LONG TERM ATHLETE DEVELOPMENT GUIDE

ORIENTEERING CANADA

ORIENTEERING
CANADA

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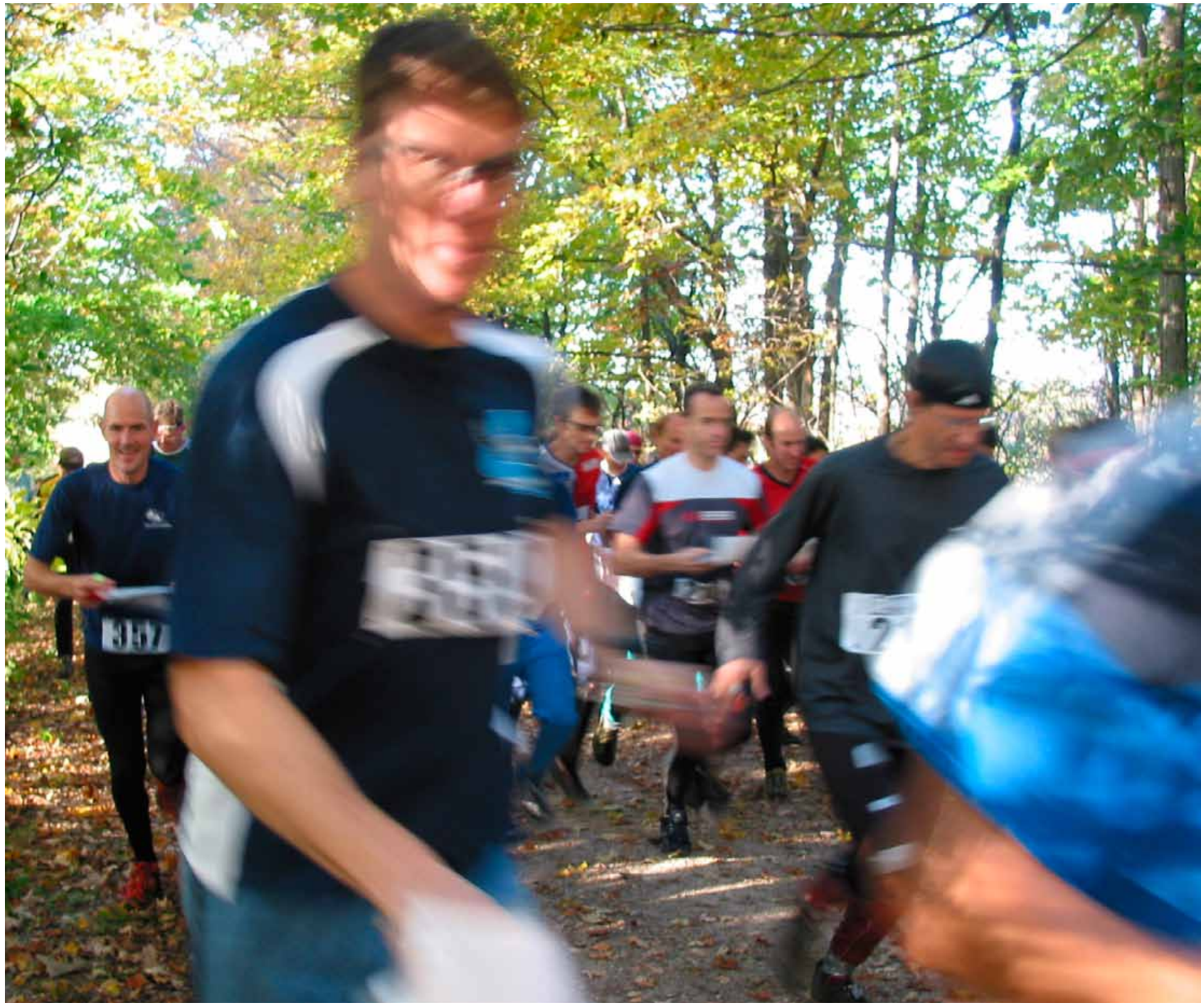


Introduction

Orienteering Canada is pleased to present its Long-Term Athlete Development (LTAD) Guide, *Orienteering – A Sport for All Ages*. This document introduces and explains the conceptual framework for athlete development for Orienteering Canada, its provincial and territorial associations, clubs and individual members as we pursue the shared vision of establishing a sport system that is in the forefront of theory and practice.

Orienteering Canada's LTAD Guide is consistent with Sport Canada's Long-Term Athlete Development Resource Paper but is customized for orienteering. It is a catalyst for change and improvement that will help our sport achieve its goals of fostering both life-long participation and international excellence. To reach these goals will require:

- A cooperative partnership between Orienteering Canada, its provincial and territorial associations, and clubs, within a sport system that recognizes and facilitates the roles of all orienteers, including those internal to Orienteering Canada and those external to the organization (e.g., multi-sport organizations, community recreational organizations, schools, universities)
- Systematic coaching and officials' development at all levels
- An effective orienteering development framework for beginning orienteers right through to our elite competitors
- Programs tailored specifically to an orienteer's developmental stage
- Long term strategies rather than a short term focus
- A systematic and frequent review process of Orienteering Canada and partner processes and programs to ensure continual improvement

Background Information on the LTAD Model

Orienteering Canada's LTAD model will become the overarching framework within which we will pursue the following goals:

- We will offer a sport which everyone can pursue at their desired level, recreational or competitive.
- We will develop orienteering in a positive manner paying heed to our unique Canadian culture, landscape, and history while taking into consideration the changing international orienteering trends.
- We will continually have better results at championship events at JWOC, WOC and WMOC (Junior, World, and Masters' Orienteering Championships).
- We will grow by attracting more people of all ages to our sport.

Our LTAD model will be reflected in our officials', coaching, and organizational materials through print and electronic means.

We will achieve success and enjoyment through the following five paths:

i) Events for all levels of orienteers
ii) Support at the club level
iii) A high performance program for elite competitors
iv) Effective promotion of our sport
v) Clear communication

Why Do We Need an LTAD Model?

Sport Canada's Long-Term Athlete Development (LTAD) Resource Paper, "Canadian Sport for Life", sets out a broad framework for sport development in Canada. As a central tenet, Canada's approach to LTAD is the notion of it being a "vehicle for change; to make all concerned examine the rationale and effectiveness of child and youth programming and the concept of "sport activity for life". It differs from other athlete development models because it acknowledges that physical education, school sports, competitive sports, and recreational activities are mutually interdependent. It is athlete-centred, coach-driven, and is supported by administration, sport science, and sponsors.

It also acknowledges that if we are truly interested in children developing the full range of physical literacy skills, sport organizations must work cooperatively. Exposing children to a wide variety of physical activities and sports at a young age will ensure that they become fully-rounded athletes who have the base to succeed in whatever sport(s) they decide to pursue. Canadian sports organizations have to stop acting as sport silos; rather we must work cooperatively to develop our children's overall capabilities by allowing them to experiment with many different sports.

The LTAD concept

- Is a nine-stage model based on the physical, mental, emotional and cognitive development of children and adolescents. Each stage reflects a different point in athlete development. The first three stages encourage physical literacy and sport experiences for all, while the next five stages are more focussed on development and competitive excellence. The final stage encourages life-long physical activity through participation in sports and informed healthy lifestyle choices.

- Is inclusive - facilitating the optimal involvement of the entire sport continuum, including participants, parents, coaches, officials, specialist consultants, Orienteering Canada, Provincial and Territorial orienteering organizations, orienteering clubs, municipalities, schools and all levels of government.

- Is "Made in Canada" - recognizing international best practices, research and normative data, while considering the social, geographical and political factors that make Canada unique.

- Supports the four goals of the Canadian Sport Policy – Enhanced Participation, Enhanced Excellence, Enhanced Capacity and Enhanced Interaction.

- Recognizes the need to involve all Canadians in the LTAD process, including athletes with a disability.

- Encourages physical literacy upon which specialized sport excellence can be developed.

- Describes principles to guide the optimal training, competition and recovery programs that should be provided throughout an athlete's career.

- Contributes to and promotes a healthy, physically literate nation whose citizens participate in lifelong physical activity.

Ten Global Factors Influencing the Athlete Development Process

The following ten factors are by no means a definitive listing but serve to illustrate critical elements for consideration.

ONE
The Ten Year Journey

Scientific research has concluded that it takes a minimum of 10 years and 10,000 hours of training for a talented athlete to reach elite levels. For athlete and coach, this translates into slightly more than 3 hours of training or competition daily over 10 years. Orienteering is a late specialization sport and the international elite typically achieve their best results only after 10 – 15 years of training and competition.

TWO
FUNdamentals

Fundamental movement skills must be learned at an early age if children are to be physically literate and thus able to take part in a wide variety of athletic activities. Basic movement skills such as running, jumping, and climbing, should be introduced through fun and games, some in a forest environment, to give children the ABCS (agility, balance, coordination, speed) and the confidence to travel through differing types of terrain, up- and downhill and over and under obstacles.


AGILITY


BALANCE


COORDINATION

THREE
Specialization

Sports can be classified as either early or late specialization. Early specialization sports include artistic and acrobatic sports such as gymnastics, diving, and figure skating. These differ from late specialization sports in that very complex skills are learned before maturation, since they cannot be fully mastered if taught after maturation.

Orienteering is a late specialization sport but youngsters can take part in modified orienteering games as early as they can walk. Nevertheless, it is important for children to participate in a wide variety of motor activities and sports at an early age so that they develop the full range of FUNdamentals that will allow them to succeed in their choice of sport(s) as they develop.

FOUR
Developmental Age

Developmental age refers to the degree of physical, mental, cognitive, and emotional maturity. Physical developmental age can be determined by skeletal maturity or bone age, after which mental, cognitive, and emotional maturity is incorporated.

Chronological age refers to the number of years and days elapsed since birth. Children of the same chronological age can differ by several years in their level of biological maturation. Currently, most athletic training and competition programs are based on chronological age. However, athletes of the same age between ages 10 and 16 can be four to five years apart developmentally. Thus, chronological age is a poor guide for segregating children and adolescents into age-graded competitions and training. Since early maturing children have a significant advantage in age-graded programs, it is important to construct our programs to be attractive and rewarding for children and adolescents who may be late maturers.

Training age refers to the age where athletes begin planned, regular, serious involvement in training. The tempo of a child's growth has significant implications for athletic training because children who mature at an early age have a major advantage during the Training to Train stage, compared to average or late maturers. However, after athletes have passed through their growth spurt, it is often later maturers who have greater potential to become top athletes, provided they experience quality coaching throughout that period.

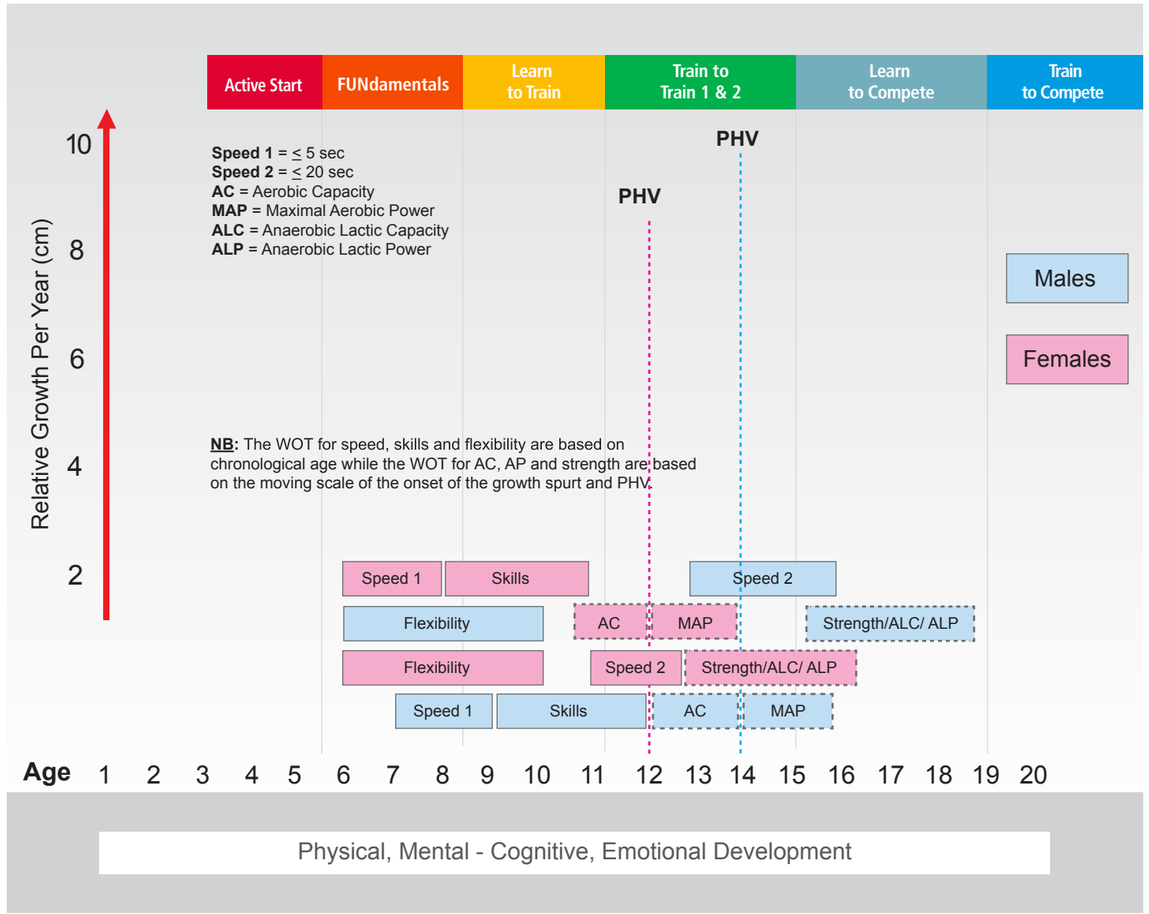
FIVE
Trainability

Trainability has been defined as the responsiveness of developing individuals to a training stimulus or stimuli at different stages of growth and maturation.

Window of trainability (WOT) refers to periods of sensitivity due to growth, development, and maturation that may identify associated trainable elements and so-called "Windows of trainability". There may be points in the development of specific behaviours when experience or training has an optimal effect on development.

Peak Height Velocity (PHV) refers to the period of growth and development when the individual's growth is undergoing the most rapid period of change. For this reason, identification of PHV is generally used to inform program planning about the period when key developmentally significant events will occur. For example, coaches can program general increases in the overall volume of training with respect to an athlete's PHV.

Pacific Sport – Windows of Optimal Trainability (WOT), *adapted from Balyi and Way, 2005*



The 5 basic S's of training and performance are Stamina (Endurance), Strength, Speed, Skill, and Suppleness (Flexibility). (Dick, 1985).

Stamina (Endurance)
Currently, the suggestion concerning endurance is that aerobic capacity training is recommended before athletes reach PHV. Aerobic power should be introduced progressively after growth rate decelerates. Both elements (endurance and power) become part of a comprehensive program as the athlete moves towards adulthood.

Strength
As the endocrine system "stabilizes" for girls after PHV or at the onset of the menarche, and for boys 12 to 18 months after PHV, structured strength training may be incorporated.

Speed
For boys, the first speed training window occurs between the ages of 7 and 9 years and the second window occurs between the ages of 13 and 16. For girls, the first speed training window occurs between the ages of 6 and 8 years and the second window occur between the ages of 11 and 13 years.

Skill
A clearly identified period for skill training for boys takes place between the ages of 9 and 12 and between the ages of 8 and 11 for girls. A more general guideline is that the period between 6 and 14 years of age is a critical period of time for skill development.

Suppleness (Flexibility)
An optimal window of trainability for suppleness for both genders occurs between the ages of 6 and 10. Special attention should be paid to flexibility during PHV.

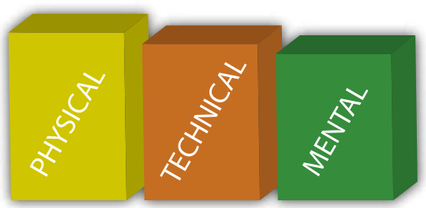
"Most of our athletes would see considerable improvements in their international results if they could significantly improve their technical orienteering."

Magnus Johansson
Senior National Team Coach

Relative Emphasis of Physical, Technical and Mental Training

With increasing specialization by elite athletes in each of the race disciplines, the balance between these three elements of training is subtly different. Likewise, between each stage of an athlete's development, the relative emphasis of these elements is different. The Swedish Orienteering Federation recommends the following balance for the world's best elite orienteers, those in the Training to Win stage of development.

Relative emphasis of training for the world's best elite orienteers (Nikulainen and Eriksson, 2008)



However, given that "all systems are always trainable," Senior National Team Coach, Magnus Johansson suggests equal or more weight to the development of orienteers' technical and mental training: "Most of our athletes would see considerable improvements in their international results if they could significantly improve their technical orienteering" (Personal communication, April 2011). It is also likely that the different disciplines of orienteering (Sprint, Middle, Long, Relay) require different emphases of physical and technical ability, with the physical being most important at the Train to Win stage for the Sprint and Long events.

SIX
Physical, Cognitive, Ethical and Emotional Development

A major objective of LTAD is fostering a holistic approach to athlete development. This includes emphasis on cognitive, ethical, and emotional development as well as physical, tactical, and technical training. LTAD emphasizes fair play and character building throughout the various stages, an objective that reflects Canadian values. Program design should also consider athletes' cognitive ability to address these concepts.

SEVEN
Periodization

At its core, periodization is a time management plan of training activities. Periodization involves scheduling the right activities for the right time in the correct sequence, in order to attain optimal improvements in performance.

FIVE PHASES OF A SINGLE PERIODIZED ANNUAL PLAN	EIGHT PHASES OF A DOUBLE PERIODIZED ANNUAL PLAN
General Preparation Phase (GPP)	General Preparation Phase (GPP)
Specific Preparation Phase (SPP)	Specific Preparation Phase (SPP)1
Pre-Competition Phase (PCP)	Pre-Competition Phase (PCP) 1
Competition Phase ***Peak*** (CP)	Competition Phase (CP) 1 ***Peak One***
Transition Phase (TP)	Specific Preparation Phase (SPP) 2
	Pre-Competition Phase (PCP) 2
	Competition Phase (CP) 2 ***Peak Two***
	Transition Phase (TP)

Periodization sequences the training components into weeks, days and sessions. Periodization is situation-specific and is based on priorities and the time available to bring about the required training and competition improvement. In the LTAD context, periodization connects the stage the athlete is in to the requirements of that stage.

EIGHT
Competition Calendar

Optimal competition calendar planning at all stages is critical to athlete development. At certain stages, development of physical capacities takes precedence over competition, and at other stages the ability to compete becomes the focus. Competition schedules should therefore be selected by the coach and athlete based on the athlete's developmental needs.

The LTAD design recommends a sport-specific system of training and competition that is optimized for the abilities of athletes during the various developmental stages. The following factors should be considered when planning:

- Optimal training to competition ratios are required for all stages of LTAD except Active Start and FUNdamentals.
- The level and length of the competitive season should be aligned with the changing needs of the developing athlete progressing through LTAD.
- Over-competition and under-training at the Learn to Train and Train to Train stages will likely result in a lack of basic skills and fitness.

- The appropriate level of competition is critical to the technical, tactical and mental development of the athlete at all stages.
- The competition and training needs of athletes may not always be met by using a simplified version of a senior competition format.
- A systematic competition and training review needs to be undertaken periodically with regard to national, provincial and club calendar planning in order to provide the best possible pathway for athletes involved in all stages of LTAD.

- Junior Development programs
- Local club competitions (*formerly C meets*)
- Provincial championships and inter-club events (*formerly B meets*)
- Western and Eastern Canadian championships, Canada Cup series (*formerly A meets*)
- National championships and North American championships
- Junior World championships
- World championships

NINE
System Alignment

Sport Canada's LTAD concept is a framework for full sport system alignment in Canada, integrating health and education with sport and physical activity. It is also a tool for motivating change towards more effective organization, alignment and integration within each national sport organization. It is important that all members of the orienteering community work together to implement the right programs and ensure a sport system that will produce optimal conditions for participation, skill development, training and competition.

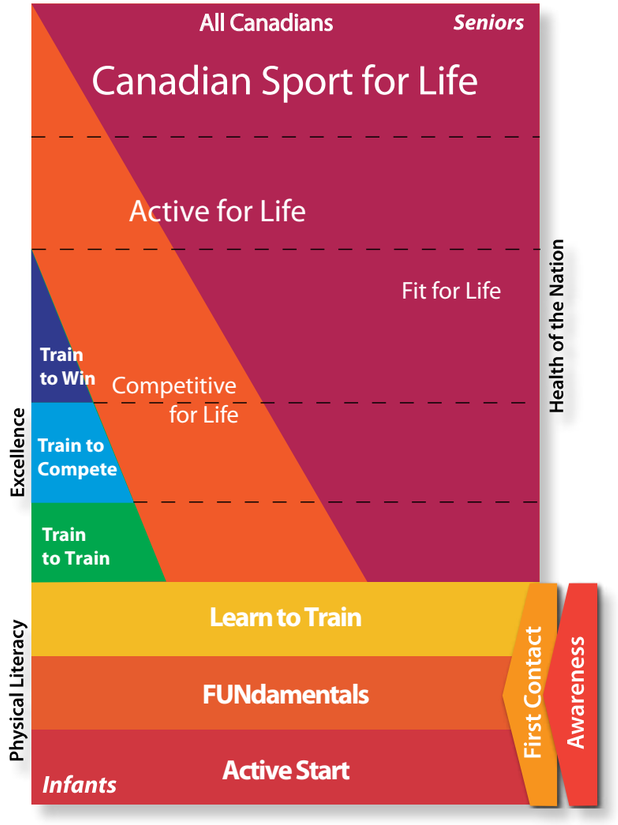
- LTAD has a strong impact on the coaching education curriculum. Developmental readiness and participant capability will replace *ad hoc* decision-making about programming.
- LTAD has a strong impact on officials' development. Competition types and classes, awards, and course setting all have to reflect the developmental age of the athlete.

The new LTAD concept is key to Orienteering Canada's new Strategic Plan. It will ultimately provide the framework for all of Orienteering Canada's programs.

TEN
Continuous Improvement

LTAD is not static. It responds and reacts to scientific and sport-specific innovations and is subject to continuous research in all aspects. As an evolving vehicle for change, it reflects all emerging facets of physical education, sport, community recreation, and life-long physical activity to ensure systematic and logical delivery of programs to all ages.

LTAD promotes ongoing education and sensitization of federal, provincial/territorial, and municipal governments, the mass media, sport and recreation administrators, coaches, sport scientists, parents, and educators about the interlocking relationship between physical education, school sport, community recreation, life-long physical activity, and high performance sport.



LTAD Framework for Orienteering - 9 Stages

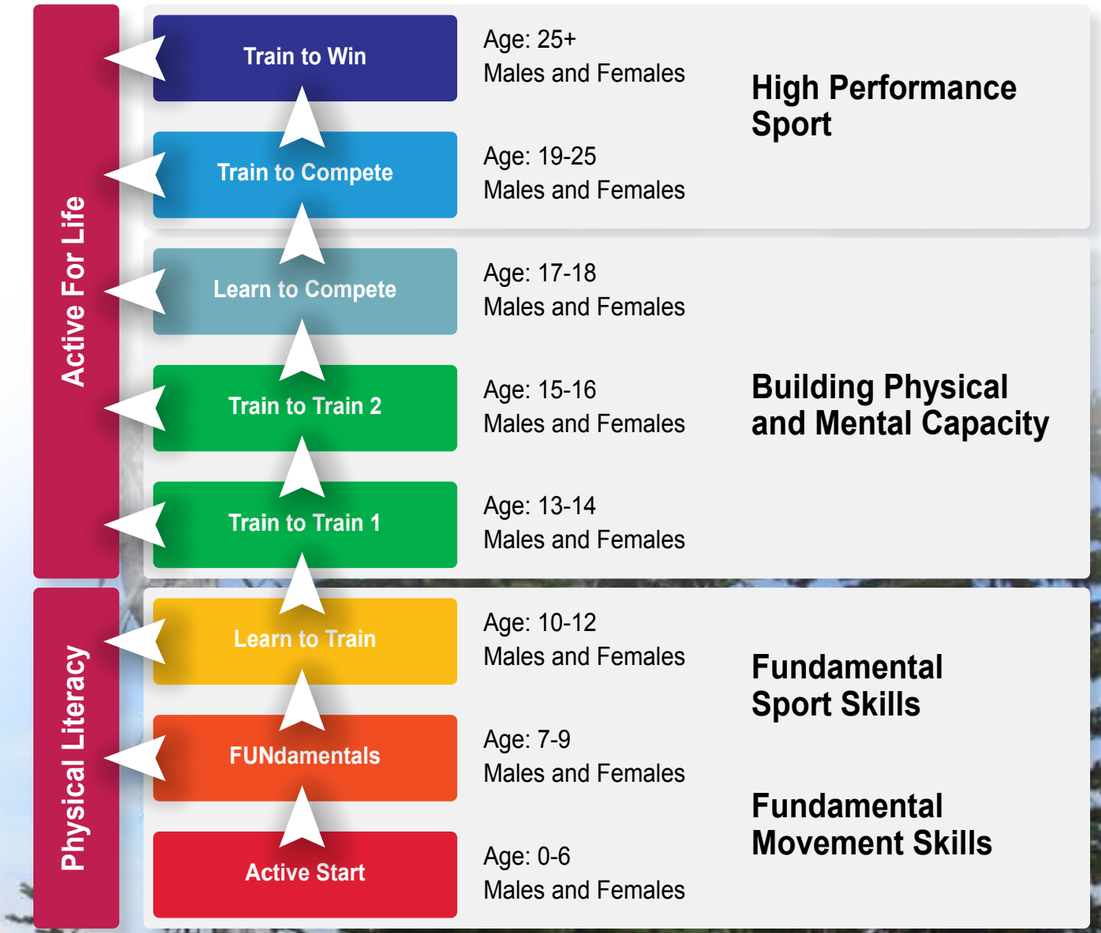
Forest Playground to Podium

Orienteering is a late specialization sport. Unlike sports such as gymnastics or figure skating, orienteering success does not depend on very complex skills that must be learned before maturation, skills that cannot be fully mastered if taught after maturation.

During the first three stages of the LTAD, children grow, become physically literate and have fun participating in active indoor and outdoor games, other sports and orienteering-related activities. Following the first three stages, there is a transition to either further competitive excellence in orienteering or to life-long participation in orienteering and/or other sports at the recreational or age-graded competitive level. For athletes who wish to pursue excellence, we are continuing to provide High Performance Programs (HPP) to enable our developing elite athletes to specialize in orienteering at the national and international level.

Regardless of the level of excellence or sport mastery achieved, however, participation in orienteering – a sport for all ages - can enhance the health, fitness and mental well-being of Canadians of all ages.

THE FIRST THREE STAGES ENCOURAGE PHYSICAL LITERACY AND SPORT FOR ALL	THE NEXT FIVE STAGES FOCUS ON DEVELOPMENT AND COMPETITIVE EXCELLENCE	THE FINAL STAGE ENCOURAGES LIFELONG PHYSICAL AND TERRAIN INTERPRETATION ACTIVITY, AND COMPETITIVE AGE-CLASS EXCELLENCE
1. Active Start	4. Train To Train1	9. Active For Life
2. FUNdamentals	5. Train To Train2	
3. Learn To Train	6. Learn To Compete	
	7. Train To Compete	
	8. Train To Win	



STAGES OF LTAD

IX - ACTIVE FOR LIFE
Age: 17 – 80+, males and females
Maintain life-long physical activity and participation in sport

VIII - TRAIN TO WIN
Age: 25+, males and females
Attain top performance at the highest competitive levels

VII - TRAIN TO COMPETE
Age: 19 - 25, males and females
Optimize fitness preparation and orienteering-specific skills as well as performance

VI - LEARN TO COMPETE
Age: 17 - 18, males and females
Optimize aerobic base and strength, learn more technical and tactical skills and continue to develop mental skills

V - TRAIN TO TRAIN 2
Age: 15 - 16, males and females
Continue to build aerobic base, speed, strength, and orienteering skills

IV - TRAIN TO TRAIN 1
Age: 13 - 14, males and females
Build an aerobic base, develop speed and strength toward the end of the stage, and further develop and consolidate orienteering skills. Build overall strength and physical stability in order to manage the coming training.

III - LEARN TO TRAIN
Age: 10 - 12, males and females
Learn overall sports skills

II - FUNDAMENTALS
Age: 7 - 9, males and females
Learn all fundamental movement skills and build overall motor skills

I - ACTIVE START
Age: 0 - 6, males and females
Learn fundamental movements and link them together into play

I - Active Start

Age: 0 - 6, males and females

Learn fundamental movements and link them together into play

Physical activity is essential for healthy child development. Among its other benefits, physical activity

- enhances development of brain function, coordination, social skills, gross motor skills, emotional health, leadership, and imagination.
- helps children build confidence and positive self-esteem.
- helps build strong bones and muscles, improves flexibility, develops good posture and balance, improves fitness, reduces stress, and improves sleep.
- promotes healthy weight.
- helps children learn to move skilfully and to enjoy being active.

Physical activity should be fun and a routine part of the child's daily life, and not something that is enforced or required.

Organized physical activity and active play are particularly important for the healthy development of children with a disability, if they are to acquire habits of lifelong activity.

Primary objective:
Learn fundamental movements and link them together into play

Technical/tactical goals:
- Develop familiarity with maps, controls and punching systems
- Develop familiarity with the process of orienteering and prominent features used to navigate (trails, streams, large objects, boulders)

Physical goals:
- Starting in infancy, and regardless of the weather, provide infants, toddlers, and preschoolers with opportunities to participate in daily physical activity that promotes fitness and movement skills. Learning should be accomplished through a mix of play and discovery. Provide parents and caregivers with age-appropriate information
- Provide unstructured physical activity — active play — for at least 60 minutes a day, and up to several hours per day for toddlers and preschoolers. Toddlers and preschoolers should not be sedentary for more than 60 minutes at a time, except while sleeping
- Encourage basic movement skills — these do not just happen as a child grows older; their development is conditioned by each child's heredity, activity experiences, and environment
- Focus on improving basic movement skills such as running, jumping, climbing, twisting, wheeling, kicking, throwing, and catching. These motor skills are the building blocks for more complex movement, and help lay the foundation for lifelong physical activity
- Design activities that help children to feel competent and comfortable participating in a variety of fun and challenging sports and activities in differing terrain
- At upper age levels encourage trail walking/running and some off-trail activities such as "jungle courses"
- Since girls tend to be less active than boys, and children with a disability are generally less active than their peers, ensure that activities are gender-neutral and inclusive so that active living is equally valued and promoted for all children. Consider targeted programs for females and children with various challenges

Mental/psychological goals:
- Help toddlers and young children develop positive associations with movement and sport by ensuring that their games are fun, non-competitive and focused on participation, e.g., orienteering string course
- Allow children to experience risk in controlled, safe and fun activities
- Provide activities that help children feel competent and comfortable

Life skill goals:
- Encourage children to participate in park/forest activities to develop an appreciation of, and comfort in the forest environment
- Encourage fair play in all games
- Develop social skills through interaction with others

Periodization and competition profile:
- "String" course
- "Course 1" with a parent or coach, in groups or individually
- Participation awards only
- Focus on skill development and participation; no competitive elements

II - FUNdamentals

Age: 7 - 9, males and females

Learn all fundamental movement skills and build overall motor skills

This is a critical stage for the development of physical literacy, and it is during this time that the foundations of many advanced skills are laid down.

Children need to participate in a variety of well-structured activities that develop basic skills. Activities and programs need to maintain a focus on fun, and formal competition should only be minimally introduced.

Skill development for children this age is best achieved by combining unstructured play in a safe and challenging environment with quality instruction from knowledgeable teachers/leaders/coaches in community recreation activities, schools, and minor sport programs.

Primary objective:
Learn all fundamental movement skills and build overall motor skills

Technical/tactical goals:
- Learn to orient the map to North
- Learn to relate features on the map to the physical terrain in the forest
- Learn more extensive set of basic map features (trails, streams, fields, boulders, cliffs, buildings, fences)

Physical goals:
- Develop proper running techniques on- and off-trail
- ABCS: Develop agility, balance, coordination and speed
- Develop speed, power, and endurance using games
- Incorporate short duration speed training (< 5 s) and some flexibility exercises
- Develop linear, lateral, and multi-directional speed with the duration of repetitions less than 5 seconds
- CPKS: Develop catching, passing, kicking and striking through a mix of hand-eye, foot-eye co-ordination games
- Perform basic resistance exercises using own body weight, medicine balls and Swiss balls
- Practise flexibility by having youngsters follow a flagged route through somewhat dense forest, over and under fallen trees, over and under fences
- Encourage participation in a wide range of sports

Mental/psychological goals:
- Set simple individualized goals, e.g., learn map symbols
- Help develop positive associations with orienteering and the forest through emphasizing fun and positive achievements
- Encourage youngsters to draw “imaginary” maps of terrain of their own choosing

Life skill goals:
- Introduce children to the simple rules and fair play principles of sport
- Develop teamwork and social interaction skills, e.g., support teammates
- Foster positive social environment through different fun activities outside of sport
- Participate in multiple sports
- Learn safety rules of orienteering
- Ensure that activities revolve around the school year and are enhanced by multi-sport camps during summer and winter holidays

Periodization and competition profile:
- None, but well structured informal programmes

III - Learn To Train

Age: 10 - 12, males and females

Learn overall sports skills

This is one of the most important periods of motor development for children, and represents a window of accelerated adaptation to motor co-ordination (skills).

In late specialization sports, too early specialization can be detrimental to later stages of skill development and to refinement of the fundamental sport skills.

At this stage, children are developmentally ready to acquire the general sports skills that are the cornerstones of all athletic development.

Primary objective:
Learn overall sports skills

Technical/tactical goals:
- Practise feature familiarization and recognition, e.g., relate map symbols and colours to the terrain and vice-versa
- Learn how to orient the map using linear terrain features
- Learn to recognize simple handrails in the terrain and how to navigate along them

- Think ahead; be aware of handrail changes along your route
- Know how Start, Finish and Controls are marked
- Start learning international control symbols
- Practise map holding and folding technique
- Learn techniques that allow athletes to navigate off trails for short distances
- Learn basic route choice tactics and decision-making principles, e.g., at every control, have a plan for getting to the next control, and commit to it
- Allow older youngsters in this group to sometimes follow one another on a training course, and afterwards tell each other what they thought the other had done well; the group comes up with at least three positives for each orienteer
- Introduce rough orienteering. Focus on safe orienteering but occasionally point out where youngsters can safely run faster
- Introduce looking ahead and advance planning; learn to look up and begin to think, “What will I see next?”
- Develop basic game concepts

Physical goals:
- Aerobic fitness is increasingly important, especially for girls. Include general aerobic activities 3-4 x per week
- Girls: include Speed training (<20 s) and Aerobic Capacity work
- This is the best stage to train forest running technique. Include agility training and running on technical/challenging terrain
- Introduce basic elements of training: warm-up, cool-down, recovery, rest, diet

Mental/psychological goals:
- Pre-race preparation: help develop athlete’s concentration through executing routines
  e.g., leg planning using *CAR*: **C**ontrol, **A**ttack-point, **R**oute
- Pre-race preparation: develop simple relaxation techniques, e.g., take 3 deep breaths before you start; smile, when standing at the start line

Life skill goals:
- Develop independence at home through fun map reading and symbol recognition games
- Develop independence from parents by orienteering with other children and/or coaches
- Foster positive social environment through different fun activities outside of sport, e.g., build “adventure-based” activities into the season plan
- Emphasize group interaction, team building and social activities
- Practise correct basic nutrition and hydration practices
- Narrow the athletic focus to three sports

IV - Train To Train 1

Age: 13 - 14, males and females

Build an aerobic base, develop speed and strength toward the end of the stage, and further develop and consolidate orienteering skills. Build overall strength and physical stability in order to manage the coming training.

During Training to Train, young athletes consolidate their basic sport-specific skills and tactics. This is a window of accelerated adaptation to aerobic, speed, and strength training.

Optimal aerobic trainability begins with the onset of PHV (peak height velocity), the major growth spurt during maturation.

During competitions, athletes strive to win and to do their best, but the major focus of training is on learning the basics as opposed to competing.

Primary objective:
Build an aerobic base, develop speed and strength toward the end of the stage, and further develop and consolidate orienteering skills. Build overall strength and physical stability in order to manage the coming training.

Technical/tactical goals:
- Emphasize technical skill development, e.g., holding a bearing while running; map reading by thumb; orienteering with flow and control
- Practise following linear features (trails, fences, streams, fields)
- Learn to make use of features slightly off the handrails
- Learn to recognize less obvious handrails, e.g., a ridge system or a valley
- Practise simple route choice, e.g., cutting directly through the forest (off-trail) for short distances, less than 100 meters, rather than taking a longer route following a handrail
- Continue to practise executing key routines, e.g., leg planning using CAR: control, attack point, route; map orientation with compass and terrain, map folding
- Automate the execution of basic orienteering processes, e.g., run at a speed that allows you to stay in contact with the map
- Practise specific tactics in order to make them routine, e.g., start the race slowly and carefully to get used to the map and scale, and to conserve energy for later in the race; take safer than normal routes early and late in the course (i.e., when excited or tired)
- Study a wide variety of orienteering maps

Physical goals:
- Make aerobic power and aerobic endurance training a priority after the onset of PHV while maintaining or further developing levels of skill, speed, strength, and flexibility
- Continue speed development for boys and girls (<5s to <20 s)
- Girls may start responding well to strength/anaerobic lactic capacity/anaerobic lactic power training
- RJT (run, jump, throw): emphasize terrain running technique - jumping; hopping on, off and over obstacles; running up, down and contouring across slopes; climbing over terrain barriers
- ABCS: Continue to develop complex agility, balance, coordination and speed
- Develop core stability and strength using medicine balls, Swiss balls and own body weight exercises as well as progressive hopping and bounding exercises
- Encourage flexibility and agility exercises, now that athletes are beginning to experience stiffness after exercising
- Continue to develop physically through FUN games
- Remember that training levels are dependent on the orienteer`s developmental maturity levels – one size does not fit all

Mental/psychological goals:
- Begin guided error detection and correction
- Introduce the concept of *SMART* goal-setting
  - » **S**pecific
  - » **M**easureable
  - » **A**chievable (you alone determine success)
  - » **R**ealistic
  - » **T**ime-frame
- Practise focusing your concentration in the face of distraction and shifting focus by using self-talk, thought stopping, refocusing and key words
- Understand the importance of breathing for control and relaxation
- Develop self confidence through the continued successful execution of technical and tactical skills
- Practise imagery, e.g., visualize successful execution of technical skills
- Learn to deal with success and failure
- Play O-simulation games, e.g., Catching Features

Life skill goals:
- Participate in complementary sports (similar energy system and movement skills)
- Establish parental / guardian support for your life style
- Practise good nutrition and hydration
- Develop good practice habits
- Understand changes puberty will bring
- Accept discipline and structure
- Understand the relationship between effort and outcome
- Further develop teamwork and interaction skills
- Develop social skills through interaction with others
- Demonstrate respect for coaches, officials and their decisions
- Narrow athletic focus to two sports

Periodization and competition profile:
- Single periodization (1x48wks) or double periodization (a winter sport and orienteering)
- 75% training to 25% competition ratio

V - Train To Train 2

Age: 15 - 16, males and females

Continue to build aerobic base, speed, strength, and orienteering skills

Technical/tactical goals:

- Practise technical skills, e.g., holding a bearing while running; map reading by thumb; orienteering with flow and control
- Practise contour interpretation; begin to distinguish upslopes from down in mapped land forms
- Navigate using rough map reading, i.e., concentrate on large contour features off-trail
- Begin to identify contour features in the forest, e.g., small and large hills, highest points in the terrain
- Learn symbols for terrain runnability (colour code and special markings)
- Use rough compass technique to maintain direction through the forest towards obvious handrails less than 300 meters distant
- Choose reliable attack points
- Use precision compass to travel accurately from attack points to controls
- Automate the execution of basic orienteering processes, e.g., move at a speed that allows you to stay in contact with the map
- Practise specific tactics in order to make them routine, e.g., start the race slowly and carefully to get used to the map and scale, and to conserve energy for later in the race; take safer than normal routes early and late in the course (when excited and/or tired)
- Study a wide variety of orienteering maps and practise choosing routes between map features

Physical goals:

- Girls: likely a greater response to Strength/Anaerobic Lactic Capacity/Anaerobic Lactic Power training tasks (Strength/ALC/ALP, see diagram p. 13)
- Girls and boys: Continue development of aerobic capacity and basic speed (<5s to <20s)
- Make aerobic power and aerobic endurance training a priority after the onset of PHV, while maintaining or further developing levels of skill, speed, strength, and flexibility
- Continue strength development using own body weight and medicine balls
- Girls: Use free weights with gradually increased weight and lower repetitions
- Boys: Use free weights with low weight and high repetitions

Mental/psychological goals:

- Continue guided error detection and correction
- Practise relocation in the terrain
- Continue to develop goals using the SMART framework
  - » Specific
  - » Measureable
  - » Achievable (you alone determine success)
  - » Realistic
  - » Time-frame
- Practise focusing your concentration in the face of distraction and shifting focus by using self-talk, thought stopping, refocusing and key words
- Practise breathing for control and relaxation
- Develop self confidence through the continued successful execution of technical and tactical skills
- Practise imagery, e.g., visualize successful execution of technical skills
- Learn to deal with success and failure
- Play O-simulation games, e.g., Catching Features

Life skill goals:

- Participate in complementary sports (similar energy system and movement skills)
- Develop time management skills
- Start developing and using pre-race routines and race plans

Periodization and competition profile:

- Compete at many regional level competitions, with at least one national level competition per year
- Single periodization (1x48wks) or double periodization (a winter sport and orienteering)
- 75% training to 25% competition ratio

VI - Learn To Compete

Age: 17 - 18, males and females

Optimize aerobic base and strength, learn more technical and tactical skills and continue to develop mental skills

Fitness preparation deals primarily with the body. By this time, the athlete's muscles have reached their maximum size, but the ligaments and tendons are continuing to strengthen. There is therefore a risk of injury if training intensity is increased too quickly. The anaerobic system is reaching its maximum capacity. Young women increase proportionally more in weight than young men.

Primary objective:
Optimize aerobic base and strength, learn more technical and tactical skills and continue to develop mental skills.

Technical/tactical goals:
- Make advance planning automatic. For each leg, decide on an execution plan and commit to it
- Further develop and refine the skills of map simplification and generalization so that they become automatic. Include in this refinement the ability to quickly select the features that are relevant to the chosen route; the nature of these selected features will change, depending on the actual terrain type
- Practise holding your elevation and taking controls when running across slopes
- Practise simplifying, enlarging, and extending the control
- Continue to practise contour interpretation and precision map reading
- Practise distance estimation; use pace counting for distances under 200 meters and practise intuitive estimation of longer distances
- Practise taking difficult controls in less detailed terrain with few catching features
- Think like a course setter
- Practise a philosophy of safe, controlled and consistent orienteering

Physical goals:
- Athletes follow individually tailored physical training programs with differing intensities
- Increase training volume but take into account individual differences. A rule of thumb is to increase training volume a maximum of 20% per year – increasing too quickly increases the risk of injuries
- Encourage cross-training for endurance
- Learn the importance of long-term and short-term training, including rest and recovery strategies.
- Boys: likely a greater response to Strength/Anaerobic Lactic Capacity/Anaerobic Lactic Power training tasks (Strength/ALC/ALP, see diagram p. 13)
- Train strength using own body weight and orienteering-like surfaces. Include hill-training and running on soft surfaces (sand, bark mulch trails, snow) but emphasize training where agility and stability are trained at the same time (terrain running)
- Use free weights to develop strength as desired
- All systems are now trainable for males and females
- Main focus is on aerobic capacity and aerobic power
- Coaches: be aware of Peak Height Velocity and windows of trainability

Mental/psychological goals:
- Take more responsibility for your own training and continue to develop your ability to analyse your behaviour and development
- Develop and practise effective coping strategies for dealing with unforeseen problems when these occur in a race
- Build self-confidence. Focus on your own improvement in the skills you use in orienteering – tactical, technical, physical, mental and life skills
- Understand and internalize the fact that self-worth is not linked to performance
- Learn to deal with winning, losing, setbacks (injuries) and rejection
- Practise goal setting
- Learn how to manage an optimal level of pre-race tension and/or excitement
- Manage your inner dialogue while orienteering; visualize staying positive and focused; learn how to refocus your thoughts, e.g., after making mistakes, or catching up with competitors
- Explore different relaxation techniques to incorporate into pre-performance and competition routines. Write a sequential list that lays out your pre-competition routine. The act of writing it out helps increase your concentration prior to a race. The routine itself can eventually be extended until it includes the entire competition
- Play O-simulation games, e.g., Catching Features
- Learn O-CAD, if interested in mapping/course-setting (learn how a course-setter thinks)
- Establish indoor winter training program to refine skills (dryland, practical skills – armchair O)
- Practise concentration. Train the ability to concentrate by using thought control during daily training; in effect, learn how to focus on the correct thought process. Recognize the situations and associated feelings when one is concentrating well and when one loses concentration

Life skill goals:
- Implement correct nutrition and hydration practices before, during and after practice and competition
- Introduce personal monitoring (training and performance logbook/diary)
- Understand the importance of injury prevention and recovery
- Understand the importance of rest and recovery strategies
- Learn effective time management strategies
- Be aware of physiological and psychological fluctuations during menstrual cycle (F)
- Be aware of how athletes and coaches deal with normal weight gain in women and the potential for associated eating disorders.
- Understand protection rights and responsibilities
- Develop interpersonal skills and learn to work effectively in a team environment
- Develop positive communication skills
- Display commitment to achieving stated goals
- Understand the concept of deliberate practice

Periodization and competition profile:
- Single (1x48wks) or double periodization (2x24wks macro-cycles)
- Focus on national-level competitions; JWOC (Junior World Orienteering Championships) for exceptional athletes

VII - Train To Compete

Age: 19 - 25, males and females

Optimize fitness preparation and orienteering-specific skills as well as performance

Primary Objectives:
Optimize fitness preparation and orienteering-specific skills as well as performance.

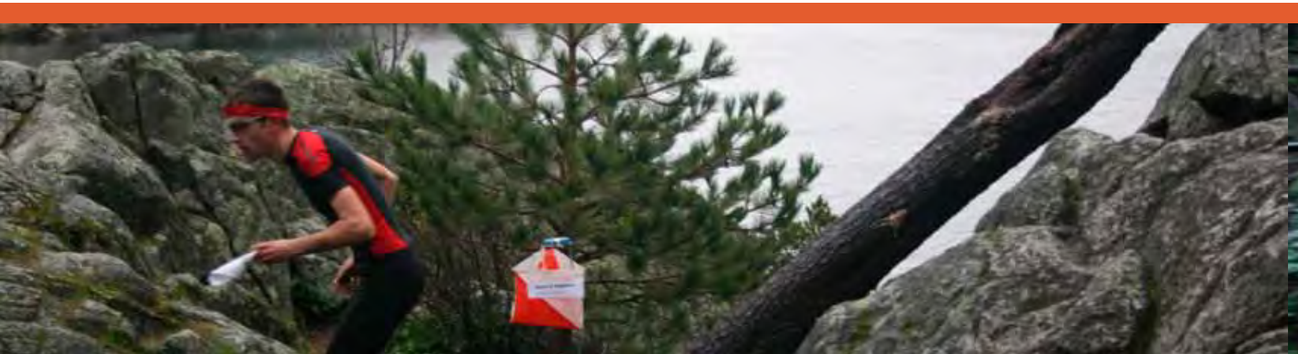
Technical/tactical goals:
- Make advance planning automatic. For each leg, decide on an execution plan and carry it out
- Continue to practise taking difficult controls in less detailed terrain with few catching features
- Start practising "bold orienteering." Move towards bold execution rather than always practising safe, controlled, mistake-free orienteering. To do this, use as much physical capacity as you can, generalize the terrain as much as possible, and visualize well. The aim here is to test your boundaries, i.e., find out how fast you can orienteer before continually making mistakes. Begin testing "bold orienteering" on parts of legs or on shorter courses where it's easier to maintain technical focus and concentration, since physical tiredness shouldn't be a factor. Be aware, while practising this approach, that the aim is not to simply develop a pattern of taking chances - some that pay off, some that don't. Rather, the aim is to develop faster, successful orienteering
- Display high level of proficiency in technical skills - these have become automatic
- 19-20 year olds are encouraged to "race up" into senior men/women categories in training to gain experience at the elite level
- Individualize technical skills training including developing and integrating new methods. Develop 'Personal Style'. Adjust speed according to the type of terrain and your individual strengths
- Practise orienteering skills under competitive conditions and at high intensity
- Display consistency and control during complex decision making
- Establish winter training program to refine skills (dryland, practical skills – armchair O)
- Develop competition plans
- Develop competition analysis
- Adapt to situations; anticipate and prepare for different environments, e.g., altitude, heat, cold, wind, rain
- Develop relay skills further
- Training camps should focus on terrain types used in key competitions (JWOC or WOC)

Physical goals:
- Athletes follow personally tailored physical conditioning and recovery programmes
- Aerobic capacity and aerobic power training is main focus – develop endurance to become competitive at the senior elite level
- Undertake event-specific (e.g., sprint, middle, long, relay) intensive physical conditioning
- Learn to perform under a variety of competitive conditions during training
- Competition-focused physical preparation
- Prepare optimally: taper and peak performance

Mental/psychological goals:
- Undertake independent error detection and correction
- Concentration, focus and thought control: use self talk and trigger words to deal with distractions and negative thoughts
- Individualize and refine relaxation techniques
- Further develop self-belief through improved tactical understanding and consistent competitive performance; discuss positive performances; set and achieve task-based goals; set and achieve acceptance goals
- Use imagery and key words to prepare for stressful situations (e.g., important competitions, mistake recovery and/or logistical problems)
- Use visualization to practise strategies
- Refine performance routines and pre-competition preparation
- Understand the importance of deliberate practice of mental skills
- Practise mental skills under competition conditions

Life skill goals:
- Integrate sport, career and life goals
- Continue personal development
- Address economic and independence issues
- Address combining education, work and personal life to allow high-level training and competition
- Compete ethically and fairly
- Display personal responsibility and involvement in decision making
- Refine self-monitoring
- Develop appropriate practice, warm-up, and competition routines
- Develop nutritional and hydration strategies for training and competition
- Demonstrate good practice in relation to injury prevention and recovery
- Learn to cope with pressures from school/work/sport/parents
- Engage in planning and periodization of training
- Develop a support network
- Be capable of teamwork, and of giving and taking advice
- Recognize the signs of fatigue, and develop appropriate recovery strategies
- International travel is essential for competition and training development

Periodization and competition profile:
- Double or triple periodization (2x24wks or 3x16wks)
- Introduce major and minor peaks to produce optimal athletic performance
- 50:50 Training: Competition
- Focus on North American Orienteering Championships (NAOC), JWOC for 19 – 20 year olds and World University Orienteering Championships for university students
- Focus on World Orienteering Championships (WOC) for exceptional athletes in this stage



VIII - Train To Win

Age: 25+, males and females

Attain top performance at the highest competitive levels

Athletes have now established their optimal personal training levels. Some orienteers experience that after many years of intense training they can now decrease the volume of training and increase the intensity in order to raise their capacity further.

Primary Objective:
Attain top performance at the highest competitive levels.

Technical/tactical goals:
- Make advance planning automatic. For each leg, decide on an execution plan and carry it out
- Maintain high level of proficiency in technical skills by continuously refining, improvising, and personalizing them
- Ensure that event- and competition-specific training skills are automatic and second nature
- Practise "bold orienteering." Use as much physical capacity as you can, generalize (simplify) the terrain as much as possible, and visualize well. Establish your personal boundaries, i.e., find out how fast you can orienteer while remaining mistake-free. Develop your own personal style based on your experience in all types of terrain
- Display the highest possible level of consistency and control over complex decision making

Physical goals:
- Athletes follow personally tailored physical conditioning and recovery programmes
- Aerobic capacity and aerobic power training remain the main focus – develop endurance to become competitive at the senior elite level
- Maintain and possibly improve physical capacities with a view to maximizing international performance
- Take planned breaks to prevent injury and burnout

Mental/psychological goals:
- Refine independent error detection and correction
- Relaxation: individualize and refine relaxation techniques
- Self-belief: develop self-belief through improved tactical understanding and consistent competitive performance
- Concentration: use refocusing plans/coping strategies. Visualize controlling different competition situations in which your concentration would be disturbed during top-level events, e.g., at World Orienteering Championships.
- Imagery: use imagery that incorporates tactics, problem-solving, pre-performance and performance routines
- Undertake competition simulation training to practise concentration skills and focusing. Visualize the most important competitions many times through different means: mental training, specific technique practice and other competitions

Life skill goals:
- Integrate sport, career and life goals to allow high level training and competition
- Be capable of teamwork, giving and taking advice
- Display discipline and personal responsibility
- Compete ethically and fairly
- Provide positive role models to younger athletes
- Recognize that international travel is essential for competition and training development
- Limit focus to one sport (orienteering)
- Establish a well-developed and integrated support network/structure
- Continue career/sport planning
- Recognize the signs of fatigue and develop appropriate recovery strategies
- Balance work and life
- Develop strategies to deal with pressure e.g., media interactions

Periodization and competition profile:
- Double or triple periodization (2x24wks or 3x16wks)
- Focus on national-level competitions, international competitions including NAOC, World Ranking Events and WOC

IX - Active For Life

Age: 17 – 80+, males and females

Maintain life-long physical activity and participation in sport

This stage can be entered at any age. Athletes who have completed the Learn to Train stage and want to remain active in the sport at a recreational level should be encouraged to continue as both athletes and officials. Adult beginners can be offered modified programs that take into consideration their specific cognitive, life skill, physical and technical abilities.

Primary Objectives:
Maintain life-long physical activity and participation in sport.

Goals:

- Athletes follow personally tailored physical conditioning and recovery programmes
- Emphasize flexibility and strength training to avoid injury
- Participate in cross-training activities
- Continue participating in orienteering competitions in addition to becoming expert in other aspects of the sport, e.g., course setting, mapping, event organization, coaching
- Work/volunteer at the provincial or federal level to support orienteering and stay active in the orienteering family
- Compete at international age-graded competitions, e.g., World Masters' Orienteering Championships and other multi-day events

An Integrated Development System for Orienteering

It will require a coordinated effort by the entire orienteering community to create a truly integrated, leading edge development system that will place Canada in the top 15 orienteering nations in the world. In order to achieve this objective, it is important that all of the primary stakeholders acknowledge their roles and responsibilities and be aware of those of the other key groups involved in the development process. The groups and their respective traits and qualities follow.

PARENTS

- Provide support and guidance in making their child's involvement in orienteering enjoyable
- Be educated about orienteering and how one can progress through the sport
- Understand the concept that increased activity will counter the current trends in childhood and adult obesity and cardiovascular disease

ATHLETES

- Enjoy orienteering
- Develop competent physical literacy
- Develop competent orienteering skills
- Become self-reliant and demonstrate independent initiative in learning and developing skills

OFFICIALS

- Be educated
- Have a thorough understanding of the LTAD principles for orienteering
- Understand where and how they fit into the system
- Commit to supporting athletes in achieving their goals

COACHES

- Be educated
- Have a thorough understanding of the LTAD principles for orienteering
- Understand where and how they fit into the system
- Commit to supporting athletes in achieving their goals

CLUBS

- Provide proper training and competition facilities
- Provide a support structure (coaching, resources, etc.)
- Operate developmental orienteering programs
- Recruit newcomers from the community

ORIENTEERING CANADA AND ASSOCIATIONS

- Ensure that appropriate programming is in place for use by clubs, coaches, officials, etc.
- Be a source of information, expertise and support providing necessary information and communications in the development of athletes

Glossary of Terms

Adaptation refers to a response to a stimulus or a series of stimuli that induces functional and/or morphological changes in the organism. Naturally, the level or degree of adaptation is dependent upon the genetic endowment of an individual.

Adolescence is a difficult period to define in terms of the time of its onset and termination. During this period, most bodily systems become adult both structurally and functionally. Structurally, adolescence begins with acceleration in the rate of growth in stature, which marks the onset of the adolescent growth spurt. The rate of statural growth reaches a peak, begins a slower or decelerative phase and finally terminates with the attainment of adult stature. Functionally, adolescence is usually viewed in terms of sexual maturation, which begins with changes in the neuroendocrine system prior to overt physical changes and terminates with the attainment of mature reproductive function.

Aerobic Capacity (for the purposes of this document) may be thought of as synonymous with aerobic endurance. That is, the ability to perform without decrement in performance over tens of minutes with the energy contribution being almost exclusively aerobic as the time of the effort/performance increases.

Aerobic Power refers to the maximal rate at which the aerobic system can contribute to energy production. Therefore, this will tend to influence maximal effort events or repetitions lasting in the range of two to eight minutes. It should be realized that 'anaerobic' processes are heavily involved in such power outputs/performance levels.

Anaerobic Capacity (following the pattern of terms above) is concerned with the ability of the various anaerobic metabolic pathways (predominantly the anaerobic glycolytic or anaerobic lactate system) to produce high power outputs in the 45 second to two minute range.

Anaerobic Power (for the purposes of this document) emphasizes the ability of the anaerobic glycolytic system to produce high, but short duration (approximately 8 – 45 seconds), power outputs. In addition to this aspect is the ability of the Anaerobic Alactate system (ATP-CP), which is able to utilize immediately available energy stores for explosive and, or, ultimate speed (i.e., 0 – 8 second durations) actions.

Attack points are easily identifiable, distinct, close-by and safe terrain features from which you make your final approach to the control flag

Bold orienteering requires planning ahead, looking up and focusing every second of the race. Bold orienteering requires strong automatic skills, high levels of self-knowledge and discipline, courage and a will to succeed.

Childhood ordinarily spans the end of infancy – the first birthday – to the start of adolescence and is characterized by relatively steady progress in growth and maturation and rapid progress in neuromuscular or motor development. It is often divided into early childhood, which includes pre-school children aged 1 to 5 years, and late childhood, which includes elementary school-age children, age 6 through to the onset of adolescence.

Chronological Age refers to the number of years and days elapsed since birth. Growth, development and maturation operate in a time framework; that is, the child's chronological age. Children of the same chronological age can differ by several years in their level of biological maturation. The integrated nature of growth and maturation is achieved by the interaction of genes, hormones, nutrients and the physical and psychosocial environments in which the individual lives. The complex interaction regulates the child's growth, neuromuscular maturation, sexual maturation and general physical metamorphosis during the first two decades of life.

Concentration/Focus is a basic skill at all levels of orienteering. Your mental resources are directed towards what is essential to solve the task at hand.

Coping is the ability to handle unforeseen negative events, such as injury and illness.

Developmental Age refers to the interrelationship between growth and maturation in relation to the passage of time. The concept of development also includes the social, emotional, intellectual and motor realms of the child. Developmental age reflects the true overall situation of an individual's growth and maturation and may be thought of as an index of development stated as the age in years of an individual and determined by specified standardized measurements such as motor and mental tests and body measurements. The terms "growth" and "maturation" are often used together and sometimes synonymously. However, each refers to specific biological activities. Growth refers to observable, step-by-step, measurable changes in body size such as height, weight, and percentage of body fat. Maturation refers to qualitative system changes, both structural and functional in nature, in the organism's progress toward maturity; for example, the change of cartilage to bone in the skeleton.

Distance estimation is the ability to systematically estimate distance and adapt to the map scale (without using a ruler and calculation).

Enlarge/extend is a technique to use prominent terrain features (marshes, distinct re-entrants, etc.), to lead you to the control.

Leg planning is the process of establishing and then executing a plan for the route to take between two controls. It requires planning ahead and discipline to stick with the plan.

Looking up means to constantly scan the terrain ahead to be able to plan better and to anticipate features far ahead which will help you maintain high running speed.

Mistake recovery is a positive behaviour that is automatically invoked when you realize that you are about to miss a control or have missed a control.

Pace counting is a technique of counting double steps in order to know how far you have run. It can be important in featureless terrain and for night-orienteering.

Peak height velocity (PHV) is the maximum rate of growth in stature during the adolescent growth spurt. The age of maximum velocity of growth is called the age at PHV. The rate of change in height varies through specific stages of growth and allows for 'height cues' or rates of growth changes to be used as potential indicators of appropriate programming and evaluation content for developing athletes.

Physical Literacy refers to the mastering of fundamental motor skills and fundamental sport skills.

Precision map reading is careful reading of a local region of the map and all its details. It requires well-developed map reading ability.

Precision compass technique requires you to look at the compass often and to aim carefully. General compass technique also includes holding the compass steady and flat in front of the navel, scanning the terrain to avoid obstacles, and always keeping accurate direction.

Punching is a method for recording whether a competitor has reached a control flag.

Readiness refers to the child's level of growth, maturity, and development, which enables him/her to perform tasks and meet demands through training and competition.

Refocusing is the ability to quickly regain concentration after a distraction.

Rough compass technique is similar to precision compass technique but you look less frequently at the compass and are less focused on aiming accurately. It is used especially when running at speed towards catching features.

Rough map reading involves using only the big features of the map, such as marshes, big hills and other major terrain features, rather than the fine details.

Route choice includes all the following: identify all potential routes, evaluate them and make a decision. The more potential routes, the more complicated the process.

Simplification enables you to filter out unnecessary detail from the map and see the "big picture". It can also be used for the actual attack of the control, which then means to extend or enlarge the control.

Speed may be thought of as the ability to move a limb, limbs, or the whole body at the greatest possible velocity. In addition, speed involves the capability to react to a stimulus or signal (such as a starting signal or stumble) in the shortest possible time. Speed improvement may be incorporated as part of physical training and/or technical training, depending upon the stage of development of the athlete or the sport specificity required.

Speed adaptation/adjustment is synonymous with tempo change. Running speed will be slower when the technical difficulty demands it and faster when it is possible.

Trainability refers to the genetic endowment of athletes as they respond individually to specific stimuli and adapt to it accordingly. Malina and Bouchard (1991) defined trainability as the responsiveness of developing individuals at different stages of growth and maturation to the training stimulus.

Training Age refers to the age where athletes begin planned, regular, serious involvement in training. The tempo of a child's growth has significant implications for athletic training because children who mature at an early age have a major advantage during the Training to Train stage compared to average or later maturers. However, after all athletes have gone through their growth spurt, it is often later maturers who have greater potential to become top athletes provided they experience quality coaching throughout that period.

Window of Trainability is a term that suggests that there may well be "periods of increased sensitivity" to particular stimuli that may lead to optimal or even accelerated development. Such periods clearly exist in several areas of human development, including physical movement.

Acknowledgements & References

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REFERENCES

Balyi, I., Way, R., Norris, S., Cardinal, C. & Higgs, C., Canadian Sport for Life: *Long-term athlete development resource paper*, Vancouver, BC: Canadian Sport Centres, ISBN 0-9738274-0-8, 2005

Dick, F.W., *Sports Training Principles*, London, Lepus Books, 1985

Flight Plan, LTAD for Skydiving in Canada, Canadian Sport Parachuting Association, 2009

Long-Term Athlete Development Guide, Cross-Country Skiing A Sport for Life, 2007

Malina, R.M. and Bouchard, C., *Growth, Maturation, and Physical Activity*, Champaign, Ill.: Human Kinetics, 1991

Nikulainen, P. and Eriksson, S., *Elitplanen*, Swedish Orienteering Federation, 2008

The Long-Term Orienteering Development Plan. Dublin: Irish Orienteering Federation, 2007

www.orienteering.ca

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