chest is should be elevated slightly to slightly extend the thoracic spine.
Precision Movement

• Motor Control:

• Mobility
  – Extensibility and Range of Motion
  – Stress and Strain – Relative Stiffness

• Stability
  – Relative Stiffness with respect to moving segments – path of least resistance

• Alignment

• Efficiency
  – Energy System requirements
  – Fatigue
Precision Movement

“DO NOT let training compromise your movement”
Training Specificity

- In many sports, **FORCE** application is a primary limitation to successful performance
- Training shouldn’t compromise skill
Training Specificity for Sport

• Training should be specific to the forces, joint angles, actions & movement patterns;
• ‘Transfer’ from standard conditioning to the specific skills of the sport
• Movement is a skill …

TRAIN THE MOVEMENT REQUIRED, NOT THE MUSCLE USED!
Jamie Cruickshank
2006 Winter Olympian
Women’s Bobsleigh

Clean = 80 kg
Front Squat = 80 kg
How do we evaluate movement?
Terminology

**Screen:** A system for preliminary appraisal and selection of an individual based on a set criteria aimed at protecting someone from something unpleasant or dangerous.

**Identify RISK**

**Test:** A series of questions, problems, or tasks to gauge somebody’s knowledge or abilities. Results must be interpreted to provide meaning.

**Identify Ability and Function to predict performance**

**Assess:** To examine something in order to judge or evaluate it and to calculate value based on the various factors assessed.

**Identify Inability and Dysfunction to predict performance**
Functional Movement Screen™ (FMS)

1. Squatting
2. Stepping
3. Lunging
4. Reaching
5. Leg raising
6. Push-up
7. Rotary Stability

- Seven tests which are graded on an ordinal scale from 3 – 0
- Portable and easily administered (10 minutes)
- Reliable \( ICC = 0.98 \) (Composite score)

Cook et al ‘99
## FMS Test Data Summary Table

<table>
<thead>
<tr>
<th>Team</th>
<th>≤14</th>
<th>FMS&gt;14</th>
<th>Athletes</th>
<th>Pass FMS</th>
<th>Fail FMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bobsleigh Men Team</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>71%</td>
<td>29%</td>
</tr>
<tr>
<td>Bobsleigh Women Team</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Luge Junior Team</td>
<td>0</td>
<td>12</td>
<td>12</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Luge Senior Team</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>89%</td>
<td>11%</td>
</tr>
<tr>
<td>Skeleton Team</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>89%</td>
<td>11%</td>
</tr>
<tr>
<td>Swimming</td>
<td>8</td>
<td>3</td>
<td>11</td>
<td>27%</td>
<td>73%</td>
</tr>
<tr>
<td>Wrestling</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>25%</td>
<td>75%</td>
</tr>
</tbody>
</table>

**Totals**

19 47 66 71% 29%
“There are no bad exercises… Just Bad Technique.”

The importance of Corrective Exercises
We are what we repeatedly do. Excellence then, *is not an act but a habit.*

- Aristotle -

Insanity:
doing the same thing over and over again and expecting different results

– Einstein
How do we train?

As kids playing like kids

As Kids playing like Adults
Play…

• Has been shown to foster and improve:
  – Motor function
  – Creativity
  – Decision-making
  – Problem solving
  – Emotion/Behavior Control
  – Social Skills
  – Communication
What is Physical Literacy

Agility
Balance
Co-ordination
Speed
Prediction
Interception
Who taught you to swim
Who taught you to THROW

Volkswagen baseball commercial - Passat
http://www.youtube.com/watch?v=KAOq0uhNL2A
Who taught you to RUN
<table>
<thead>
<tr>
<th>Body control skills</th>
<th>Agility, balance, and co-ordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhythm, poise, expression</td>
<td></td>
</tr>
<tr>
<td>Body movement (locomotor) skills</td>
<td>Walk, run, hop, skip, jump</td>
</tr>
<tr>
<td>Slide, skate, ski, swim</td>
<td></td>
</tr>
<tr>
<td>Object manipulation skills</td>
<td>Catch, trap, receive</td>
</tr>
<tr>
<td>Throw, strike, push, kick</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gliding</td>
</tr>
<tr>
<td>Court movement</td>
<td>In the hack</td>
</tr>
<tr>
<td>Drawing the bow</td>
<td>Defensive stance</td>
</tr>
<tr>
<td>Cadence</td>
<td>Simple rhythmic gymnastics routine</td>
</tr>
<tr>
<td>Back dive</td>
<td></td>
</tr>
<tr>
<td>Full swing</td>
<td></td>
</tr>
<tr>
<td>Overhead serve</td>
<td></td>
</tr>
<tr>
<td>Long-jump</td>
<td>Running a pass route</td>
</tr>
<tr>
<td>Base running</td>
<td>Volleyball spike</td>
</tr>
<tr>
<td>Basic ollie</td>
<td>Riding the wake</td>
</tr>
<tr>
<td>Sculling</td>
<td>Slide on skis</td>
</tr>
<tr>
<td>Backwards skating</td>
<td></td>
</tr>
<tr>
<td>Front crawl</td>
<td>Goalkeeping</td>
</tr>
<tr>
<td>Overhead pass</td>
<td>Accept a punt</td>
</tr>
<tr>
<td>Passing</td>
<td>Ring handling</td>
</tr>
<tr>
<td>Martial arts throw</td>
<td>Pitching</td>
</tr>
<tr>
<td>Delivering a bowl</td>
<td>Lay up</td>
</tr>
<tr>
<td>Chipping</td>
<td></td>
</tr>
</tbody>
</table>
Athlete Development

An athlete’s adaptation bears the imprint of the type of exercise systematically used in training/treatment.
46% of Canadian kids get 3 hours or less of active play per week, including weekends.
Benefits of Multi-Sport Participation and Training
Benefits of Multi-Sport Training

Can you not learn about nutrition, mental training, rest, recovery, race planning, prediction, interception, agility, balance, co-ordination, speed, team work, conflict management, coaching strategies, tactics, preparation .... In multiple sports?
Benefits of Multi-Sport Training

When learning the piano do you only learn one song?

The importance of posture, hand position, technique, scales, styles, speeds …

This is our Multi-Sport Opportunity
During any given training session, quality of exercise performance is the cornerstone of the training program.

Think of the **Means** of skill performance, not the end product.
Success is not an accident. It is the product of a **thoughtful** and **well executed** plan.

“Those who are enamored with practice without science are like a pilot who goes into a ship without a rudder or compass and never has any certainty where he is going”

Leonardo da Vinci
Performance Excellence
Goldsmith (2003), Groves (2011)

The ability to maintain:
- TECHNICAL excellence
- at SPEED
- under PRESSURE
- when FATIGUED
- with the WILL TO WIN
“In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we have been taught”

- Baba Dioum