

uk:athletics 

Long Term Athlete Development

coaches manual



Text copyright ©

This pack is copyright under the Berne Convention. All rights are reserved. Apart from any fair dealing for the purposes of private study, criticism or review, as permitted under the Copyright, Designs and Patents Act 1988, no part of this publication can be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, electrical, mechanical, optical, photocopying, recording or otherwise, without the prior written permission of the copyright owner. Enquiries should be addressed to UK Athletics.

Overview of Long-term Athlete Development

1: Time to excel

It has been shown that it takes between 8 and 12 years of extensive practice to excel at anything – art, music, sport and so athletics. This is called the 10 year or 10,000 hours rule and means that it will take this sort of long-term commitment (an average of around 3 hours a day of deliberate practice) for a talented athlete to reach elite levels (Bloom 85, Ericsson et al, 93 and 94). For young children, this will be less than 3 hours a day and post puberty; there will inevitably be more than three hours of practice a day.

It takes 10 years of extensive practice to excel at anything

H Simon, Nobel Laureate

Governing bodies, coaches, parents and athletes need to realise that young athletes are not miniature adults and that short term gains and successes and ad hoc watered down adult training programmes will not produce long term excellence. There has to be a long term commitment to excellence and a long term athlete development strategy that provides each athlete with the appropriate training, competition and recovery schedules to ensure the optimum development of his or her genetic talent.

2: Slow cooking

Pushing athlete development too quickly and rushing competition will not only result in likely injury or burnout but will always result in shortcomings in the athlete's physical, technical, tactical and mental abilities. Few sports require early specialisation – specialisation before 10 years of age. These include gymnastics, diving and figure skating – all sports with a high technical component where the skills are more easily learnt in the immature body that has short levers, a low centre of gravity, high power to weight ratio. Most sports, including athletics, are classified as late specialisation sports, where specialisation is not advocated before 10 years of age. This has significant implications for the way track and field athletes are brought into the sport, for the type and intensity of training and competition as the athlete develops his or her skills and capacities from the age of 10 through to senior international athlete. It is a long-term process to take young athletes to elite athletes.

3: Long-term athlete development stages

Based on a number of preceding research articles Bayli (2002) recommends a five-stage model for the long-term development of track and field athletes (see table).

This model recognises that young athletes develop at different rates; they are not miniature adults and their training must be adapted to their biological and training age and not simply their chronological age (see explanation in panel), particularly as athletes approach adolescence. The age bandings for each stage also reflect the fact that boys typically mature later than girls. It is vital that coaches working with athletes in World Class Start, Potential and Performance programmes identify accurately the biological and training age of each athlete and base their long term development programmes on these factors and not on chronological age. Chronological age is in fact a very poor determinant of biological and training age. From the onset of puberty, coaches need to group their athletes for training and competition as early, average or late maturers, according to their biological age.

The model also proposed that while all systems are trainable, there are sensitive periods or windows where there are accelerated gains. Failure to capitalise on these critical periods will result in a longer-term deficit that the athlete cannot ever fully recoup.

5-stage model	Girls	Boys
Fundamentals - F	6-8 years	6-9 years
Learning to Train - L2T	8-11 years	9-12 years
Training to Train - T2T	11-14 years	12-15 years
Training to Compete - T2C	14-17 years	15-18 years
Training to Win - T2W	17 + years	18+ years

Chronological age refers to the athlete's actual years from their birth.
Biological age refers to the athlete's developmental age physically, emotionally and socially.
Training age refers to the number of years the athlete has been in specialised training for the sport.

	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
Girls	FUNdaMENTALS (F)		LEARNING TO TRAIN (L2T)			TRAINING TO TRAIN (T2T)			TRAINING TO COMPETE (T2C)			TRAINING TO WIN (T2W)		
Boys	FUNdaMENTALS (F)			LEARNING TO TRAIN (L2T)			TRAINING TO TRAIN (T2T)			TRAINING TO COMPETE (T2C)			TRAINING TO WIN (T2W)	

4: Current and recommended practice

This individualised approach based on biological and training age is not typical of current coaching practice in athletics and indeed in most other sports. The following table compares traditional with recommended practice.

Traditional practice	Recommended practice
Coaches tend to base their training programmes solely on chronological age.	Coaches should base their training programmes on biological and training age
Chronological age dominates competition schedules and design at all ages.	Competition schedules and design should be based on biological and training age particularly from 11-16 years where there are significant differences in maturation
Adult competition schedules are imposed on younger athletes.	Competition schedules should reflect the biological age and not the chronological age.
Adult training programmes are watered down for younger athletes.	Training programmes should reflect the unique and specific needs of the young athlete and his or her biological and training age
More often than not male programmes are superimposed on females.	Training programmes for boys and girls are likely to be different after 8-9 years of age
Training and competition at the beginner and intermediate levels focuses on the outcome (the performance and winning)	Training and competition at the beginner and intermediate levels should focus on the process (i.e. the development of the athlete, how the training is being optimised and the athlete developed over the longer term, the way they are performing). There is a need to review competition structure for young athletes in the L2T and T2T stages
The critical periods of accelerated adaptation to training is not fully (or at all in some cases) used by coaches at world class start or learning to and training to train stages.	Coaches must identify and capitalise on the critical training windows that accompany the maturing body (see section xx)
The best coaches tend to coach at elite level	The programming demands on coaches are in many ways much greater during the L2T, T2T and T2C stages
Age bandings for competition are based on age at 1 September each year	Age bandings for competition should be based on actual age on the day of the competition
Parents left out of the picture.	Parent education needs to be an important part of UKA and the coach's role

5: FUNdaMENTAL (Fun) stage

This refers to the crucial introductory phase so often neglected by governing bodies and schools. The 6 – 8/9 age is one of the most important periods of motor development (Bayli and Hamilton 95, Rushall 98, Viru et al 98) where the child is developmentally ready to acquire the fundamental movement skills that are the cornerstones of athletic development (see examples in panel). This is referred to as the **first skill window** (the second occurs during the learning to train stage).

It is essential to develop the basic movement skills, for these provide the foundation for excellence in later years. There is no difference between boys and girls at this stage. It is important for all young children to be given the broadest possible movement experience for no one knows at this point in which sport they might later excel. Participation in a wide range of sports should be encouraged and these foundation movement skills should be practised before sport specific skills are introduced.

Fundamental Movement Skills

- Agility, balance and coordination
- Running
- Jumping, hopping, and bounding
- Throwing and catching
- Striking and kicking
- Kinaesthetics
- Gliding
- Bouyancy
- Games sense/games for understanding

During the fundamental stage, the **first speed window** also occurs (typically at 6-8 girls, 7-9 boys). This is not an energy system training window but a CNS training window where the neural system is sufficiently well developed to be able to fire small muscles associated with linear, lateral, multi-directional and segmental speed. This type of speed work should be of very short duration.

Speed, power and endurance should all be developed using fun games and strength using own body weight exercises (and perhaps medicine ball work). The approach must always be fun and positive. At this stage, competition should be simply for fun and can take place throughout the year: there is no periodisation.

6: Learning to train (L2T) stage

This stage extends up to the peak growth spurt that precedes the onset of the menarche in girls and sexual development in boys. Typically, it extends from around 8 to 11 years in girls and 9 to 12 years in boys; although the actual age depends on the genetic makeup of the individual and shows considerable variation – as much as five years for example in the time at which girls start to mature.

The **skill window** for both boys and girls extends into this stage so there should be a continuing emphasis on skill development through participation in a range of sports but with progressively more attention towards the end of the phase on athletics specific basic skills of all events groups using modified equipment indoors and outdoors (running, jumping and throwing). 9 to 12 peak coordination

During this stage, the young athlete is learning how to train and should therefore be introduced to warm-up and cool-down, stretching, hydration and nutrition, the importance of sleep and rest and basic mental skills training (e.g. focusing and relaxation). Six monthly screening is advocated to check for body alignment and imbalances to prevent longer term injuries. Strength work against own body weight, with medicine and Swiss ball is appropriate.

The emphasis should be on learning to train and not on competition. Consequently, athletes might have sport specific training 3 times a week for between 45-60 minutes. The emphasis should be on frequency and volume rather than intensity, with lots of varied repetition work to develop skill. There is no real periodisation (1 x 48 weeks) and competition should be unlimited but fun.

7: Training to train stage (T2T)

The training to train stage addresses the critical period of physical development. If athletes miss the critical development windows in this stage of training, then they will never reach their full potential. The reason many athletes plateau during the later stage of their careers is primarily due to an over emphasis on competition instead of training during this critical period in their athletic development. The start of this stage (around 11- 14 in girls and 12 -16 in boys) coincides with the onset of the peak growth spurt (PHV) that characterises the start of the sexual development associated with adolescence. Due to cultural and climatic changes, the onset of PHV is now beginning to occur much earlier, particularly in girls. Menarche in girls typically occurs between 3-8 months after PHV and peak weight velocity (PWV) follows PHV.

The onset of PHV provides coaches with a key reference point - boys and girls can no longer train together and squads need to be divided into early, average and late maturers. In addition to plotting annual growth, standing and sitting height should be measured once a month, increasing to once a week during PHV. This will help the coach to identify the all-important windows as well as help to avoid injuries. Weight and heart rate should be monitored daily and iron levels checked regularly in female athletes. Medical monitoring and regular musculoskeletal screening (to identify muscle imbalances, ankle, knee, hip, shoulder, vertebrae alignment, range of movement) should take place.

The T2T stage therefore creates significant challenges for coaches. PHV is associated not only with the onset of sexual development but also crucial development windows for aerobic training, speed and strength. It is further complicated by the fact that some of the windows occur at different times for males and females.

Due to a maturation effect, a **second speed window** occurs for girls (somewhere between 12-14) and slightly later for boys (13-15 years). In addition to CNS skill training, the energy systems can now be trained to develop anaerobic alactic power. All types of speed work should be carried out.

For girls, the **first strength window** occurs toward the end of this T2T stage (PWV?). Strength work should focus on shoulder, elbow, core, spine and ankle stabilisation. In addition to strength training using own body weight, strength gains can also be achieved through medicine and Swiss ball work and girls should be introduced to Olympic lifting techniques. The **second strength window** for females occurs after PHV at the end of T2T or start of training to compete (T2C) stage. In males, there is only one strength window and this occurs 12-18 months after PHV and therefore in the training to compete stage.

An important **aerobic window** occurs for both males and females at the onset of peak weight velocity (PWV). This will take place towards the end of this T2T stage in females and may be as late as the start of T2C stage in males. As this occurs at different times for boys and girls and for early, average and late maturers, this means that athletes should all start aerobic training at different times. This will be challenging for the coach to manage but is very important. Aerobic conditioning should include continuous, fartlek and interval training. Care needs to be taken to avoid excessive weight bearing aerobic work that can result in Osgood Schlatters' condition. It may be appropriate therefore to consider doing half the aerobic work as non-weight bearing if the athlete is complaining of any growing pains.

During the training to train stage, all forms of training (technical, tactical, fitness and mental) become increasingly individualised. Athletes will start to specialize in a group of events and should be encouraged to retain at least one technical event. Technically, the focus is on refining skills and introducing tactics. There should be further work on the development of mental skills, on rest and recovery, nutrition and hydration and flexibility.

During this stage, the focus is still very much on training and competition goals should be more about process than outcome. An approximate 75% training to 25% competition ratio is recommended. For power events, there should be single periodisation but single or possibly double (cross country) for endurance events (2 x 24 week macro-cycle). Sport specific training should take place 4-9 times a week (including PE and other sports), each session for between 60-90 minutes. Volume and frequency are still more important but intensity increases progressively during this stage.

8: Training to compete (T2C) stage

This T2C phase of development is introduced after the goals and objectives of the T2T stage have been achieved. During this stage (between 14 to 16 in girls and 16 to 18 in boys), athletes need high intensity sport specific training all year round. Although all fitness components need to be trained, there will be a need to focus on one while maintaining the others. The aerobic window for both males and females is still open at the start of this phase, as is the all important strength window for males and the end of the second strength window for females. This should include Olympic lifting and plyometrics for both males and females. Coaches need to be aware of differing biological ages of athletes and the consequential effects on the type and loading of training.

Athletes will now specialise fully in one event or event group and the technical emphasis is on further improvement. There is a gradual shift towards performing skills in a variety of competitive conditions during training (modeling competitive environments). There needs to be a focus on optimizing preparation both physically and mentally. Fitness programmes, recovery programmes, psychological preparation and technical development must all be individually tailored to a greater degree. These activities are organised above and beyond group preparation to address athlete's individual weaknesses.

Regular musculoskeletal screening is still needed to identify muscle imbalances, ankle, knee, hip, shoulder, vertebrae alignment, range of movement deficiencies. Height should be measured once a month and weight and HR daily. Regular medical monitoring is advocated for all athletes and this should include iron monitoring for females. Both field based (including strength) and lab based performance tests are useful in identifying weaknesses and assessing the efficacy of training programmes on individual athletes.

The training to competition ratio now changes to 50:50. Sport specific technical, tactical and fitness training needs to take place between 9-12 times per week for 1-2 hours per session dependent on the component

being trained and the event (i.e. total of 9 – 24 hours per week). A double periodised year (indoor and outdoor, very occasionally triple) is likely for most athletes but this will be dependent on individual needs and event specialisation (2 x 24 week macro-cycles). Cross country competition may be used as training (i.e. no tapering and peaking) or as competition (track events now seen as part of training). The recommendation is of a maximum of 12 competitions per cycle. It is important for coaches to monitor this carefully for athletes may be engaged in school, club and representative competitions at this stage, particularly if they are talented.

9: Training to win stage (T2W)

Typically this is from the age of 18 in males and 17 in females and is the **final** stage of athletic preparation. All of the athlete's physical, technical, tactical, mental and ancillary capacities should now be fully established so the focus of training can shift to the optimization of competitive performance. The emphasis is on maximising physical, mental technical and tactical capacities to attain full potential to be able to produce maximum performance for the major competitions. There will be advanced mental skills work focusing on preparation for competition and skills to deploy during competition. Recovery and rehabilitation are crucial and there need to be frequent prophylactic breaks. T2C monitoring regimes need to be continued.

Athletes are trained to peak for major competitions. There will be double (distance athletes), triple (middle distance) or multiple periodisation (sprinters) dependent on individual needs and events. Training is likely to be 9-15 times a week for 2+ hours (i.e. about 18-30 hours per week) dependent on component being trained, event and individual needs. Again the recommendation will be for a maximum of 12 competitions per cycle.

10 Planning Principles

11 Implications of LTAD on Planning

The chart on the following pages summarises the characteristics of each stage.

Appendix 1: Critical Development Windows in the Young Athlete

Girls

Age	STAGES	SKILL	SPEED	STRENGTH	AEROBIC
6	FUNdaMENTAL	skill window 1	speed window 1		
7					
8	LEARNING TO TRAIN				
9					
10					
11	TRAINING TO TRAIN				
12			speed window 2	strength window 1	aerobic window at onset of PWV
13				strength window 2	
14	TRAINING TO COMPETE				
15					
16					
17					
18	TRAINING TO WIN				
19					
20					

Boys

Age	STAGES	SKILL	SPEED	STRENGTH	AEROBIC	
6	FUNdaMENTAL	Skill window 1	speed window 1			
7						
8	LEARNING TO TRAIN					
9						
10						
11						
12	TRAINING TO TRAIN					
13			speed window 2		aerobic window at onset of PWV	
14				strength window		
15	TRAINING TO COMPETE					
16						
17						
18						
19	TRAINING TO WIN					
20						
21						