



SIS40215 Certificate IV in Fitness

Notebook

SISXCAI005 Conduct individualized Long-Term Training Programs





Planning the Training

The purpose of a Training Plan is to identify the work to be carried out to achieve agreed objectives. Training Plans should be drawn up to identify long term (4 years) objectives as well as short term plans for the forth coming season. For the rest of this topic I will concentrate on the development of the short term annual Training Plan. In its simplest form the plan could comprise of a single, A4 sheet identifying the overall plan for the year, and more detailed weekly plans identifying the specific activities the athlete is to carry out.

Training year

The start of the training year will depend upon the athlete's circumstances and objectives, but this would generally be around October for track and field athletics.

Information Gathering

The first stage of preparing a Training Plan is to gather background information about your athlete and the objectives for the forth coming season. The sort of information to collect is as follows:

•Personal details

•Name, address, date of birth, telephone numbers, transport arrangements

•Objectives

•Performance (time, height, distance)

•Technical (development of event technique)

•Indoor and/or outdoor season

•Experience

•Personal best (PB's)

•Competition experience (club, county, national, country)

•Equipment

◦Does the athlete have his own equipment (e.g. starting blocks, javelin etc.)?

◦Harness and tyre

◦Elastic harness

◦Weight jackets

◦Video camera

◦Distance, time, % effort matrix chart

•Finance

◦Where can grants be obtained from?

•Competition

◦Date of main competition



- National and Area Championships
- School , University competitions
- Required qualification times for competitions

- Fixture lists - Club, County etc.**
- Open Meetings**
- Competitors**

- Who are the competition and what are their PB's?

- Competition behaviour**
- Athlete's other Commitments**

- School, college, work, part time jobs
- Family and partner
- Hobbies and other sports

- Time available for training**
- Planned holidays**
- Medical**

- Previous injuries or illness
- Current problems (diabetes, asthma etc.)
- Access to medical support
- Physiotherapy support
- On any medication - is it a banned substance?
- Using asthma inhaler - application to use Beta 2 agent inhalers

- Training facilities**

- Tracks and other running facilities (bad weather)
- Gymnasiums and weight training
- Swimming pools, saunas and massage

- Coaching Workshops**
- Last season**

- What can be learnt from last season - good and bad aspects

- Key questions for the athlete**



- How serious are you about your athletics?
- What do expect from your coach?

Analysis of the last program

If this is not the first program you have generated with the athlete then an important activity to conduct is a SWOT analysis of the last training program:

•Strengths

- What were the best aspects of the program and why?
- What did we do well and why?

•Weaknesses

- Are there gaps in the program?
- What did we not do very well and why?

•Opportunities

- How can we enhance the program to the benefit of the athlete?

•Threats

- What may prevent us achieving the short and long term objectives?

Athlete Assessment

Before we can start to create a training program we need to analyse our athlete to determine their strengths and weaknesses. The first step is to identify the ideal attributes (e.g. body build, strength, endurance, speed, flexibility etc) that will allow our athlete to achieve their agreed goals. The next step is to assess our athlete against our ideal athlete to identify their strengths and weaknesses (gap analysis). Addressing the gaps may require us to think in terms of long term planning (4-8 years) but for this macrocycle we can set realistic but challenging goals to start to address the gaps. The following link provides an example form for this athlete analysis process.

Periodisation

Periodisation is the method of organising the training year into phases where each phase has its specific aims for the development of the athlete.

The phases of a training year

The training year is divided into 6 phases as follows:

- Phase 1 - 16 weeks - Oct, Nov, Dec, Jan
- Phase 2 - 8 weeks - Feb, Mar



- Phase 3 - 8 weeks - Apr, May
- Phase 4 - 8 weeks - Jun, Jul
- Phase 5 - 8 weeks - Jul, Aug
- Phase 6 - 4 weeks - Sep

This assumes that the competition climax will be in August. What if there is an indoor and an outdoor season?

For the athlete with competitive objectives for both the indoor and outdoor season then the phase allocation for the indoor season could be as follows:

- Phase 1 - 6 weeks - Oct, Nov
- Phase 2 - 8 weeks - Nov, Dec, Jan
- Phase 3 - 6 weeks - Jan, Feb

and the outdoor season as follows:

- Phase 1 - 4 weeks - Feb, Mar
- Phase 2 - 6 weeks - Mar, Apr
- Phase 3 - 5 weeks - Apr, May
- Phase 4 - 7 weeks - Jun, Jul
- Phase 5 - 6 weeks - Jul, Aug
- Phase 6 - 4 weeks - Sep

This assumes that the climax of the indoor season is in February and the outdoor season in August. Depending on your athlete's objectives and abilities, then the year start and duration of each phase may have to be adjusted to achieve appropriate development.

Objectives of each phase

The objectives of each phase are as follows:

- Phase 1 - General development of strength, mobility, endurance and basic technique
- Phase 2 - Development of specific fitness and advanced technical skills
- Phase 3 - Competition experience - achievement of indoor objectives
- Phase 4 - Adjustment of technical model, preparation for the main competition

- Phase 5 - Competition experience and achievement of outdoor objectives

- Phase 6 - Active recovery - planning preparation for next season

Activities of each Phase

The athlete's physical needs that require development are:

Basic body Conditioning

One of the misconceptions in the sports world is that a sports person gets in shape by just playing or taking part in his/her chosen sport. If a stationary level of performance, consistent ability in executing a few limited skills is your goal, then engaging only in your sport will keep you there. However, if you want the utmost efficiency, consistent improvement, and balanced abilities sportsmen and women must participate in year round conditioning programs.

The bottom line in sports conditioning and fitness training is stress, not mental stress, but adaptive body stress. Sportsmen and women must put their bodies under a certain amount of stress (overload) to increase physical capabilities.

The Components of Fitness

Health is a state of complete mental, physical and social wellbeing whereas fitness is the ability to meet the demands of a physical task.

Basic fitness can be classified in four main components: strength, speed, stamina and flexibility. However, exercise scientists have identified nine components that comprise the definition of fitness:

- Strength** - the extent to which muscles can exert force by contracting against resistance (e.g. holding or restraining an object or person)



- Power** - the ability to exert maximum muscular contraction instantly in an explosive burst of movements. The two components of power are strength and speed. (e.g. jumping or a sprint start)

- Agility** - the ability to perform a series of explosive power movements in rapid succession in opposing directions (e.g. ZigZag running or cutting movements)

- Balance** - the ability to control the body's position, either stationary (e.g. a handstand) or while moving (e.g. a gymnastics stunt)



•**Flexibility** - the ability to achieve an extended range of motion without being impeded by excess tissue, i.e. fat or muscle (e.g. executing a leg split)



•**Local Muscle Endurance** - a single muscle's ability to perform sustained work (e.g. rowing or cycling)

•**Cardiovascular Endurance** - the heart's ability to deliver blood to working muscles and their ability to use it (e.g. running long distances)



•**Strength Endurance** - a muscle's ability to perform a maximum contraction time after time (e.g. continuous explosive rebounding through an entire basketball game)

•**Co-ordination**- the ability to integrate the above listed components so that effective movements are achieved.

Of all the nine elements of fitness cardiac respiratory qualities are the most important to develop as they enhance all the other components of the conditioning equation.

Physical Fitness

Physical fitness refers to the capacity of an athlete to meet the varied physical demands of their sport without reducing the athlete to a fatigued state. The components of physical fitness are:

- Strength
- Endurance
- Speed
- Flexibility
- Body Composition

Motor Fitness

Motor Fitness refers to the ability of an athlete to perform successfully at their sport. The components of motor fitness are:

- Agility



- Balance
- Co-ordination
- Power
- Reaction Time

Improving your condition

Identify the most important fitness components for success in your sport or event and then design sport/event specific conditioning and training programs that will enhance these fitness components and energy systems.

Conditioning Exercises

The following are examples of general conditioning exercises:

- General core stability exercises
- General all round body conditioning exercises using dumbbells
- General conditioning exercises for the upper body
- General and specific leg conditioning exercises
- Specific exercises to develop lower leg strength and foot speed

General and Specific Strength

The common definition is "the ability to exert a force against a resistance". The strength needed for a sprinter to explode from the blocks is different to the strength needed by a weight lifter to lift a 200kg barbell. This therefore implies that there are different types of strength.

What are the classifications of strength?

The classifications of strength are:

- Maximum strength - the greatest force that is possible in a single maximum contraction
- Elastic strength - the ability to overcome a resistance with a fast contraction
- Strength endurance - the ability to express force many times over

Absolute and Relative strength

- Absolute strength - The maximum force an athlete can exert with his or her whole body, or part of the body, irrespective of body size or muscle size
- Relative strength - The maximum force exerted in relation to body weight or muscle size.



How do we get strong?

A muscle will only strengthen when it is worked beyond its normal operation - it is overloaded. Overload can be progressed by increasing the:

- number of repetitions of an exercise
- number of sets of the exercise
- intensity by reduced recover time

How do we develop strength?

•Maximum strength can be developed with :

- weight training

•Elastic strength can be developed with :

- conditioning exercises
- complex training sessions
- medicine ball exercises
- plyometric exercises
- weight training

•Strength endurance can be developed with :

- circuit training
- dumbbell exercises
- weight training
- hill and harness running

The effects of strength training

Strength training programs cause biomechanical changes that occur within muscle and serve to increase the oxidative capacity of the muscle. The affects of strength training are:

- an increase in ATP, CP and glycogen concentration
- a decrease in oxidative enzyme activity
- a decrease in mitocarbohydratendrial density



These changes vary slightly according to the training intensity.

Changes that occur within the muscle because of strength training are classified as:

- Myogenic - changes within the muscle structure
- Neurogenic - changes to the connection between muscle and nerve

Myogenic changes

Strength training results in muscle hypertrophy, an increase in the cross-sectional size of existing fibres. This is achieved by increasing:

- number of myofibrils
- sarcoplasmic volume
- protein
- supporting connective tissue (ligaments and tendons)

Strength training programs increase the intramuscular stores such as adenosine triphosphate (ATP), creatine phosphate (CP) and glycogen.

In women, the potential for hypertrophy is not as great as men due mainly to the lower levels of testosterone in women.

Neurogenic changes

By repeatedly stimulating muscle, you increase the rate of response of the central nervous system. The recruitment patterns become more refined and as a result gross movement patterns become more efficient and effective.

General and Specific Technique

When we choose to move, the action is controlled by the conscious brain using a collection of learned movements. For the movement to progress successfully, the athlete requires information feedback.

Types of skill

There are a number of different types of skills:

- Cognitive - or intellectual skills that require thought processes
- Perceptual - interpretation of presented information
- Motor - movement and muscle control
- Perceptual motor - involve the thought, interpretation and movement skills



How do we teach a new skill?

The teaching of a new skill can be achieved by various methods:

- Verbal instructions
- Demonstration
- Video
- Diagrams
- Photo sequences

The Learning Phases - Fitts & Posner

Fitts and Posner (1967) suggested that the learning process is sequential and that we move through specific phases as we learn. There are three stages to learning a new skill:

- Cognitive phase - Identification and development of the component parts of the skill - involves formation of a mental picture of the skill
- Associative phase - Linking the component parts into a smooth action - involves practicing the skill and using feedback to perfect the skill
- Autonomous phase - Developing the learned skill so that it becomes automatic - involves little or no conscious thought or attention whilst performing the skill - not all performers reach this stage

The learning of physical skills requires the relevant movements to be assembled, component by component, using feedback to shape and polish them into a smooth action. Rehearsal of the skill must be done regularly and correctly.

Schmidt's Schema Theory

Schmidt's theory (1975) was based on the view that actions are not stored rather we refer to abstract relationships or rules about movement. Schmidt's schema is based on the theory that that every time a movement is conducted four pieces of information are gathered:

- the initial conditions - starting point
- certain aspects of the motor action - how fast, how high
- the results of the action - success or failure
- the sensory consequences of the action - how it felt

Relationships between these items of information are used to construct a recall schema and a recognition schema. The Recall schema is based on initial conditions and the results and is used to generate a motor program to address a new goal. The recognition schema is based on sensory actions and the outcome.

Adam's Closed Loop Theory



Adam's theory (1971) has two elements:

- Perceptual trace - a reference model acquired through practice
- Memory trace - responsible for initiating the movement

The key feature of this theory is the role of feedback.

- Analyse the reference model actions, the result of those actions and the desired goals
- Refine the reference model to produce the required actions to achieve the desired goals

Transfer of learning

Transfer of learning can take place in the following ways:

- Skill to skill

- this is where a skill developed in one sport has an influence on a skill in another sport. If the influence is on a new skill being developed then this is said to be proactive and if the influence is on a previously learned skill then this is said to be retroactive

- Theory to practice

- the transfer of theoretical skills into practice

- Training to competition

- the transfer of skills developed in training into the competition situation

Effects of transfer of learning

The effects of transfer can be:

- Negative

- Where a skill developed in one sport hinders the performance of a skill in another sport

- Zero

- Where a skill in one sport has no impact on the learning of a new sport

- Positive

- Where a skill developed in one sport helps the performance of a skill in another sport

- Direct

- Where a skill can be taken directly from sport to another

- Bilateral



◦ Transfer of a skill from side of the body to the other - use left and right

• Unequal

◦ A skill developed in one sport helps another sport more than the reverse

How do we assess skill performance?

Initially, compare visual feedback from the athlete's movement with the technical model to be achieved. Athletes should be encouraged to evaluate their own performance. In assessing the performance of an athlete, consider the following points:

- Are the basics correct?
- Is the direction of the movement correct?
- Is the rhythm correct?

It is important to ask athletes to remember how it felt when correct examples of movement are demonstrated (kinaesthetic feedback).

Appropriate checklists/notes can be used to assist the coach in the assessment of an athlete's technique. The following are some examples:

- Sprint Technique
- Running Technique for the Middle Distance runner





How are faults caused?

Having assessed the performance and identified that there is a fault then you need to determine why it is happening. Faults can be caused by:

- Incorrect understanding of the movement by the athlete
- Poor physical abilities
- Poor co-ordination of movement
- Incorrect application of power
- Lack of concentration
- Inappropriate clothing or footwear
- External factors e.g. weather conditions

Strategies and Tactics

Strategies are the plans we prepare in advance of a competition, which we hope will place an individual or team in a winning position. Tactics are how we put these strategies into action. Athletes in the associative phase of learning will not be able to cope with strategies, but the athlete in the autonomous phase should be able to apply strategies and tactics.

To develop strategies and tactics we need to know:

- the strengths and weaknesses of the opposition
- our own strengths and weaknesses
- environmental factors

Remember

Practice makes permanent, but not necessarily perfect.



General and Specific Mobility

What is flexibility?

Flexibility, mobility and suppleness all mean the range of limb movement around joints. In any movement there are two groups of muscles at work:

- protagonistic muscles which cause the movement to take place and
- opposing the movement and determining the amount of flexibility are the antagonistic muscles



Why do flexibility exercises?

The objective of flexibility training is to improve the range of movement of the antagonistic muscles.

What are the benefits?

Flexibility plays an important part in the preparation of athletes by developing a range of movement to allow technical development and assisting in the prevention of injury.

How will I know if I am stretching properly?

When you perform a stretch correctly, you will feel mild discomfort in the antagonistic muscles. If you feel pain or a stabbing sensation, you must STOP.

What do I need to consider before conducting flexibility exercises?

The body responds best to a stretching program when it is warm and the muscles and joints have been exercised through their current range of movement.

What types of flexibility exercises are there?

The various techniques of stretching may be grouped as Static, Ballistic, Dynamic, Active, Passive, Isometric and Assisted. [Click here for some examples of general mobility exercises.](#)

Static stretching

Static stretching (isometric contractions) involves gradually easing into the stretch position and holding the position. The amount of time a static stretch is held depends on your objectives. If it is part of your cool down then stretches should be held for 10 seconds, if it is to improve your range of mobility then hold the stretch for 30 seconds. Often in static stretching, you are advised to move further into the stretch position as the stretch sensation subsides. [Click here for some examples of static stretching exercises](#)

Ballistic stretching

Ballistic stretching uses the momentum of a moving body or a limb in an attempt to force it beyond its normal range of motion.



Dynamic stretching

Dynamic stretching (isotonic or isokinetic contractions) consists of controlled leg and arm swings that take you gently to the limits of your range of motion.

Where the event requires a dynamic movement then it is appropriate and perhaps necessary to conduct dynamic stretching exercises. Start with the movement at half speed for a couple of repetitions and then gradually work up to full speed.

Active stretching

An active stretch is one where you assume a position and then hold it there with no assistance other than using the strength of your agonist muscles. Active stretching is also referred to as static-active stretching.

Passive stretching

Passive stretching is also referred to as relaxed stretching, and as static-passive stretching. A passive stretch is one where you assume a position and hold it with some other part of your body, or with the assistance of a partner or some other apparatus.

Isometric stretching

Isometric stretching is a type of static stretching which involves the resistance of muscle groups through isometric contractions (tensing) of the stretched muscles.

Assisted stretching

Assisted stretching involves the assistance of a partner who must fully understand what their role is otherwise the risk of injury is high. A partner can be employed to assist with Partner stretches and Proprioceptive Neuromuscular Facilitation (PNF) techniques.

Partner stretches

Your partner assists you to maintain the stretch position or helps you ease into the stretch position as the sensation of stretch subsides. You should aim to be full relaxed and breathe easily throughout the exercise. Partner assisted stretches are best used as developmental exercises, with each stretch being held for thirty seconds.

PNF technique

Proprioceptive Neuromuscular Facilitation (PNF) involves the use of muscle contraction before the stretch in an attempt to achieve maximum muscle relaxation.

1. You move into the stretch position so that you feel the stretch sensation
2. Your partner holds the limb in this stretched position
3. You then push against your partner by contracting the antagonistic muscles for 6 to 10 seconds and then relax. During the contraction, your partner aims to resist any movement of the limb.
4. Your partner then moves the limb further into the stretch until you feel the stretch sensation

5. Go back to 2. (Repeat this procedure 3 or 4 times before the stretch is released.)

Which method is best?

Static methods produce far fewer instances of muscle soreness, injury and damage to connective tissues than dynamic or ballistic methods. Static methods are simple to carry out and may be conducted virtually anywhere. For maximum gains in flexibility in the shortest possible time PNF technique is the most appropriate. Dynamic - slowed controlled movements through the full range of the motion - will reduce muscle stiffness. Where the sport or event requires movement then dynamic stretches should be employed as part of the warm up.

What order should the flexibility methods be used?

When conducting flexibility exercises it is recommended to perform them in the following order - Static, Assisted and then Dynamic.

When should they be performed?

Flexibility exercises could be part of:

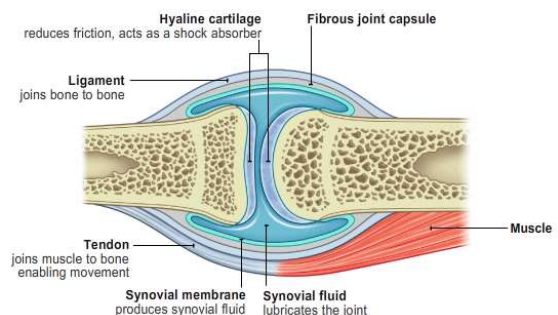
- the warm up or cool down program
- a stand alone unit of work

It is considered beneficial to conduct flexibility exercises as part of the cool down program but should not include ballistic or dynamic exercises, as the muscles are fatigued and more prone to injury. Static exercises are recommended as they relax the muscles and increase their range of movement.

Factors limiting flexibility

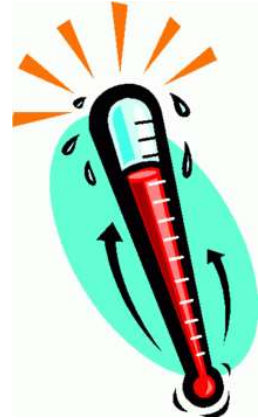
Internal influences

- the type of joint
- the internal resistance within a joint
- bony structures which limit movement
- the temperature of the joint and associated tissues
- the elasticity of muscle tissue, tendons, ligaments and skin
- the ability of a muscle to relax and contract to achieve the greatest range of movement



External influences

- the temperature of the place where one is training (a warmer temperature is more conducive to increased flexibility)
- the time of day (most people are more flexible in the afternoon than in the morning)
- the stage in the recovery process of a joint (or muscle) after
- age (pre-adolescents are generally more flexible than adults)
- gender (females are generally more flexible than males)
- the restrictions of any clothing or equipment
- one's ability to perform a particular exercise
- one's commitment to achieving flexibility



Flexibility program

All athletes require a basic level of general all round flexibility to allow them to benefit from other forms of training. In addition, athletes will need to develop specific flexibility for those joint actions involved in the techniques of their events or sports.

General and Specific Endurance

What is the objective of endurance training?

The objective of endurance training is to develop the energy production systems to meet the demands of the event.

What are the energy production systems?

Adenosine triphosphate (ATP) is a chemical compound that supplies energy for muscular contraction. Actively contracting muscles obtain ATP from glucose stored in the blood stream and the breakdown of glycogen stored in the muscles. Exercising for long periods of time will require the complete oxidation of carbohydrates or free fatty acids in the mitochondria.



What types of endurance are there?

The types of endurance are aerobic endurance, anaerobic endurance, speed endurance and strength endurance. A sound basis of aerobic endurance is fundamental for all events.

Work conducted by Paul B Gastein, ["Energy system interaction and relative contribution during maximal exercise" Sports Med 2001: 31(10); 725-741] , provides estimates of anaerobic and aerobic energy contribution during selected periods of maximal exercise (95% effort).

Duration	% Aerobic	% Anaerobic
0-10 seconds	6	94
0-15 seconds	12	88
0-20 seconds	18	82
0-30 seconds	27	73
0-45 seconds	37	63
0-60 seconds	45	55
0-75 seconds	51	48
0-90 seconds	56	44
0-120 seconds	63	37
0-180 seconds	73	27
0-240 seconds	79	21

Aerobic Endurance

During aerobic (with oxygen) work, the body is working at a level that the demands for oxygen and fuel can be met by the body's intake. The only waste products formed are carbon dioxide and water which are removed by sweating and breathing.

Aerobic endurance can be sub-divided as follows:

- Short aerobic - 2 minutes to 8 minutes (lactic/aerobic)
- Medium aerobic - 8 minutes to 30 minutes (mainly aerobic)
- Long aerobic - 30 minutes + (aerobic)

Aerobic endurance is developed using continuous and interval running.

- Continuous duration runs to improve maximum oxygen uptake (VO₂max)
- Interval training to improve the heart as a muscular pump

Aerobic threshold

The aerobic threshold, point at which anaerobic energy pathways start to operate, is around 65% of maximum heart rate. This is approximately 40 beats lower than the anaerobic threshold.

Anaerobic endurance



During anaerobic (without oxygen) work, involving maximum effort, the body is working so hard that the demands for oxygen and fuel exceed the rate of supply and the muscles have to rely on the stored reserves of fuel. The muscles, being starved of oxygen, take the body into a state known as oxygen debt and lactic starts to accumulate in the muscles. This point is known as the lactic threshold or anaerobic threshold or onset of blood lactate accumulation (OBLA). Activity will not be resumed until the lactic acid is removed and the oxygen debt repaid.

The body can resume limited activity after a small proportion of the oxygen debt has been repaid. Since lactic acid is produced, the correct term for this pathway is lactic anaerobic energy pathway.

The alactic anaerobic pathway is when the body is working anaerobically but without the production of lactic acid. This pathway depends on the fuel stored in the muscle which lasts for approximately 4 seconds at maximum effort.

Anaerobic endurance can be sub-divided as follows:

- Short anaerobic - less than 25 seconds (mainly alactic)
- Medium anaerobic - 25 seconds to 60 seconds (mainly lactic)
- Long anaerobic - 60 seconds to 120 seconds (lactic +aerobic)

Anaerobic endurance can be developed by using repetition methods of high intensity work with limited recovery.

Anaerobic threshold

The anaerobic threshold, the point at which lactic acid starts to accumulates in the muscles, is considered to be somewhere between 80% and 90% of your maximum heart rate and is approximately 40 beats higher than the aerobic threshold. Your anaerobic threshold can be determined with anaerobic threshold testing.

Speed endurance

Speed endurance is used to develop the co-ordination of muscle contraction. Repetition methods are used with a high number of sets, low number of repetitions per set and intensity greater than 85% with distances covered from 60% to 120% of racing distance. Competition and time trials can be used in the development of speed endurance.

Example sessions

The following are the different types of speed endurance sessions with examples for a 800m athlete targeting a sub two minute 800m.

- Pyramids - 200m, 300m, 400m, 300m, 200m (frp) [3', 4', 5', 4']
- Up the clock - 600m, 700m, 800m (frp) [8']
- Down the clock - 800m, 700m, 600m (frp) [8']

- Differentials - 4 x 400m (1st 200m 32", 2nd 200m 28") [8']
- Over distance - 4 x 1200m (srp) [8']
- Under distance - 2 x (3 x 400m) (frp) [3', 8']
- Quality - 3 x 600m (rp) [8']

' = minute, " = seconds, frp = faster than target race pace,

srp = slower than target race pace, rp = target race pace

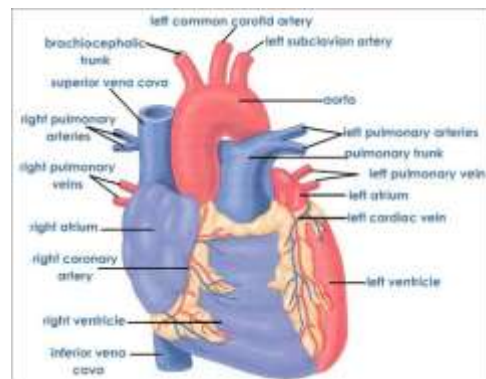
Strength endurance

Strength endurance is used to develop the athlete's capacity to maintain the quality of their muscles' contractile force. All athletes need to develop a basic level of strength endurance. Examples of activities to develop strength endurance are - circuit training, weight training, hill running, harness running, Fartlek etc.

Effect on the heart

As an endurance athlete, you will develop an athlete's heart which is very different to the non athlete's heart. You will have:

- Bradycardia - Low resting pulse rate of under 50 bpm
- ECG shows ventricular hypertrophy (thickening of the heart muscle wall)
- X-ray reveals an enlarged heart
- Blood tests shows raised muscle enzymes



The above for the average person (non athlete) indicate a probable heart block, hypertension, heart failure, a recent myocardial infarct or cardiomyopathy. Should you need to go into hospital or see your doctor, you should inform them that you are an endurance athlete.

Speed

Speed is the quickness of movement of a limb, whether this is the legs of a runner or the arm of the shot putter. Speed is an integral part of every sport and can be expressed as any one of, or combination of, the following: maximum speed, elastic strength (power) and speed endurance.

How is speed influenced?

Speed is influenced by the athlete's mobility, special strength, strength endurance and technique.

Energy system for speed

Energy for absolute speed is supplied by the anaerobic alactic pathway. The anaerobic (without oxygen) alactic (without lactate) energy system is best challenged as an athlete approaches top speed between 30 and 60 metres while running at 95% to 100% of maximum. This speed component of



anaerobic metabolism lasts for approximately eight seconds and should be trained when no muscle fatigue is present (usually after 24 to 36 hours of rest)

How do we develop Speed?

The technique of sprinting must be rehearsed at slow speeds and then transferred to runs at maximum speed. The stimulation, excitation and correct firing order of the motor units, composed of a motor nerve (Neuron) and the group of muscles that it supplies, makes it possible for high frequency movements to occur. The whole process is not very clear but the complex coordination and timing of the motor units and muscles most certainly must be rehearsed at high speeds to implant the correct patterns.

Flexibility and a correct warm up will affect stride length and frequency (strike rate). Stride length can be improved by developing muscular strength, power, strength endurance and running technique. The development of speed is highly specific and to achieve it we should ensure that:

- Flexibility is developed and maintained all year round
- Strength and speed are developed in parallel
- Skill development (technique) is pre-learned, rehearsed and perfected before it is done at high speed levels
- Speed training is performed by using high velocity for brief intervals. This will ultimately bring into play the correct neuromuscular pathways and energy sources used

When should speed work be conducted?

It is important to remember that the improvement of running speed is a complex process that is controlled by the brain and nervous system. In order for a runner to move more quickly, the leg muscles of course have to contract more quickly, but the brain and nervous systems have to learn to control these faster movements efficiently. If you maintain some form of speed training throughout the year, your muscles and nervous system do not lose the feel of moving fast and the brain will not have to re-learn the proper control patterns at a later date.

In the training week, speed work should be carried out after a period of rest or light training. In a training session, speed work should be conducted after the warm up and any other training should be of a low intensity.

Speed Workouts

Event	Speed Session
100 metres	10 × 30 metres at race pace from blocks with full recovery 3 to 4 × 80 metres at race pace with full recovery
800 metres	5 × 200 metres at goal race pace with 10 seconds recovery 4 × 400 metres at 2 to 3 seconds faster than current race pace with 2

	minutes recovery
1500 metres	4 × 400 metres at goal race pace with 15 to 10 sec recovery 4 to 5 × 800 metres at 5 to 6 seconds per 800 metres faster than goal race pace with 6 minutes recovery
5,000 metres	4 to 5 × 800 metres at 4 seconds per 800 metres faster than goal race pace with 60 seconds recovery 3 × 1 mile at 6 seconds per mile faster than goal race pace with 2 minutes recovery
10,000 metres	3 × 2000 metres at 3 seconds per 200 metres faster than goal race pace with 2 minutes recovery Five 5 min intervals at current 5km race pace with 3 minutes recovery
Marathon	Six 1 mile repeats at 15 seconds per mile faster than goal race pace with 1 minute recovery 3 × 3000 metres at 10km race pace with 6 minutes recovery

Reaction Speed Drill

The athletes start in a variety of different positions - lying face down, lying on their backs, in a push up or sit up position, kneeling or seated. The coach standing some 30 metres from the group then gives a signal for everyone to jump up and run towards him/her at slightly faster than race pace. Repeat using various starting positions and with the coach standing in different places so that the athletes have to change directions quickly once they begin to run. Speed reaction drills can also be conducted whilst controlling an item (e.g. football, basketball, hockey ball) with an implement (e.g. feet, hands, hockey stick).

Acceleration Training

Greek researchers looked at weighted sledge training and their effect on sprint acceleration [J Sports Med Phys Fitness, 2005 Sep;45(3):284-90] and they concluded that training with a weighted sledge will help improve the athlete's acceleration phase. The session used in the research was 4 x 20m and 4 x 50m maximal effort runs.

Australian researchers [Strength Cond Res., 2003 Nov;17(4):760-7] investigated the effects of various loadings and concluded that when using a sledge a light weight of approx. 10-15% of body weight should be used so that the dynamics of the acceleration technique are not negatively effected.

Starts over 10-20 metres performed on a slight incline of around five degrees have an important conditioning effect on the calf, thigh and hip muscles (they have to work harder because of the incline to produce movement) that will improve sprint acceleration.

Sprinting Speed

Downhill sprinting is a method of developing sprinting speed following the acceleration phase. A hill with a maximum of a 15° decline is most suitable. Use 40 metres to 60 metres to build up to full speed and then maintain the speed for a further 30 metres. A session could comprise of 2 to 3 sets of 3 to 6 repetitions. The difficulty with this method is to find a suitable hill with a safe surface.

Over speed work could be carried out when there are prevailing strong winds - run with the wind behind you.

Speed Principles



The general principles for improved speed are as follows:

- Choose a reasonable goal for your event, and then work on running at velocities which are actually faster than your goal over short work intervals
- Train at goal pace in order to enhance your neuromuscular coordination, confidence and stamina at your desired speed
- At first, utilise long recoveries, but as you get fitter and faster shorten the recovery periods between work intervals to make your training more specific and realistic to racing. Also move on to longer work intervals, as you are able
- Work on your aerobic capacity and lactate threshold, conduct some easy pace runs to burn calories and permit recovery from the speed sessions
- Work on your mobility to develop a range of movement (range of motion at your hips will effect speed) and assist in the prevention of injury

Seven Step Model

The following is seven step model for developing playing speed.

- 1.Basic training** to develop all qualities of movement to a level that will provide a solid base on which to build each successive step. This includes programs to increase body control, strength, muscle endurance, and sustained effort (muscular and cardiovascular, anaerobic and aerobic)
- 2.Functional strength** and explosive movements against medium to heavy resistance. Maximum power is trained by working in an intensity range of 55 to 85% of your maximum intensity (1 RM)
- 3.Ballistics** to develop high-speed sending and receiving movements
- 4.Plyometrics** to develop explosive hopping, jumping, bounding, hitting, and kicking
- 5.Sprinting** form and speed endurance to develop sprinting technique and improving the length of time you are able to maintain your speed
- 6.Sport loading** to develop specific speed. The intensity is 85 to 100% of maximum speed
- 7.Over speed training.** This involves systematic application of sporting speed that exceeds maximum speed by 5 to 10% through the use of various over speed training techniques

Each of these needs should be seen as a building block, where specific blocks need to be in place before you progress to the next. Failure to do this may result in injury. How you allocate the blocks to each phase depends upon the athlete's weaknesses and strengths and is for you as the coach to decide with the athlete.

One approach is to progress the building blocks as follows:

- basic body conditioning
- general strength, endurance, mobility and technique
- specific strength, endurance, mobility and technique

•speed

When progressing from one block to the next, remember to fade one out as the other comes in and not to switch from one block to the next overnight. Some blocks once started may continue to the end of the season but at a less intense level e.g. mobility. Other blocks to consider are relaxation, visualisation and psychology (mental attitude).

Volume, Intensity & Recovery

The relationship of Volume of work, Intensity of the work and Recovery within the session:

	General Preparation phase	Specific Preparation Phase	Pre-competition Phase	Competition Phase
Intensity	Low	Low	Medium	High
Volume	High	High	Medium	Low
Recovery	Low	Low	Medium	High

Preparing a plan

The steps in producing a Training Plan are as follows:

•Gathering information

•Produce an overall plan template and identify the months/weeks of the year

•Identify on the plan at the appropriate period

- the main competition
- area, national, school etc. championships
- qualification competitions
- club fixture meetings
- the 6 phases based on the main competition in phase 5

•Identify on the plan

- the blocks (e.g. strength, endurance) to be developed in each phase
- the period of development for each block
- the intensity of training week by week
- number of training sessions per week
- evaluation points to monitor progress



Performance Evaluation Tests

Performance is an assessment of how well a task is executed and the success of a training program is largely dependent upon satisfying the performance aims associated with it.

How can performance be monitored?

Testing and measurement are the means of collecting information upon which subsequent performance evaluations and decisions are made.

What is the evaluation process?

The whole measurement/evaluation process is a six stage, cyclic affair, involving:

- The selection of characteristics to be measured
- The selection of a suitable method of measuring
- The collection of that data
- The analysis of the collected data
- The making of decisions
- The implementation of those decisions

All of the above stages should be completed with the athlete - especially the analysis of the collected data and making decision of an appropriate way forward.

What are the requirements of a test?

In constructing tests it is important to make sure that they really measure the factors required to be tested, and are thus objective rather than subjective. In doing so all tests should therefore be specific (designed to assess an athlete's fitness for the activity in question), valid (the degree to which the test actually measures what it claims to measure), reliable (capable of consistent repetition) and objective (produce a consistent result irrespective of the tester).

In conducting tests the following points should be considered:

- Each test should measure ONE factor only
- The test should not require any technical competence on the part of the athlete (unless it is being used to assess technique)
- Care should be taken to make sure that the athlete understands exactly what is required of him/her, what is being measured and why
- The test procedure should be strictly standardised in terms of administration, organisation and environmental conditions

What are the benefits of testing?

The results from tests can be used to:

- predict future performance
- indicate weaknesses
- measure improvement
- enable the coach to assess the success of his training program
- place the athlete in appropriate training group
- motivate the athlete

Tests additionally break up and add variety to the training program. They can be used to satisfy the athlete's competitive urge out of season. Maximal tests demand maximum effort of the athlete so they are useful at times as a training unit in their own right.

What factors may influence test results?

The following factors may have an impact on the results of a test (test reliability):

- The ambient temperature, noise level and humidity
- The amount of sleep the athlete had prior to testing
- The athlete's emotional state
- Medication the athlete may be taking
- The time of day
- The athlete's caffeine intake
- The time since the athlete's last meal
- The test environment - surface (track, grass, road, gym)
- The athlete's prior test knowledge/experience
- Accuracy of measurements (times, distances etc.)
- Is the athlete actually applying maximum effort in maximal tests
- Inappropriate warm up
- People present
- The personality, knowledge and skill of the tester



Why record information?

For the coach and athlete it is important to monitor the program of work, to maintain progression in terms of the volume of work and its intensity. Both coach and athlete must keep their own training records. A training diary can give an enormous amount of information about what has happened in the past and how training has gone in the past. When planning future training cycles, information of this kind is invaluable.

What should be recorded?

The information to be recorded falls into two broad categories: -

- The day-to-day information from training
- State of the athlete (health, composure)
- Physiological data (body weight, resting heart rate, etc.)
- The training unit (speed, speed endurance, strength, technique)
- The training load (the number of miles, the number of sets and repetitions, the number of attempts)

- The training intensity (kilograms, percentage of maximum, percentage of VO₂)
- The prevailing conditions (wet, windy, hot etc.)
- The response to training (the assignments completed, the resultant heart rate recovery, felt tired, etc.)

- Information that measures status. This can take the form of a test. If the test is repeated throughout the program, it can then be used as a measure of progress within the training discipline. Examples of such tests are:
 - Time trials - speed, speed endurance, endurance
 - Muscular endurance - chins, push ups, dips
 - Strength maximum - single repetitions, maximum repetitions
 - Explosive strength - power bounding, vertical jump, overhead shot putt
 - Mobility - objective measurements of the range of movement
 - Event specific

Competition evaluation

Following competition, it is important that the coach and athlete get together as soon as possible in order to evaluate the athlete's performance. Elements to be considered are pre race preparations, focus and performance plans and achievement of these plans. An evaluation form is useful to help the athlete and coach conduct this review.

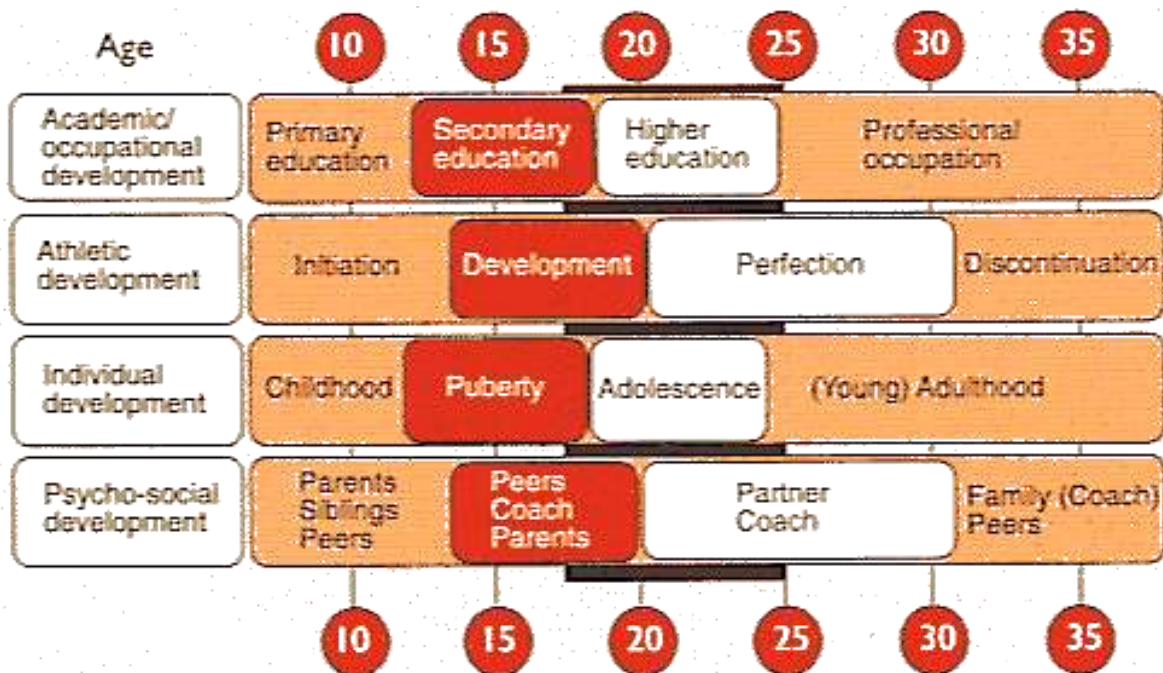
- Identify appropriate training units for each block as appropriate to the phase of development.
- Group the training units for each block into training schedules taking into consideration the number of training sessions the athlete can complete per week, the required training intensity and the phase of development.

Athlete Development

As an athlete matures, they are not only developing in terms of their sports but also in terms of education, career, physical maturity and their relationships with those around them. On average, an athlete is likely to face up to seven transitions during their full athletic and perhaps the critical transition occurs around the age of 20 when they may be:

- moving to university/college or commencing in full time employment
- progressing to a high performance level
- maturing through adolescence
- establishing relationships with a partner

Coaches must take into consideration these transitions when planning the annual and long term training programs for their athletes.



Athlete development model, P. Wylleman, 2004

What are a Macrocycle, Mesocycle, Microcycle?

Macrocycle is a period of time (e.g. 11 months) defining the available preparation time up to a major competition.

This can be divided into developmental periods called Mesocycles. A mesocycle is usually 4-8 weeks in duration and has a specific objective e.g. general preparation, specific preparation, competition.

A Microcycle is a shorter training period of about 7-10 days and includes more detailed information on the intensity, frequency, duration and sequencing of the Training sessions.

Athlete Assessment

Athlete Information

Name Dave Hunt	Gender M	Event 400m	PB 49.8 sec (2007)
Age 18	Developmental age (if U21) 16	Training age 6 yrs	LTAD stage T2C
Time you have coached the athlete 6 yrs	Training session/week 6	Other sports/interests Tennis & swimming	
Athlete's objectives for this season Improve his 400m time from 49.8s to 48.5s in order to compete in the National Championships (June 2008) and the English Schools Championships (Aug 2008)			
School/work hours School – 6th Form	Support (family, friends, teachers) Support from whole family and PE Teachers at his school		

Strengths and Weaknesses

Component	Ideal	Current		
Endurance	Vo2max >65 ml/kg/min	62		
Speed	100m < 11 seconds	10.8		
Anaerobic Endurance	RAST Max Power 676-1054	946		
	Min Power 319-674	400		
	Fatigue Index <10	12		
Strength (1RM)	Bench press 1.25 x body weight	1.1		
	Leg press 2.5 x body weight	1.9		
	Squat 2 x body weight	1.6		
	Leg Curl 80% Leg Extension	85%		
Strength Elastic	Sergeant Jump Test >80cm	75		
Core Stability	Complete Core Stability Test	Completed full test		
Muscle Balance <small>Right and left limb 1RM scores should not differ by more than 10%.</small>		Left	Right	%
	Hamstrings (leg extension)	75	85	>10
	Quadriceps (leg curl)	60	70	>10
	Arm Curl	17	18	<10
	One arm military press	18	20	<10
	Single leg press	70	75	<10
Body Composition	Body Fat <11%	14%		
	BMI 18.5 to 24.9	20.1		
Psychology	Score <15 on SCAT	18		

Key: **Areas of potential weakness**

What are a training unit and a training session?

A training unit is a single activity (e.g. 6 × 60 metres at 90% effort with 2 minutes recovery) with a set objective (e.g. develop specific endurance). A training session is made up of one or more training units e.g. warm up unit, Technique drills unit, Speed Endurance unit and a cool down unit.

What is a training schedule?

A training schedule (microcycle) comprises of a number of training sessions that can span from 7 to 10 days.

Goal Setting

Goal setting is a simple, yet often misused motivational technique that can provide some structure for your training and competition program. Goals give a focus, and there are two well known acronyms to guide goal setting.



**"If you aim at
nothing, you will hit
it every time"**

Author Unknown

SMART or SMARTER

- S** - goals must be **Specific**
- M** - training targets should be **Measurable**
- A** - goals should be **Adjustable**
- R** - goals must be **Realistic**
- T** - training targets should be **Time** based
- E** - goals should be challenging and **Exciting**
- R** - goals should be **Recorded**



SCCAMP

- S** - goals must be *Specific*
- C** - within the *Control* of the athlete
- C** - goals are *Challenging*
- A** - goals must be *Attainable*
- M** - training targets should be *Measurable*
- P** - goals are *Personal*

FITT Principles

The basic principles of fitness training are summed up in the acronym F.I.T.T

- F - Frequency** - how often
- I - Intensity** - how hard
- T - Time** - how long
- T - Type** - the type of training (strength, endurance etc.)

Training ages

When developing a training program it is important, especially for young athletes, to take into consideration the athlete's:

- Chronological age - age from date of birth
- Development age - physical, mental and emotional development
- Training age - number of years they have been seriously training

Long Term Athlete Development (LTAD) is a sports development framework that matches training needs to an athlete's growth and development.

Sports scientists have reported that there are critical periods in the life of a young person in which the effects of training can be maximised. They have also concluded that it can take anything from eight to twelve years of training for a talented athlete to achieve elite status. This has led to the development of athletic models, which identify appropriate training aims at each stage of the athlete's physical development.

Athletic model indicators

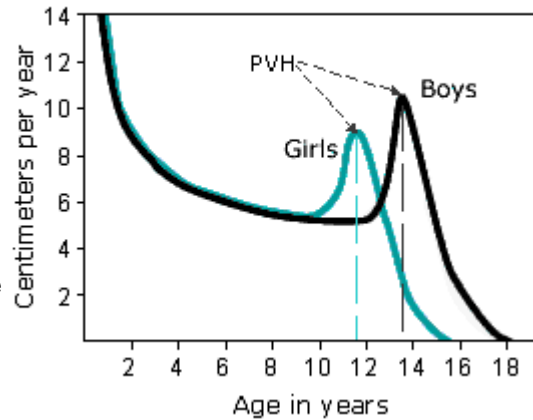
Research has shown that that chronological age is not a good indicator on which to base athletic development models for athletes between the ages of 10 to 16 as within this age group there is a wide variation in the physical, cognitive and emotional development.

One practical solution is to use the onset of Peak Height Velocity (PHV), which is influenced by genetics and environmental factors (climate, cultural & social), as a reference point for the design of training programs.

PVH is the point in a child's development when they reach their maximum growth rate. The average age for reaching PVH is 12 for girls and 14 for boys. Peak weight velocity normally follows shortly after PVH.

Following PVH Vo₂max and strength increase significantly as a result of growth. Most girls experience their first menstrual cycle approximately one year after PVH.

Peak Velocity Height (PVH)



Using simple measurements (standing height & sitting height) PHV can be monitored and appropriate training can be set to match the athlete's development.

Model for LTAD

Sports can be classified as early specialization (e.g. gymnastics) or late specialization (e.g. Track and Field, Team sports). Early specialization sports require a four phase model while a late specialization model requires six phases.

Early Specialization Model

1. Training to train
2. Training to compete
3. Training to win
4. Retirement & retainment

Late Specialization Model

1. FUNdamental.
2. Learning to train
3. Training to train
4. Training to compete
5. Training to win
6. Retirement & retainment

Late Specialization Model

Phase 1 – FUNdamentals

This phase is appropriate for boys aged 6 to 9 and girls aged 5 to 8. The main objective should be the overall development of the athlete's physical capacities and fundamental movement skills. The key points of this phase are:

- Participation in as many sports as possible
- Speed, power and endurance are developed using FUN games
- Appropriate and correct running, jumping and throwing techniques are taught using the ABC's of athletics
- Introduction to the simple rules and ethics of sports
- Strength training with exercises which use the child's own body weight; medicine ball and Swiss ball exercises
- Training programs, based on the school year, are structured and monitored but not periodised
- Develop the athlete's:
 - ABC's (Agility, Balance, Coordination and Speed)
 - RJT (Running, Jumping, Throwing)
 - KGBs (Kinesthetics, Gliding, Buoyancy, Striking with a body part)
 - CKs (Catching, Kicking, Striking with an implement)



The first 'critical period of speed development' will occur during this phase, age 6-8 for girls and 7-9 for boys respectively. Linear, lateral and multi-directional speed should be developed and the duration of the repetitions should be less than 5 seconds. Fun and games should be used for speed training and the volume of training should be lower.

Phase 2 - Learning to train



This phase is appropriate for boys aged 9 to 12 and girls aged 8 to 11. The main objective should be to learn all fundamental sports skills. The key points of this phase are:

- Further develop fundamental movement skills

- Learn general overall sports skills
- Continue to develop strength with medicine ball, Swiss ball and own body-weight exercises as well as hopping-bounding exercises
- Continue to develop endurance with games and relays
- Introduce basic flexibility exercises
- Continue to develop speed with specific activities during the warm-up, such as agility, quickness and change of direction
- Develop knowledge of warm up, cool down, stretching, hydration, nutrition, recovery, relaxation and focusing
- Training programs are structured and based on a single periodisation
- Competition is structured and a 70:30 training/practice to competition-ratio is recommended

Phase 3 - Training to train



This phase is appropriate for boys aged 12 to 16 and girls aged 11 to 15. The main objective should be the overall development of the athlete's physical capacities (focus on aerobic conditioning) and fundamental movement skills. The key points of this phase are:

- Further develop speed and sport-specific skills
- Develop the aerobic base - after the onset of PHV
- Learn correct weight lifting techniques
- Develop knowledge of how and when to stretch, how to optimise nutrition and hydration, mental preparation, how and when to taper and peak
- Establish pre-competition, competition and post competition routines
- The strength training window for boys begins 12 to 18 months after PHV
- There are two windows of opportunity to strength training for girls
- Window one is immediately after PHV
- Window two begins with the onset of menarche (the first menstrual period)

- Special emphasis is also required for flexibility training due to the sudden growth of bones, tendons, ligaments and muscles

- A 60% training to 40% competition ratio (includes competition and competition-specific training) is recommended

Phase 4 - Training to compete



This phase is appropriate for boys aged 16 to 18 and girls aged 15 to 17. The main objective should be to optimise fitness preparation, sport/event specific skills and performance. The key points of this phase are:

- 50% of available time is devoted to the development of technical and tactical skills and fitness improvements

- 50% of available time is devoted to competition and competition-specific training

- Learn to perform these sport specific skills under a variety of competitive conditions during training

- Special emphasis is placed on optimum preparation by modeling training and competition

- Fitness programs, recovery programs, psychological preparation and technical development are now individually tailored to the athlete's needs

- Double and multiple periodisation is the optimal framework of preparation

Phase 5 - Training to win

This phase is appropriate for boys aged 18+ and girls aged 17+. The main objective should be to maximize fitness preparation and sport/event specific skills as well as performance. The key points of this phase are:

- All of the athlete's physical, technical, tactical, mental, personal and lifestyle capacities are now fully established and the focus of training has shifted to the maximization of performance



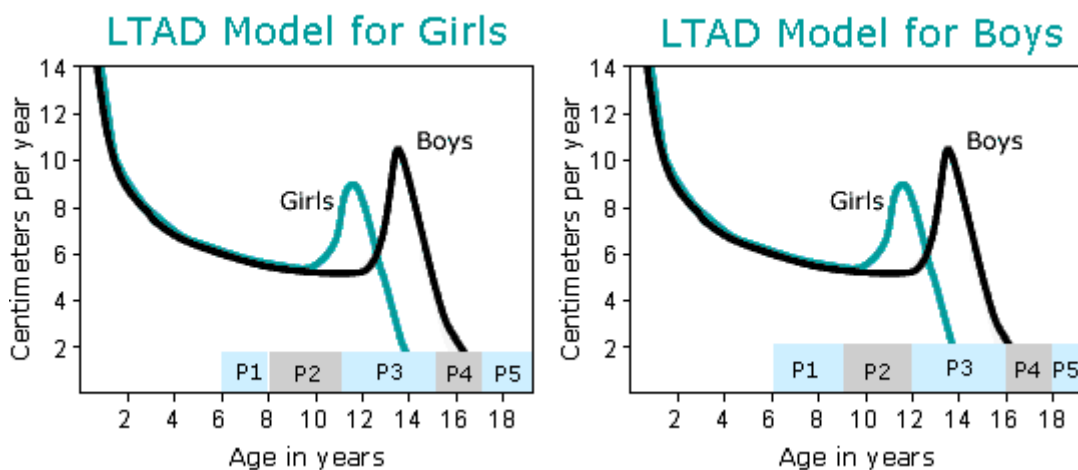
- Athletes train to peak for major competitions
- Training is characterized by high intensity and relatively high volume with appropriate breaks to prevent over training
- Training to competition ratio in this phase is 25:75, with the competition percentage including competition-specific training activities

Phase 6 - Retirement & retainment

The main objective should be to retain athletes for coaching, officiating, sport administration etc.

LTAD Model

The diagrams below show the above Late Specialization LTAD Model phases for boys and girls.



UK Athletics Model

The following is an example of a five stage progression (UK Athletics model) for long term athlete development:

1.Fundamentals - where the emphasis is on fun, developing basic fitness and general movement skills - training years 1 to 3 and ideally a chronological age of 6 to 13.

2.Learning to Train - where the emphasis is to learn how to train and develop their general skills - training years 3 to 5 and ideally a chronological age of 10 to 15.

3.Training to Train - where the emphasis is event(s) specific training - training years 5 to 7 and ideally a chronological age of 13 to 17.

4.Training to Compete - where the emphasis is to correct weaknesses and develop athletic abilities - training years 7 to 9 and ideally a chronological age of 15 to 19.



5. Training to Win - where the emphasis is on enhancing performance - training years 10+ and ideally a chronological age of 18+.

General Annual Training Programs

The following are examples of basic training programs suitable for the young athlete or for the mature athlete who is just starting out in Track and Field athletics:

- Sprint events - 100 metres, 200 metres, 400 metres, 4 × 100 metre relay and 4 × 400 metre relay.
- Throw events - Discus, Shot, Javelin and Hammer
- Jump events - High Jump, Long Jump, Triple Jump and Pole Vault
- Endurance events - 800 metres, 1500 metres, 5km, 10km, Race Walking and Steeplechase.

See attached a copy of a sample training plan. Found on www.brianmac.co.uk, 7/2/2011

See attached a copy of sample AFL training plan.

How to structure a training session

It is important a coach takes time to plan each training session. Training sessions should be developed from two or three goals that have been identified for that session. The elements of a training session that all coaches should include are:

- session introduction
- warm up
- games, skill and fitness activities
- cool down
- review

Gathering information and setting goals

Before planning a training session, coaches should gather information about the participants, and set goals. If you are working with a new group, the type of information you might need includes:

- previous experience in the sport
- level of development, both with the technical and tactical skills of the sport as well as their level of physical fitness
- why they like to play the sport and what motivates them
- goals and aspirations in the sport
- any illness, injury or medical condition that might restrict their ability to participate.

Goals should be established for the season as well as each training session. Goals help to guide the program and provide a reference point to monitor progress throughout the season.

Tips for planning training activities

Session content:

- Over-plan rather than under-plan. It is easier to omit drills than to add unplanned drills.
- The session must have variety of activities to ensure the participants stay active and enthusiastic. Look for new ideas and adapt old favourites or games from other sports.

Appropriate activities:

- Avoid activities that require inactivity or drills that eliminate participants. It is likely that the participants to be first eliminated will be the less skilled, who are the ones that need most practice.
- Use more groups with a small number of participants rather than a few groups containing large numbers.
- The activities must be appropriate for the participant's ability and age.
- Even younger participants are capable of working independently in small groups. Develop activity station cards that explain the drill to be practised.

Progression:

- Plan so that activities flow from one to the next smoothly. Have equipment close at hand and develop routines so that participants know what to do next.

Practice:

- Ensure enough time for participants to practice and experiment with activities. Practice in small sided games is beneficial as it allows skills as well as technique to develop.

Rehabilitation

MUSCULOSKELETAL INJURIES are common and the causes are multifactorial. Some are benign and self-limiting and little is required besides routine medical care and advice; others become chronic and present complex therapeutic challenges. Optimal management, especially for patients with associated comorbidities, requires a multidisciplinary team to simultaneously address the physical condition, the underlying psychological processes and the social milieu of the patient.

Evaluation and management plan

The focus of evaluation is to identify the injury, grade its severity and formulate a multidisciplinary management plan to return the patient to normal activity as soon as possible.

- *Identifying* the injury involves taking a careful history, performing a thorough general and local examination and conducting relevant investigations.

- *Grading* the injury involves assessing the level of disability in relation to the patient's ability to return to normal activity levels, as well as his or her occupation and role in the community.



- A multidisciplinary management plan is developed with the patient, doctor and physical therapist as the core team members. Other health professionals such as an exercise physiologist, psychologist, occupational therapist, nurse, dietitian, podiatrist and orthotist are recruited as required.

Management options

Rest, ice, elevation and compression to minimise tissue damage after injury are the foundations of first aid. However, rest beyond the first 24–48 hours is contraindicated in most injuries, as inactive muscle rapidly atrophies, connective tissue contracts and detrimental changes occur in immobilised joints.

1: Management options after musculoskeletal injury

Progressive active mobilisation

Strengthening, flexibility and endurance exercises

Proprioceptive retraining

Functional training

Passive physical treatment

Heat, ice

Manual therapy

Drug therapy

Psychological treatment

Education/explanation

Counselling, reassurance

Cognitive behavioural therapy

Biomechanical techniques and devices

Taping/orthotics

Altered technique/equipment

Relevant specialist opinion

In the post-acute phase, optimal management of musculoskeletal injuries consists of multiple parallel interventions

Progressive active mobilisation

Progressive active mobilisation consists of strengthening and flexibility exercises, while maintaining or improving cardiovascular endurance. Proprioceptive retraining (balance and stability exercises) are used when such deficits are present. These exercises are then combined in progressive functional training in the context of relevant tasks in which they are used sequentially and in overlapping combinations. Initially, the exercises, described below, are supervised, usually by the physiotherapist.



Strengthening exercises are used to minimise disuse atrophy, increase circulation and maintain muscle condition. *Isometric* strengthening exercises, in which muscles are contracted without movement of an affected joint, are very useful in joint injury (eg, straight-leg raises in knee injury). *Isotonic* exercises, in which muscle contraction powers a joint through a range of motion, are used in a pain-free range of motion. They include daily progressive resistance exercises using weights or other resistance devices. Multiple repetitions varying in number and degree of resistance are employed. Instruction and supervision are provided.

Flexibility exercises help restore normal joint motion. They may also play a role in prevention of injury. Graduated stretching over time increases the length of contractile and connective tissue within the muscle–tendon unit, and allows restoration of normal range of joint motion.⁴ Stretching exercises after injury may be combined with passive modalities (eg, heat or ice) to reduce spasm induced by activity of the fusimotor system and provide both analgesia and increased range of motion. Flexibility exercises should be continued after recovery.

Endurance exercises at moderate levels of exertion should be performed most days of the week. Most patients with chronic musculoskeletal injury and pain will not do this spontaneously. Benefits include cardiovascular improvements, metabolic stimulation, maintenance of muscle bulk, immunological modulation and positive psychological effects. The aim is to increase heart rate without aggravating the injury.

Endurance exercises include:

- exercising in water and swimming;
- brisk walking or gentle jogging;
- circuit training using light weights in a sequence of exercises;
- calisthenics or aerobics; and
- use of exercise machines such as bicycles, steppers, rowers, treadmills and armcranks.

2: Exercising without weight-bearing

For lower-limb injuries and arthropathies, swimming and water exercises are particularly useful, allowing all limb muscles to provide the work of exercise, with an 80%–90% reduction in weight-bearing forces.





Proprioceptive retraining

Ligament, tendon and joint injuries are often accompanied by proprioceptive impairments, which persist after the acute injury phase.⁷ This retraining aims to increase speed and efficiency of muscular control to prevent reinjury.

The components of proprioceptive retraining are:

- taping or bracing to aid joint alignment and increase sensory input;
- progressive static balance exercises (eg, in ankle injury, standing on one leg and graduating from firm surfaces to foam to a "wobble board"); and
- increasing the difficulty of balance and control exercises sequentially (eg, using a blindfold or increasing the required speed to complete a task).

Functional training

Functional training combines the previous components of strength, flexibility, endurance and proprioceptive exercises. Muscle groups are exercised in tandem to allow coordinated, purposeful movement. Training is progressive (eg, walk–jog–run) as healing progresses. It forms the basis of graduated return-to-work programs. Functional training has been shown to decrease time off work, and speed return to sporting activities.

Passive physical treatments

These should only be used as part of a structured program and not as a substitute for more active participation. A preference for and reliance on passive treatment modalities should be discouraged. Ultrasound, laser, magnets and acupuncture have very little, if anything, to offer, and there is a dearth of scientific evidence to support their use.

Cooling has beneficial effects in both the acute and subsequent phases of injury. Ice packs are cheap and easy to employ. Cooling provides analgesia, vasoconstriction and oedema reduction and may be used in combination with active exercises.

Heat causes vasodilatation, increased metabolic rate, analgesia, increased collagen extensibility and reduces spasm. It is used most often in chronic painful conditions with associated muscle spasm (eg, whiplash).

Manual therapy is one of the oldest treatments in medicine and encompasses all forms of massage, mobilisation, manipulation and traction. Benefits include reduction in oedema and spasm, and improved flexibility and range of joint motion, as well as psychological effects. Referral for this purpose should be made to physical therapists who have appropriate scientific training and experience and who are willing to work as part of a team. There is some evidence that manual therapy, in combination with exercise and education, is beneficial.

Drug therapy



Several classes of drugs have a role to play in musculoskeletal injury management.

Analgesics (paracetamol or combinations of paracetamol and aspirin plus codeine) can be used to provide sufficient pain reduction to allow an increase in activity levels.

Opiates (codeine, tramadol, oxycodone) tend to be overused for analgesia in post-injury rehabilitation. Longer-acting agents (eg, Tramal SR; CSL), taken orally, are preferable, but their use should be closely monitored because of the risk of dependence and abuse.

Non-steroidal anti-inflammatory drugs (NSAIDs) (short-acting indomethacin, diclofenac with a medium action time, and long-acting piroxicam), taken orally, are particularly useful, providing a combination of analgesic and anti-inflammatory effects. In conditions with ongoing inflammation (eg, enthesopathies, arthropathies and ligamentous strains), duration of use of NSAIDs may vary from days to weeks.

Selective COX-2 inhibitors provide anti-inflammatory and analgesic effects with lower gastric side-effect profiles than traditional NSAIDs, and are most useful in chronic arthropathy.

Local corticosteroid injections are useful for some conditions (eg, rotator cuff injuries). However, the benefits may only last for weeks to months, and training is required in administration techniques. There is limited evidence to support the use of parenteral corticosteroids in plantar fasciitis and finger flexor tendinopathy.

Tricyclic antidepressants (eg, amitriptyline, dothiepin) are often helpful in relatively low doses for chronic pain and also provide nocturnal sedation.

Benzodiazepines act centrally as sedatives, but tend to be overused and should only be viewed as a short-term adjunctive treatment. Co-existing anxiety states and depression should be treated separately.

Anticonvulsants (carbamazepine, gabapentin, valproate) can be prescribed as adjunctive therapy in patients with neuropathic pain. Of these, gabapentin has been advocated for its favourable side-effect profile.

Muscle relaxants (eg, baclofen) may be helpful in patients with severe muscle spasm.

Psychological treatment

Patients may respond to a chronic injury and pain with mood disturbances, including depression, lowered self-esteem, anxiety, anger and maladaptive behaviour. Calm explanation, reassurance and involvement in the rehabilitation plan can counteract these psychological disturbances, as can cognitive behavioural therapy and family and social support. Occasionally, medication, supportive psychotherapy and referral to a psychiatrist are required. Many studies have found general exercise programs to have positive psychological benefits.



Biomechanical devices and techniques

The trauma leading to musculoskeletal injury may be acute or involve chronic repetitive forces. A subtle and diverse combination of body type, physical factors and work requirements, as well as individual technique, can be the aetiological factors producing or maintaining an injury. Protective devices (eg, knee pads for workers who are required to kneel) can protect an existing injury and prevent new occurrences. Techniques used during activity may require alteration, and exercise equipment used should be in a good state of repair. Orthotic devices help biomechanical alignment and reduce stress on joints and can be an effective part of a treatment plan. They have been shown to help prevent ankle injuries.

Specialist referral

Specialist surgical, rehabilitation and psychiatric interventions may be required in particular cases in which the condition is resistant to the management options outlined above.

Chronic musculoskeletal conditions

Chronic conditions, in particular back pain, are difficult to treat, and, despite being given optimal care, a proportion of patients do not improve and exhibit abnormal illness behaviour. There is often coexisting depression and anxiety, especially in the elderly. There may be "secondary gain" inhibiting improvements in function (eg, compensation payments, increased family or social attention, and work avoidance). Drug dependence should be recognised, if present.



In such patients a problem list helps identify and prioritise issues to be addressed, and pain and activity diaries can give the clinician a clearer idea of the patient's physical capabilities. Again, a coordinated multidisciplinary approach is desirable.

In chronic back pain, there is little evidence to support the effectiveness of manipulation, soft-tissue injections, acupuncture or back orthoses.

A functional restoration approach to the management of patients with chronic back pain, combining quantification of back strength, flexibility and aerobic fitness with an occupational and goal-oriented strengthening program, an aerobic conditioning program and cognitive behavioural therapy, has shown some promise. A meta-analysis of the results of intensive biopsychosocial rehabilitation supports its efficacy. There is Australian evidence that media campaigns can positively alter community perceptions of back pain.

Return to activity

Progressive, staged return to activity is encouraged after the achievement of full range of movement, adequate strength and control. Simulated environmental testing and effective team communication facilitate this. In returning patients to employment tasks that require physical activity, contact with the employer is helpful to prescribe which job roles can be safely undertaken. The decision to return to full activity should be made by the whole treatment team, including the patient.



Selection Policies

When is a selection policy required?

Natural justice activists would probably argue that there should be a policy anytime a coach or sporting body has to select one athlete over another. The reality is, however, that this is impractical, as the implication is that the coach of an under-5 soccer team would need to have a documented policy setting out how they are going to pick their team to compete in the Saturday morning local mini-soccer game.

It is far more realistic to consider implementing a formal selection policy when representative team selections are to be made. This is the level where athletes are competing against each other for selection to a particular team or event, and often there are more athletes competing for selection than places available.

Who is eligible for selection?

This needs to be clearly stated so that only those who are eligible can be considered for selection. For example, in some cases age eligibility needs to be stated; in other cases it needs to be stated that only athletes who have registered and are financial members of the association will be considered for selection.

What should go into a selection policy?

A selection policy should provide sufficient detail so that a reader can answer the following questions:

What is being selected?

The purpose and/or philosophy behind the selection criteria should be clearly articulated at the beginning of the selection policy. For example, the selection policy of an under-15 boys state volleyball team could have an opening statement that says:

The ACT Volleyball Association (ACTVA) supports the early identification and development of potential AIS athletes. ACTVA believes that the Under-15 National Volleyball Championships provides an ideal opportunity for AIS coaches to identify potential AIS scholarship athletes. Accordingly, ACTVA will give preference in the selection of athletes for the ACT Under-15 National Volleyball



Championships to those who have the greatest potential to be recruited to the AIS Men's Volleyball program.

An alternative opening statement for the same team could be:

The ACT Volleyball Association (ACTVA) will select players for the Under-15 National Volleyball Championships who will achieve the best possible result for the ACT at these championships.

Obviously there is a different purpose/philosophy behind each of these statements. By clearly stating these at the beginning of a selection policy the reader should be left with no uncertainty.

Who is doing the selecting?

One of the easiest things to get right is to identify who will form the selection panel. This may be one person (for example, the head coach), or it could be a panel of people that may or may not include the coach. Whoever is on the selection panel must be unbiased. Members of the selection panel do not have to be 'experts', but ideally the panel should have a range of expertise that can assist in the process of applying the selection policy to a list of potential athletes.

Regardless of how many people and who these people are, it is important to identify the selection panel in the selection policy. It is also important to include a 'conflict of interest' clause that details what will happen if one or more of the selection panel has a conflict of interest. Possible wording of this statement could be:

All members of the selection panel will be required to declare any conflict of interest. In the event that a conflict of interest is declared, that person will take no further part in the selection process.

A clause such as this helps to protect the integrity of the decision-making process.

How does an athlete get selected?

Once the purpose/philosophy is established, the criteria that is used to evaluate potential athletes should clearly spell out what an athlete must do (for example, what events they need to compete in and what standards they must achieve) and should advise what the selection period is.

Ideally these criteria should be as clear and unambiguous as possible. In some sports, most notably individual sports, this should be relatively easy to achieve as there is often an objective standard such as time, distance, finish position or judge's score against which athletes can be directly compared. In establishing these criteria, it must be made clear to the reader what events/competitions will be used. It is also essential that when a selection policy is written, it does not use any retrospective results to select athletes.

For many sports, such as team sports, there is no single objective measure that can be used to compare one athlete against another. Often the decision is a subjective one based on many interconnected factors. In these situations it is critical that the process, time frames and events/competitions that will be reviewed by the selector/s are well documented, so that the athlete knows where and when they must compete in order to be considered for selection.

In other situations an objective result may be available, but a degree of subjectivity needs to be applied. An example of this could be in the sport of triathlon where a team is being selected for a world championship to be held in hot, humid conditions on a tough and hilly bike and run course.

In this situation it may not be relevant to base selection on a particular World Cup race that is held in cool conditions over a relatively flat course. It may be best to have the policy read:

Selection will be based on performances in World Cup races held during the seventh to last-month period immediately prior to the world championships (performances in World Cup races held in the month immediately prior to the world championships will not be considered, as the selection panel has



determined that it is not in Australia's best interests to have athletes risk fatigue and/or injury by trying to earn selection during the month immediately prior to the world championships).

Athletes will be selected on the basis of their performances during these World Cup races. The selection panel will especially consider head-to-head performances of Australian athletes from these World Cup races and will pay particular attention to performances in World Cup races that have similar characteristics (heat, humidity, course profile) to those expected at the world championships.

What can an athlete do if not selected?

The principles of natural justice dictate that everyone should have the right to appeal against a decision that affects them.

This does not mean, however, that anyone can appeal against anything. It simply means that if an athlete wishes to appeal against their non-selection then there is a detailed process and set of guidelines that must be followed.

Generally the grounds for a selection appeal are along the following lines:

- the selectors did not follow the procedures laid out in the policies, rules, regulations and/or criteria of the organisation
- there was an error in the information on which the decision was based
- members of the decision-making group were influenced by bias
- the decision reached was grossly unfair or unreasonable.



Typically the appeal policy will set out the following:

- Who can appeal against a decision (this should be limited to the person affected by the decision)?
- Who comprises the appeal panel?
- What can be appealed? A good appeal policy will define the limits of an appeal. This is often referred to as the 'grounds for appeal' and sets out what a person can appeal against.
- What are the process and time lines for submitting an appeal?
- How will the appeal hearing be conducted?
- What should be done in the case where the appellant is still not satisfied with the decision? Many sports attempt to provide mediation or have a number of internal processes to hear an appeal before having the dispute resolved by a higher authority, such as the Court of Arbitration for Sport. This avenue should only be used as a last resort.

Summary

A selection policy should be as clear and as simple as possible. Ideally it should not be a document full of legal jargon but should be something that anyone can pick up, read and understand what needs to be done in order to gain selection for a particular team and/or event.

The reality is, however, that as the importance of the selection increases (for example, being selected for an Olympic team), the complexity of the selection document also increases.

For examples of selection policies, review websites from a range of national and state sporting organizations, as well as the Australian Olympic Committee.

In addition to the principles of planning and preparing an individualised long term training plan for an athlete, the trainer also needs to be aware of how to monitor and adjust the training program.

In order to understand when to adjust a training plan, it is useful for the trainer to understand the principle of fitness testing and measuring the athlete's performance.

When you assess an athlete, and their performance has either decreased or increased, then their program will need to be evaluated and modified.

The reasons for assessing health and fitness often differ between a competitive athletic population and a recreationally active or sedentary population. In competitive athletes, developing an athletic performance profile requires a detailed battery of testing that thoroughly analyses all the components comprising athletic performance (ie. Strength, anaerobic power, speed, agility, maximal aerobic capacity and endurance, flexibility, and body composition).

Test results can determine the relevance of a fitness component to a particular sport and can direct the appropriate emphasis on that variable in the athlete's training program. In addition, a sport specific athletic profile can help establish standards for predicting potential success in that sport. Athletes and coaches alike can use these standards as a motivational tool when establishing personal training goals by comparing personal results to normative data from similar athletic populations. Performance testing can also provide baseline data for prescribing individual exercise programs, feedback for evaluating a training program, and information for assessing recovery following injury.

- In recreationally active or sedentary individuals, health and fitness assessment assesses the health and wellness of the majority of our population
- Physical fitness testing on recreational athletes provides benefits similar to those seen in the competitive athletic population. The primary difference is that assessment emphasises health risk



appraisal in the recreational population while it focuses primarily on athletic achievement in the athletic population.

- Fitness testing in both populations provides information for exercise prescription, and serves as a motivating tool for individuals.

After preparing a program for an athlete, you must ensure it is followed so that the testing procedures can be accurately completed, allowing the coach to accurately assess the progress of the athlete. This assessment will assist in adjusting the program to benefit the athlete.

Exercise Prescription: Individuality, Modality, Overload, Adaptation, Frequency, Duration, Intensity, and Specificity.

Study of Exercise, Program Design and Science of Human Movement

In the study of exercise science, there are universally accepted scientific fitness principles that must be followed in order to get the most from exercise programs and improve both physical fitness and functional physical performance. These principles behind the development of exercise programs include:



Exercise Individuality: Assessment, Fitness Program Design, and Implementation

These are critical components of training that demands optimal benefits are achieved by devising training programs to suit the specific needs of individual athletes, novice, beginner, intermediate, and advanced exercisers alike—each exerciser should have an individualized exercise program. This component ensures that exercises and exercise programs are tailored to meet the requirements of the individual, and would minimize the risk of overtraining and overuse injuries. Well prepared exercise programs should be based on our individual differences and responses to exercise. This is extremely important to remember when evaluating a new exercise program or workout routine—this is the initial responsibility of a qualified personal trainer.

Exercise Modality: Choosing between Exercise Modalities

Exercises are chosen based on an individual's specific needs, limitations, goals, influences, preferences, and current ability levels. One might use various forms of exercise, exercise tools, exercise machines, and or aids. For example, one modality of knee articulation resulting in lower leg extension, utilizing the quadriceps, moving the lower leg away from the back of the thigh (commonly referred to as "leg extension") requires that an individual use a leg extension machine to exercise muscles of the upper leg. This movement or exercise strengthens the quadriceps muscles of the upper leg. Another example of a similar exercise used to strengthen the quadriceps of a person recovering from a knee injury might be a modified "leg lift" which strengthens the quadriceps without deep knee flexion or extension.

The above mentioned modalities serve to address very different strengthening, limitations, and client needs. The two simple quadriceps exercise modalities detailed above may involve the same muscle groups to a varying extent—but, chiefly they address very specific needs and goals in two very different clients. The client recovering from injury utilizing a modified version of the leg extension exercise will strengthen and utilize several exercise modalities to meet his or her goals. Once an exercise helps a person meet an established goal, the participant will follow progressive modalities utilizing a wide variety of tools, applications, and methods to accomplish greater goals. A mix of specific exercise modalities can keep a client on the sure and steady track to ultimate success.



Exercise Overload: Stress, Resistance, and Weight Load

The exercise science principle of overload states that a greater than normal stress or load on the body is required for training adaptation to take place. What this means is that in order to improve our fitness, strength or endurance, we need to increase the workload accordingly. In order for a muscle (including the heart) to increase strength, it must be gradually stressed by working against a load greater than it is used to. To increase endurance, muscles must work for a longer period of time than they are used to or at a higher intensity. For example, training with a set stress load on your body for long periods of time will produce little result. You must increase, progressively, the stress applied to a body, muscles, skeletal system, and connective tissues in order for all involved to become stronger, more resilient, and better functional.

Exercise Progression: Stress, Duration, Frequency, Intensity & Specificity Over Time

Exercise progression or progressive exercise implies that there is an optimal level of overload that should be achieved, and an optimal time frame for this overload to occur. A gradual and systematic increase of the workload over a period of time will result in improvements in fitness without risk of injury. If overload occurs too slowly, improvement is unlikely, but overload that is increased too rapidly may result in injury or muscle damage. For example, the weekend athlete who exercises vigorously only on weekends violates the principle of progression and most likely will not see obvious fitness gains—in fact, because of the infrequency with which a weekend warrior exercises, progressive, continuous, increases in heart, cardio, strength, endurance, and body composition values may change very little. Additionally, the likelihood of over-use injury or strain is high, while your body does require proper rest and recovery, the body responds best to moderate intensity levels and frequency best.

Exercise Adaptation: Adjustment to Physical Demand

Adaptation refers to the body's ability to adjust to increased or decreased physical demands. It is also one way we learn to coordinate muscle movement and develop sports-specific skills, such as batting, swimming freestyle or shooting free throws. Repeatedly practicing a skill or activity makes it second-nature and easier to perform. Adaptation explains why beginning exercisers are often sore after starting a new routine, but after doing the same exercise for weeks and months they have little, if any, muscle-soreness.

Additionally, it makes an athlete very efficient and allows him to expend less energy doing the same movements. This reinforces the need to vary a workout routine if you want to see continued improvement.

Muscle Dependence on Exercise: Muscle, Connective Tissue, and Bone Strength

This simply means that your muscles hypertrophy with use and atrophy without use. This also explains why we decondition or lose fitness when we stop exercise. Hundreds of years ago people worked very hard, physically, to manage day to day life. Often we hear stories about a grandfather who ate bacon and sausage gravy with biscuits every morning, slept very little, and lived to be 100 yrs old. Yes, but he also probably worked very hard physically. Our bodies are capable of enduring and recovering from great stress. The more we exercise our bodies the stronger the muscles, tendons, heart, circulatory system, bones, and joints become. When living a sedentary lifestyle, our body becomes very weak and much less likely to endure or recover from great stress. So, use it—or lose it!

Exercise Specificity: Becoming a Better, Stronger, Faster & Skilled Exercise Enthusiast

Exercise specificity simply states that exercising a certain body part or component of the body primarily develops that part. Specificity demands that, to become better at a particular exercise or skill, you must perform that exercise or skill. A golfer who wants to become a better golf player must spend time on the golf course, a runner should train by running, a swimmer by swimming and a cyclist by cycling, etc. While it's helpful to have a good base of fitness and to do general conditioning exercise routines, if you want to be better at your sport, you need to train specifically for that sport. Personal



trainers will add additional guidelines and principles to this list. However, these basics are the cornerstones of all other effective exercise methods. These cover all major aspects of a solid foundation of athletic and general fitness training programs.

How to develop a Training Program

The process of creating a training program to help develop an individual's level of fitness comprises of 6 stages:

- Stage 1 - gather details about the individual
- Stage 2 - identify the fitness components to develop
- Stage 3 - identify appropriate tests to monitor fitness status
- Stage 4 - conduct a gap analysis
- Stage 5 - compile the program
- Stage 6 - monitor progress and adjust program

Stage 1

The first stage is to gather details about the individual:

- Age
- Reasons for wanting to get fit
- Current or recent injuries
- Health problems
- The sports they play and how often
- Their dislikes and likes with regards training
- What sports facilities they have access to - gym, sports centre etc.

Prior to starting any training, it is recommended you have a medical examination to ensure it is safe for you to do so.

Stage 2

The second stage is to determine what components of fitness they need to improve. This will depend upon what the individual wants to get fit for - to improve general fitness, get fit enough to play in the Saturday hockey league, run a local 5 km fun run or compete in next year's London Marathon.

Exercise scientists have identified nine elements that comprise the definition of fitness. The following lists each of the nine elements and an example of how they are used:

- Strength - the extent to which muscles can exert force by contracting against resistance (holding or restraining an object or person)
- Power - the ability to exert maximum muscular contraction instantly in an explosive burst of movements (Jumping or sprint starting)
- Agility - the ability to perform a series of explosive power movements in rapid succession in opposing directions (ZigZag running or cutting movements)
- Balance - the ability to control the body's position, either stationary (e.g. a handstand) or while moving (e.g. a gymnastics stunt)
- Flexibility - the ability to achieve an extended range of motion without being impeded by excess tissue, i.e. fat or muscle (Executing a leg split)
- Local Muscle Endurance - a single muscle's ability to perform sustained work (Rowing or cycling)
- Cardiovascular Endurance - the heart's ability to deliver blood to working muscles and their ability to use it (Running long distances)
- Strength Endurance - a muscle's ability to perform a maximum contracture time after time (Continuous explosive rebounding through an entire basketball game)
- Coordination - the ability to integrate the above listed components so that effective movements are achieved

Of all the nine elements of fitness cardiac respiratory qualities are the most important to develop as they enhance all the other components of the conditioning equation. You will need to consider which



of these elements are applicable to the individuals training program based on what it is they want to get fit for.

Stage 3

The next stage is to identify appropriate tests that can be used to initially determine the individual's level of fitness and then to monitor progress during the training.

Identified test should be conducted and the results recorded.

Stage 4

We now know the individual's background, objectives and current level of fitness. We now need to conduct a gap analysis of the current fitness levels (from test results at stage 3) and target fitness levels (identified at stage 2). The results of this process will assist in the design of the training program so that each component of fitness is improved to the desired level.

The following is an example of a gap analysis:

Test	Fitness Component	Current	Target
<u>Multistage Fitness Test</u>	Aerobic	Level 12 Shuttle 2	Level 12 Shuttle 5
<u>30 metre acceleration Test</u>	Speed	4.3 seconds	3.9 seconds
<u>Illinois agility run Test</u>	Agility	20 seconds	<16 seconds
<u>Standing Long Jump Test</u>	Leg power	2.4 metres	2.8 metres
Over head medicine ball throw	Arm power	16.1 metres	16 metres

Gap analysis - Aerobic fitness and arm power are good and just need to be maintained - sprint, agility and leg power tests are below target - leg power needs to be improved.

Stage 5

The next stage is to prepare a training program using the results of the gap analysis and FITT principles.

- F - frequency - how often should the individual exercise?
- I - intensity - how hard should the individual exercise?
- T - time - how long should each session last?
- T - training activity - what exercise or training activity will help achieve the individual's fitness goals?

For frequency, intensity and time you should start at an easy level and increase gradually e.g. 10% increments. Aerobic training should last for 20 to 40 minutes. Strength work should last 15 to 30 minutes and comprise of 3 sessions a week with 48 hours recovery between sessions.

Plan the program in four week cycles where the workload in the first three weeks increase each week (easy, medium, hard) and the fourth week comprises of active recovery and tests to monitor training progress. The aim of the four week cycles is to:

- Build you up to a level of fitness (3 weeks)
- Test, recovery and adjustment of the training program (1 week)
- Build you up to higher level of fitness (3 weeks)
- Test, recovery and adjustment of the training program (1 week)
- Build you up to an even higher level of fitness (3 weeks)
- and so on



The tests used to assess the individual's initial level of fitness should be planned into week 4 of the program in order to monitor progress and effectiveness of the program. The test results can be used to adjust the program accordingly.

The program needs to last 12 to 16 weeks in order to see any real benefits and the planning (initial & subsequent adjustments) should be conducted with the individual so that they feel they own the program. This will ensure the program is enjoyable and convenient to do.

Stage 6

The program has now been agreed and the individual can undertake the program. Every 4 weeks meet and discuss with the individual:

- How the training has gone
- The test results
- Progress towards target fitness levels
- Adjustments to the training program

Where training needs to be modified, the trainer should apply the FITT principles, and adjust program accordingly.

Performance of an athlete in top-sport depends on the athlete's technical, tactical, physiological, and psychological/social characteristics. These elements are closely linked to each other, e.g., the technical quality of an athlete may not be utilized if the athlete's tactical knowledge is low. The physical demands in a sport are related to the activities of the athlete. In some sports, continuous exercise is performed with either a very high (e.g., 400-m run) or moderate intensity (e.g., marathon run) during the entire event. In other sports, like soccer and basketball, athletes perform different types of exercise ranging from standing still to maximal running with varying intensity.

Under optimal conditions, the demands in sport are closely related to the athlete's physical capacity, which can be divided into the following categories:

- (i) the ability to perform prolonged exercise (endurance);
- (ii) the ability to exercise at high intensity;
- (iii) the ability to sprint; and
- (iv) the ability to develop a high power output (force) in single actions during competition such as kicking in soccer and jumping in basketball

The performance within these categories is based on the characteristics of the respiratory and cardiovascular system as well as the muscles, combined with the interplay of the nervous system. Competition naturally provides the best test for an athlete, but it is difficult to isolate the various components within the sport and get objective measures of performance. Fitness testing can provide relevant information about specific parts of a sport. Before selecting a test, clear objectives should be defined. The reasons for testing an athlete are outlined below:

- To study the effect of a training program
- To motivate the athletes to train more
- To give an athlete objective feedback
- To make an athlete more aware of the aims of the training
- To evaluate whether an athlete is ready to compete
- To determine the performance level of an athlete during a rehabilitation period
- To plan short- and long-term training programs
- To identify the weaknesses of an athlete

To obtain useful information from a test, it is important that the test is relevant and resembles the conditions of the sport in question. For example, a cycle test is of minor relevance for a swimmer.



There are a number of commonly used laboratory tests, which evaluate the various aspects of performance. These include determination of maximum oxygen uptake to evaluate the athletes' ability to take up and utilize oxygen.

A Wingate test, which consists of 30 s of maximal cycle exercise, aiming at determining the maximum anaerobic power and ability to maintain a high power output. Strength measurements in which the strength of an isolated muscle group is measured either during isometric, concentric, or eccentric contractions are also used as laboratory tests. Such tests provide general information about the capacity of an athlete and may separate the different performance levels of athletes within a sport. In some sport such general tests can provide information on the requirement of the sport, e.g., to be a top-class cross-country skier a maximum oxygen uptake higher than 80mLmin⁻¹ kg⁻¹ is required.

These classical laboratory tests may also be useful for comparisons of performance between various sports. However, to a minor extent, they may only express the performance of the athlete during competition.

Fitness training

In many sports the athletes need a high level of fitness to cope with the physical demands of the competition and to allow for their tactical and technical skills to be utilized throughout the competition. Fitness training in any sport has to be focused on the demands in the sport and in many sports is has to be multifactorial to cover the different aspects of physical performance in the sport. Therefore, the exercise performed should, whenever it is possible, resemble the activities during competition as closely as possible.

It is useful to divide fitness training into a number of components related to the purpose of the training. The terms aerobic and anaerobic training are based on the energy pathway that dominates during the activity periods of the training session. Aerobic and anaerobic training represent exercise intensities below and above the maximum oxygen uptake, respectively. However, in some sport like ball games, in which the ball is used in the fitness training, the exercise intensity for an athlete varies continuously, and some overlap exists between the two categories of training.



Planning fitness training

The time course of adaptations in the various tissues should be taken into account when planning fitness training. A change in heart size is rather slow, and there is a need for training over a longer period of time (years) to improve the pump capacity of the heart significantly. Blood volume changes more quickly than the heart size, but this adaptation is optimal first after a dimensional development of the cardiovascular system has occurred. The content of oxidative enzymes in a tissue and the degree of capillarization of skeletal muscle change more rapidly than the volume of a tissue, e.g., the heart, but months of regular training are needed to obtain considerable increase in muscle capillaries and oxidative enzymes.

On the other hand, a reduction in these parameters can occur with a time constant of weeks. The changes in glycolytic enzymes are rapid and they can be markedly elevated within a month of appropriate training.

With appropriate training, performance of an athlete can be increased and the risk of injury can be reduced. To design an efficient training program it is important to be aware of the physical demands of the sport, the capacity of the athlete which can be determined by various tests, and the different components of fitness training. Aerobic training increases the ability to exercise at an overall higher intensity during competition, and minimizes a decrease in technical performance induced by fatigue. Anaerobic training elevates an athlete's potential to perform high-intensity exercise. Muscle strength training, combined with technical training, improves an athlete's power output during explosive activities in a match.

Planning of fitness training is essential in top-class sport, and an example of the preparation of the Danish National Soccer team for the European Championship 2004 combined with physiological measurements and testing is provided taken into account individual needs.

Fitness Assessment

For any fitness assessment, it is recommended that you ensure that the body is primed physically to perform to its potential. Maximum performance is more likely if these nutritional and physical guidelines are followed. If all participants follow the same procedures and are in the same physical state, then comparisons are more valid, and if the same procedures are followed for each testing session, then the results will be more reliable.

Nutritional Preparation for the athlete/s being tested:

- Ensure you are well nourished on the day of testing.
- Where possible, consume a high carbohydrate diet in the 24 hours prior to the testing sessions (such as pasta, potatoes, cereals, toast, fruit etc.).
- In the two hours before completing the tests do not consume a heavy meal; however, you are strongly advised to have eaten some food in the four hours preceding testing.
- Caffeine products (such as coffee, cola or tea) should be avoided on the day of testing.
- Alcoholic beverages and tobacco products should be avoided 24 hours prior to testing.
- Ensure you are fully hydrated, particularly in hot conditions. Drink regularly in the days leading up to the test, particularly in the 12 hours prior to testing.
- Top up body fluids by drinking water regularly throughout the testing session. Continue to consume adequate fluids following exercise to replace any fluids lost during testing.



Physical Preparation

- Avoid heavy strenuous exercise for the 24 hours prior to testing. Do not exercise at all on the day of testing to ensure you are well rested.
- Wear appropriate clothing for the conditions (e.g. shorts/track pants and t-shirt/singlet/sports top) and non-slip athletic footwear with laces securely fastened.
- Remove restrictive jewelry, watches, bracelets or hanging earrings that may get caught in equipment.
- Do not participate in the testing if you are suffering any injury or illness that is likely to worsen as a result of participation or you are unwell/not in good general health.
- Be sure to warm-up prior to the commencement of testing. See warm up guidelines.
- Cool down appropriately. Do not sit or lie down immediately following maximal exercise. Following completion of testing continue moderate-to light aerobic activity (jog or walk) for 5 minutes followed by some light stretching of both the upper and lower body.

General Warm Up Procedure

Here is a general warm up procedure that you can use as a basis for your testing. This is only a guide and you can adapt it based on the time and facilities that you have available. You may wish to include specific stretches when a certain part of the body is to be specifically tested. See also the specific test warm ups below.

- 5-10 minutes of light aerobic activity, such as jogging or stationary cycling.
- stretches to include both upper and lower body. e.g.
 - lunges
 - quad stretch
 - calf stretch
 - side bend
 - arm stretches



This guide is presented as a service to athletes, coaches, parents and exercise physiologists, who wish to evaluate their own or someone else's fitness level, or to gain a greater understanding of tests that they have performed.

There are probably hundreds of standard fitness tests used, and hundreds more variations of these. They can range from elaborate and expensive laboratory tests to simple and inexpensive field tests. Each test also has many advantages and disadvantages that can ultimately determine which is the most appropriate test to perform. If you are designing your own fitness testing regime, with the information about the relative merits and requirements of each test that is contained in this guide, you can make an informed choice of the most appropriate test or tests to use.

Firstly this guide discusses why we should perform fitness testing and the benefits of testing, then how to select appropriate fitness tests, some tips about conducting tests, and interpret the results. There are also some further readings so you can find some more detailed information yourself.

Once you have a good understanding of the issues concerning fitness testing, you can go and explore the growing list of tests and their descriptions on this site.

Why Fitness Test?

Performance in any sporting event is the result of a multitude of factors, which include the amount of training performed, the body's adaptation to the training, motivation level, nutritional status and weather conditions to name a few. As you can see, physiological parameters only account for a portion of any performance, and so the role of any exercise physiologist is also similarly limited. Through fitness testing, the factors involving physiological processes, over which there is some control, can be measured and ultimately improved upon.

Competition is the ultimate test of performance capability, and is therefore the best indication of training success. However, when trying to maximize performance, it is important to determine the athlete's ability in individual aspects of performance. Fitness testing attempts to measure individual components of performance, with the ultimate aim of studying and maximizing the athlete's ability in each component.

Benefits of Fitness Testing

Identify Weaknesses and Strengths

Of the many benefits of fitness testing, the major use is to establish the strengths and weaknesses of the athlete. This is done by comparing test results to other athletes in the same training group, the same sport, or a similar population group. Previous test results of large groups are often published as normative tables.

By comparing results to successful athletes in your sport, you can see the areas which need improvement, and the training program can be modified accordingly. This way valuable training time can be used more efficiently. However, beware that some athletes perform well in their sport despite their physical or physiological attributes, and it may not be advantageous to be like them.

Monitor Progress

The initial testing session can give the athlete an idea of where their fitness levels are at the start of a program, so that future testing can be compared to this and any changes can be noted. A baseline is especially important if you are about to embark on a new training phase. Subsequent tests should be planned for the end and start of each new phase.

By repeating tests at regular intervals, you can get an idea of the effectiveness of the training program. The time-frame between tests can depend on the availability of time or costs involved, or the phase of training the athlete is in. Depending on these factors, the period between tests may range from two weeks to six months. It usually takes a minimum of 2-6 weeks to see a demonstrable change in any aspect of fitness.

Provide Incentives

The incentive to improve can often be provided by the 'goal' of a certain test score. By knowing that they will be tested again at a later date, the athlete can aim to improve in that area.

Talent Identification

Testing is primarily used for help in designing the most appropriate athletic training program. A general non-sport specific testing battery can provide you with an idea of your basic strengths and weaknesses, and from this you may find you would be better suited to another sport which makes better use of your strengths. Although testing has sometimes been used in this way for talent identification, it has generally not been very reliable in predicting the future success of juniors (mainly due to varying growth patterns) and in sports which rely heavily on other factors such as technique, tactics and psychological factors.

Fitness Testing & Talent ID for Sports

Fitness testing is primarily used to determine an athlete's strengths and weaknesses, so as to design the most appropriate athletic training program. Another use of testing is for talent identification, to direct the athlete to a better suited sport or to play in a more appropriate position or compete in a more appropriate event in their chosen sport.

Talent identification in sports has been used with varying degrees of success. Talent ID has generally not been very reliable in predicting the future success of juniors (mainly due to varying growth patterns) and for sports which rely heavily on other factors such as technique, tactics and psychological factors. Successful programs have been for sports that do not have a large participation base, and have clear physical attributes for success that can be tested for.

However, being a successful athlete in any sport is a result of a multitude of factors, and they may also not be easy to test for. In addition to the physical and physiological attributes which usually make up a talent identification process, other factors such as motivation, determination, resilience, positive attitude, resistance to injury, ability to learn and perform skills can all be important. Finding potential athletes is one thing. The success of a talent ID program relies on getting the athlete into the best training program, support system and onto a sport career pathway to the elite level.

A general non-sport specific testing battery can provide you with an idea of a person's basic strengths and weaknesses, and from this they can be matched to sport which makes the best use of their strengths. You can also use muscle fiber testing to determine the relative composition of fast and slow twitch muscle fibers, to help match the person to appropriate sports. More specific tests can be performed when athletes for a certain sport are being recruited. Here are some example sports, with a few of the factors that may be of interest.

- Rowing - good height and arm reach, with a excellent aerobic base.
- Volleyball - height, vertical jump ability
- Cycling - body height/weight ratio, leg power for sprint cyclists

The Australian Institute of Sport has a very successful history of recruiting and developing athletes into non mainstream sports, such as in rowing and the winter sport of skeleton. A program called Talent Search for Australian school children has been used in the past, and now there is an online system of recruitment, called eTID, recruiting athletes for the sports of canoeing, cycling, rowing, triathlon, athletics and beach volleyball.

Selecting Fitness Tests

There is often a standard set of tests that are performed for the fitness testing of any sport. If you do not have access to such as list, or you wish to modify a protocol to suit individual needs, you can use the following information to design your own testing regime. Remember that the test that best determines your capability in any component of fitness is not always the most appropriate tests to perform; there are many other factors to consider.

Identifying Components of Performance

The first step in designing a fitness testing regimen is to identify the components of fitness that you wish to investigate. These may depend on the phase of training or the phase of the season in which the testing is being done. Each sport requires certain attributes and relies on certain factors more than others for successful performance. For example, you would not necessarily want to test a marathon runner on sprinting speed. Your fitness testing time could be better spent on doing more relevant tests.

One method of categorizing the different components of fitness are as presented on the list of tests, though this categorization is somewhat arbitrary. Your testing battery may include a few similar tests from one fitness component and none from others, depending on what your aims of the testing are.



All Fitness Tests

Here are a few common tests, there are many more that are conducted around the world, but you would need to determine the most relevant when you are ready to conduct testing,

Please note: that tests are not described in this unit

Recommended reading lists are found at beginning of module for further information on specific tests, as they are too many tests to list.

Cardiovascular Endurance / Aerobic Tests



- Beep Test
- Walk or Run tests
- Step Tests
- more

Strength & Strength Endurance



- Push-up
- Sit Ups
- 1RM Tests
- more

Speed and Power (Anaerobic Power)



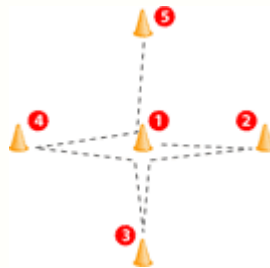
- Sprint Tests
- Vertical Jump Test
- Medicine Ball Throw
- more

Anaerobic Capacity



- Wingate test
- Sprint Fatigue Test
- Intermittent Sports
- more

Agility



- Illinois Agility Run
- T-Test
- 3-Cone Drill
- more

Anthropometry



- Skinfolds
- BMI
- Girths
- more

Flexibility

Balance

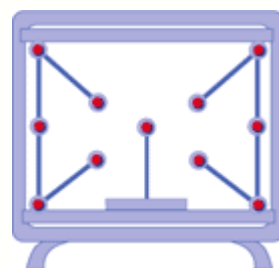
Coordination



- Sit and Reach
- Shoulder Flex Test
- Goniometer Tests
- more



- Stork Test
- Beam Walk
- more



- Wall-Toss Test
- Soda Pop Test
- more

Reaction Time



- Online Reaction Test
- Make your own
- more

Health Related



- Blood pressure
- Lung Function
- Hydration
- more

Questionnaires



- PARQ
- Recovery Q
- RPE
- more

Sport Specific



- Basketball
- Aussie Rules
- Swimming
- more



Performance Evaluation Tests

Performance is an assessment of how well a task is executed and the success of a training program is largely dependent upon satisfying the performance aims associated with it.

How can performance be monitored?

Testing and measurement are the means of collecting information upon which subsequent performance evaluations and decisions are made.

What is the evaluation process?

The whole measurement/evaluation process is a six stage, cyclic affair, involving:

- The selection of characteristics to be measured
- The selection of a suitable method of measuring
- The collection of that data
- The analysis of the collected data
- The making of decisions
- The implementation of those decisions

All of the above stages should be completed with the athlete - especially the analysis of the collected data and making decision of an appropriate way forward.

What are the requirements of a test?

In constructing tests it is important to make sure that they really measure the factors required to be tested, and are thus objective rather than subjective. In doing so all tests should therefore be specific (designed to assess an athlete's fitness for the activity in question), valid (the degree to which the test actually measures what it claims to measure), reliable (capable of consistent repetition) and objective (produce a consistent result irrespective of the tester).

In conducting tests the following points should be considered:

- Each test should measure ONE factor only
- The test should not require any technical competence on the part of the athlete (unless it is being used to assess technique)
- Care should be taken to make sure that the athlete understands exactly what is required of him/her, what is being measured and why
- The test procedure should be strictly standardised in terms of administration, organisation and environmental conditions

What are the benefits of testing?

The results from tests can be used to:

- predict future performance
- indicate weaknesses
- measure improvement
- enable the coach to assess the success of his training program
- place the athlete in appropriate training group
- motivate the athlete

Tests additionally break up and add variety to the training program. They can be used to satisfy the athlete's competitive urge out of season. Maximal tests demand maximum effort of the athlete so they are useful at times as a training unit in their own right.

What factors may influence test results?

The following factors may have an impact on the results of a test (test reliability):

- The ambient temperature, noise level and humidity
- The amount of sleep the athlete had prior to testing
- The athlete's emotional state
- Medication the athlete may be taking
- The time of day
- The athlete's caffeine intake
- The time since the athlete's last meal
- The test environment - surface (track, grass, road, gym)
- The athlete's prior test knowledge/experience
- Accuracy of measurements (times, distances etc.)
- Is the athlete actually applying maximum effort in maximal tests
- Inappropriate warm up
- People present
- The personality, knowledge and skill of the tester

Why record information?

For the coach and athlete it is important to monitor the program of work, to maintain progression in terms of the volume of work and its intensity. Both coach and athlete must keep their own training records. A training diary can give an enormous amount of information about what has happened in the past and how training has gone in the past. When planning future training cycles, information of this kind is invaluable.

What should be recorded?

The information to be recorded falls into two broad categories: -

- The day-to-day information from training
 - State of the athlete (health, composure)
 - Physiological data (body weight, resting heart rate, etc.)
 - The training unit (speed, speed endurance, strength, technique)
 - The training load (the number of miles, the number of sets and repetitions, the number of attempts)
 - The training intensity (kilograms, percentage of maximum, percentage of VO₂)
 - The prevailing conditions (wet, windy, hot etc.)
 - The response to training (the assignments completed, the resultant heart rate recovery, felt tired, etc.)
- Information that measures status. This can take the form of a test. If the test is repeated throughout the program, it can then be used as a measure of progress within the training discipline. Examples of such tests are:
 - Time trials - speed, speed endurance, endurance
 - Muscular endurance - chins, push ups, dips
 - Strength maximum - single repetitions, maximum repetitions
 - Explosive strength - power bounding, vertical jump, overhead shot putt
 - Mobility - objective measurements of the range of movement
 - Event specific

Competition evaluation

Following competition, it is important that the coach and athlete get together as soon as possible in order to evaluate the athlete's performance. Elements to be considered are pre race preparations, focus and performance plans and achievement of these plans. An evaluation form is useful to help the athlete and coach conduct this review.

Maximal Tests

Maximal means the athlete works at maximum effort or tested to exhaustion. Examples of maximal anaerobic tests are the 30 metre acceleration test and the Wingate ANaerobic 30 cycle test. Examples of maximal aerobic tests are the Multistage Fitness Test or Bleep test and the Cooper VO₂max test

Disadvantages of maximal tests are:

- difficulty in ensuring the subject is exerting maximum effort
 - possible dangers of over exertion and injury
 - dependent on the athlete's level of arousal
- Submaximal Tests

Submaximal means the athlete works below maximum effort. In sub maximal tests, extrapolation is used to estimate maximum capacity. Examples of submaximal aerobic test are the PWC-170 test and the Queens College Step Test.

Disadvantages of submaximal tests are:

- depend on extrapolation being made to unknown maximum
 - small measurement inaccuracies can result in large discrepancies as a result of the extrapolation
- Normative data

Where normative data (average test results) is available, it is included on the appropriate evaluation test pages which are identified below.

Evaluation Test Groups

The 108 evaluation tests are grouped as follows:

- | | |
|--|---|
| <ul style="list-style-type: none"> •Aerobic Endurance - VO₂ max (24) •Anaerobic Endurance (2) •Agility (8) •Balance (2) •Body Composition (6) •Coordination (1) •Event Time Predictors (4) •Fitness General (4) •Flexibility (9) •Psychology (2) •Reaction Time (1) •Strength - Core (1) •Strength - Elastic (5) •Strength - General (18) •Speed and Power (18) •Talent Evaluation (1) •Tests for young athletes (2) | <ul style="list-style-type: none"> •Conconi test •Critical Swim Speed - measure of a swimmers aerobic capacity •Home Step Test - a step test you can conduct at home •Harvard Step Test - measure of cardiovascular fitness •Multistage Fitness Test or Bleep test - VO₂ max test for endurance sports •Queens College Step Test - VO₂ max test •Rockport Fitness walking test - VO₂ max test •Tecumseh Step Test - measure of cardiovascular fitness •Treadmill VO₂max test - VO₂ max test |
|--|---|

Evaluation Tests

Aerobic Endurance - VO₂ max

- 2.4km Run Test
- Astrand Treadmill test - VO₂max test running on a treadmill
- Astrand 6 minute Cycle test - Vo₂ max test on a static bike
- Balke VO₂max test - suitable for endurance sports
- Balke Incremental treadmill protocol test- VO₂max test on a treadmill (male and female tests)
- Bruce Incremental treadmill protocol test- VO₂max test on a treadmill (male and female tests)
- Cooper VO₂max test - suitable for endurance sports



- VO2max from non-exercise data - VO2 max test
- VO2max from a one mile jog
- VO2max from a race result (time for a distance)
- VO2max Step Test
- Wheelchair VO2max Test
- Yo-Yo Endurance Test
- Yo-Yo Intermittent Endurance Test
- Yo-Yo Intermittent Recovery Test

Anaerobic Endurance

- Cunningham and Faulkner Test
- RAST - Running-based Anaerobic Sprint Test

Agility

- 505 Agility Test - suitable for sports with multidirectional movement
- Hexagonal Obstacle Agility Test - suitable for sports with multidirectional movement
- Illinois agility run test - suitable for sports with multidirectional movement
- Lateral Change of Direction test - suitable for sports with multidirectional movement
- Quick Feet test - suitable for sports with multidirectional movement
- Shuttle Run Test - suitable for sports with multidirectional movement
- 'T' Drill test - suitable for sports with multidirectional movement
- Zig-Zag Test - suitable for sports with multidirectional movement

Balance

- Standing Stork Test - balance test
- Standing Stork Test Blind- balance test

Body Composition

- Body Fat Percentage
- Body Mass Index (BMI)
- Muscle Fibre Test - Dr F. Hatfield
- Yuhasz skinfold test
- Body Fat Percentage using Girth Measurements
- Waist to Hip Ratio test

Coordination

- Hand Eye coordination
- Event Time Predictors
- 400 metre predictor test - predicts an athlete's potential 400 metre time
- 1500 metre predictor test - predict an athlete's potential 1500 metre time
- 5km predictor test - predict an athlete's potential 5km time

- Kosmin predictor test - predict an athlete's potential 800 metre and 1500 metre time

Fitness General

- Medicine Ball Javelin Quadrathlon - fitness and strength test for Javelin throwers
- McCloy Physical Fitness test
- Quadrathlon - an excellent all round test - originally devised for throwers
- Wilf Paish Rugby Football Tests

Flexibility

- Hip Flexion Test
- Modified Sit and Reach Test - lower back and hamstring test
- Sit and Reach test - lower back and hamstring test
- Static Flexibility Test - Ankle
- Static Flexibility Test - Hip & Trunk
- Static Flexibility Test - Shoulder & Wrist
- Static Flexibility Test - Trunk & Neck
- Static Flexibility Test - Shoulder
- Trunk Flexion Test

Psychology

- SCAT - Sport Competition Anxiety Test
- TEOSQ - Task and Ego Orientation in Sport Questionnaire

Reaction Time

- Ruler Drop Test

Strength - Core

- Core muscle strength and stability test - Abdominals and lower back

Strength - Elastic

- Jumps Decathlon - suitable for jumpers
- Leg Elastic Strength test - suitable for jumpers
- Standing Long Jump test - suitable for sprinters, rugby, football, hockey, fencing etc.
- Sprint Bound Index - suitable for sprinters
- Sargent Jump Test or Vertical Jump Test - suitable for basketball, volleyball, football, rugby etc.

Strength - General

- Abdominal Curl Conditioning Test (NCF)
- Biceps Curl Test
- Burpee Test
- Canadian Crunch Test
- Chin up Test - Arm and shoulder muscular endurance
- Dynamic Knee Extension Test - Knee extensor muscles
- Flexed Arm-Hang Test
- Sit Ups test - Abdominal curl strength
- Curl-Up test - Abdominal muscle endurance

- Grip Strength - Grip strength with a Dynamometer
- Overhead Press Test - Elbow extensors and superior shoulder girdle muscles
- Press Up test - Upper body muscle endurance
- Strength test - upper body - Bench Press
- Strength test - lower body - Leg Press
- Strength test - hamstrings - Leg Curl
- Strength test - quadriceps - Leg Extension
- Squats Test
- Wall Squat Test - Quadriceps strength endurance

Speed and Power

- 10 stride test for 100m and 200m athletes
- 30 metre acceleration test for 100m and 200m athletes
- 30 metre Sprint Fatigue - Power Maintenance Test
- 35 metre Sprint Speed Test
- 40 metre multiple Sprint Test
- 40 yard Sprint Speed Test- predict an athlete's 400 metre time
- 60 metre speed test for 100m and 200m athletes
- 150 metre Endurance test for 100m athletes
- 250 metre Endurance test for 200m athletes

- 300 yard shuttle test - suitable for football, rugby, hockey, basketball, squash
- 400 metre Drop off test for 100m and 200m athletes
- 400 metre Control tests for 400m athletes
- Concept 2 Rowing Step test - Monitor anaerobic threshold
- Flying 30 metre speed test for 100m and 200m athletes
- LAS (Lactic vs Speed) test for 400m athletes
- Margaria Kalamen Power Test
- PWC-170 test- predicts power output at a heart rate of 170 bpm
- Wingate ANAerobic 30 cycle test- Cycling based Anaerobic test

Talent Evaluation

- Evaluation of male and female physical talent

Tests for young athletes

The following test can be used with young athletes

- Aviva UKA Awards - Primary and Secondary School Children
- Athletics 365 - aimed at 8-15 year olds, but can be adapted for younger athletes

Example: Field tests available for group / team testing

20 metre sprints

- Sprint performance is measured on a track surface with single-beam electronic timing gates. Splits can be provided for 5, 10, 15, and 20 metres.

40 metre sprints

- Sprint performance is measured on a track surface with single-beam electronic timing gates. Splits can be provided for 5, 10, 20, and 40 metres.

Repeat sprint ability

- Repeated sprint performance is measured over a sport-specific distance with standardised recovery intervals. This test is also known as the Phosphate Recovery Anaerobic Capacity Test and analysis of the results involves measurement of absolute speed as well as performance decrement during repeat trials.

5-0-5 agility

- This is a measure of the ability to rapidly change direction on a horizontal plane. Athletes begin 10 metres behind the timing gates, sprint through the gates, turn 5 metres past the gates, and sprint back through.

Vertical jump

- Reach height and vertical jump height are measured using a pole with mobile vanes at 1cm increments.

Bench pull

- This is a measure of back and shoulder strength and endurance. Athletes lay face down on a bench and lift a weighted bar up to the bottom of the bench. An electronic system is employed to measure lift velocity and bar displacement. Maximal power generation is measured for one pull and endurance is measured using repeated lifts to exhaustion.

Chin-ups

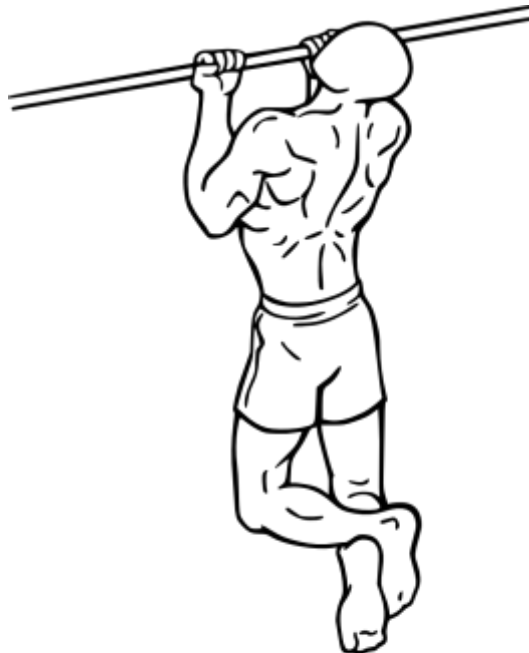
- A Chin-up bar is mounted 2.5 metres from the floor and athletes are supervised for chin-up technique and number of repetitions.

Beep test

- This is a multi-stage fitness test used to assess aerobic power, it is also known as the 20 metre Shuttle Run Test. A number of athletes can complete the test at one time and the final stage completed by each athlete can be used to estimate their VO₂max.

Sit and reach

- Hamstring flexibility is measured using a standardised sit and reach box.





Standardized Protocols

The test protocols need to be standardized so that comparisons can be made between your test scores performed at different times and comparisons between athletes tested at different places. Athletes and coaches should be aware of the need to control for factors which can affect the results obtained. Such things that need to be controlled are: the warm up, order of tests, recovery periods, environmental conditions, and fluid and nutritional status. If comparing test results to normative tables, the test must be conducted exactly the same as it was when the original test group was tested, for the comparison to be valid.

Relevance

You need to select sport specific tests. If you believe that the tests are relevant to the sport you play, you will be more inclined to put a maximal effort into the testing. If not, you can be wasting valuable time on tests that are not relevant to your particular sport, and the results will be meaningless.

Reliability

A test is considered reliable if the results are consistent and reproducible over time. You should be able to obtain the same or similar result on two separate trials. This is important as you are often looking for small changes in scores, and you want the difference in results to reflect the changes in fitness of the person and not an error in measurement.

Some of the errors in recording of tests results can come about from poor following of the test protocols, equipment error, and variability in environmental conditions and/or surfaces. Reliability can be improved by greater control of these variables, and by using competent and well trained testers, though there is still some variability expected. All the equipment used should be standard and regularly calibrated to the manufacturer's standards. If more than one test is being conducted at a time, the ordering of tests can affect results for each test, as can be training and fatigue of the athlete between test sessions. If the test requires pacing or practice, the more experienced athletes will do better at maximizing their performance, and their score will be more reliable.

Validity

Validity is whether the tests actually measure what they set out to. It is quite possible that a test can be very reliable but not valid. The validity of a test is usually better if the test is specific to the sport being tested: i.e., the tests should resemble the sport being tested, so that similar actions and therefore the specific muscle groups and muscle fibre types actually used in the sport are being used. There are different forms of validity - internal, external and ecological validity. For an experiment to possess ecological validity, the methods, materials and setting of the experiment must approximate the real-life situation that is under study. A fitness test having external and ecological validity enables you to make 'generalizations' about their sports performance from specific tests.

Interpretable Results

If you don't know what the numbers in the results mean, the tests are fairly useless. The results must have meaning so that they can be applied to modify a training program. If you want to compare the results to that of other groups you must have access to normative data ('norms'). These norms should be based on a large homogeneous population, be up to date, and preferably be of local origin.

Facilities and Other Testing Demands

The time, costs, equipment and personnel required can be the most important considerations when selecting a test, and often determines what tests are actually conducted. This is especially important if you intend to test large groups of athletes.

Conducting Tests

Test Preparation

To ensure that each subject is primed physically to perform up to their potential, they should follow set nutritional and physical guidelines. If all participants follow the same procedures and are in the same physical state, then comparisons are more valid, and if the same procedures are followed for each testing session, then the results will be more reliable.

Test Sequence

The order in which the fitness tests are performed can affect performance in subsequent tests. Here are some guidelines when deciding on what order to conduct the test. These are guidelines that can be used to determine the best order in your situation. There are other factors to consider such as logistics of getting from one test location to another, group sizes, number of assessor, and time constraints. Whatever order is used should be recorded made consistent for future testing sessions.

- Health Checks: Blood pressure and resting heart rate should always be tested first while the person is fully rested.
- Anthropometry: There should be no physical activity prior to the measurements of body composition. This test should always take place first, and directly after any health checks.
- Flexibility: Depending on whether the test protocol requires a warm up or not, the flexibility tests should be scheduled early in the session prior to any activity, or after a thorough warm up or after the speed tests.
- Speed / Power tests: Power tests are usually performed first, followed by speed, agility, strength, muscle endurance and, finally, cardiorespiratory or repeat sprint tests. A thorough warm-up should precede any speed and power test. The vertical jump test may be performed prior to the sprint test.
- Muscle Strength: Muscle strength (1-10RM) tests should always be completed prior to muscle endurance tests, but after the speed and power tests.
- Muscular Endurance: A minimum break of five minutes is recommended between muscle strength and muscle endurance tests. If there are several muscular strength and endurance tests in one session, you must allow plenty of time for recovery between tests.
- Aerobic Fitness: Many of the submaximal aerobic tests are based on a heart rate response may be affected by previous tests and by the mental state of the athlete, and should be scheduled accordingly. Fatiguing maximal exercise tests, such as a VO₂max or beep test and repeat sprint tests, should always be scheduled at the end of a session. If the protocol includes both a repeat sprint test and a maximal aerobic test, it is usually wise to have these in separate sessions.

Scheduling

Testing should be done performed at particular times that correspond to the aims of the tests. For example, you may wish to test at the beginning of certain phases of training, and then at regular intervals to monitor progress. For school groups it may be appropriate to schedule testing at the beginning and ends of school semesters.

Safety

Safety checks should be done prior to any testing session, such as checking for the proper working of equipment, and adequate supply of safety equipment such as mats, water bottles and first aid kits. During the sessions, give adequate warm-up when necessary (see more about warming up for fitness testing). For maximal endurance testing on elderly and special populations (after medical clearance has been given), medical assistance should be close at hand, and adequate resuscitation equipment should be available nearby .

Any person older than 35 years of age, particularly anyone overweight or with a history of high blood pressure and heart disease, should consult a physician before undertaking any vigorous testing. Fitness testing should not be avoided, as for this population it can be useful as a screening device and to help devise a program to suit special needs. For all participants that are not accustomed to exercise, it would be wise to conduct a PARQ - Physical Readiness Questionnaire.



PAR-Q

Physical Activity Readiness Questionnaire

Being more active is very safe for most people, and for most should not pose any problem or hazard. However, some people should check with their doctor before they start becoming much more physically active. The following list of questions should be completed by anyone who is looking to start an exercise program, to increase their current activity level, or partake in a fitness testing assessment. The questionnaire helps to determine how safe it is for you.

The questionnaire is suitable for those aged between 15 and 69. If you are over 69 years of age, and you are not used to being very active, check with your doctor. Common sense is your best guide in answering these questions. Read the questions carefully and answer each one honestly.

Yes or No

- *Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?*
- *Do you feel pain in your chest when you do physical activity?*
- *In the past month, have you had chest pain when you were not doing physical activity?*
- *Do you lose your balance because of dizziness or do you ever lose consciousness?*
- *Do you have a bone or joint problem that could be made worse by a change in your physical activity?*
- *Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?*
- *Do you know of any other reason why you should not do physical activity?*

If you answered YES

If you answered "yes" to one or more questions, talk with your doctor before you start becoming much more active or before you have a fitness test. Tell your doctor about the PAR-Q and which questions you answered "yes".

If you answered NO

If you answered "no" honestly to all of the questions, you can be reasonably sure that you can start becoming much more physically active or take part in a physical fitness appraisal – begin slowly and build up gradually. This is the safest and easiest way to go.

Things Change

Even if you answered "no" to all questions, you should delay becoming more active if you are temporarily ill with a cold or a fever, or if you are or may be pregnant. If your health changes so that you then answer "yes" to any of the above questions, tell your fitness or health professional and ask whether you should change your physical activity plan.

References

This simple screening questionnaire was first developed by The Canadian Society for Exercise Physiology. The questionnaire is also recommended by the American College of Sports Medicine as a minimum test of readiness for moderate physical activity programs.

•*PAR-Q and You. Canadian Society for Exercise Physiology. Revised 1994.*

•*Physical Activity Readiness Questionnaire, British Columbia Ministry of Health Department of National Health and Welfare, Canada, revised 1992.*



Recording Sheets

Well-designed scoring sheets make recording scores more efficient and avoids errors. They should include space for all relevant information. In addition to the test results, the following should also be recorded with every testing session:

- date and time of testing.
- personal details (name, age, contact details).
- current state of the athlete (fitness level, any injuries, health status, fatigue level, sleep).
- activity details (sport involved in, event).
- basic physiological data (weight, resting heart rate).
- current training phase (e.g. speed, speed endurance, strength, technique).
- current training load (the number of miles, the number of sets and repetitions, the number of attempts).
- current training intensity (kilograms, percentage of maximum, percentage of VO₂).
- environmental and surface conditions (wet, slippery, wind, temperature, humidity, indoors?).
- name of assessors.

Measuring Environmental Conditions

When conducting fitness testing in the field, it is important to be aware of the effects of environmental and surface conditions and either reduce their effect (move indoors, change surface or direction), record and control for the conditions, or postpone testing. Here is a discussion about a few of the common environmental conditions that may affect fitness testing.

Air Temperature

Extreme hot or cold conditions can greatly affect field testing fitness test results. The (shade) air temperature, which is measured using a thermometer shielded from the sun is the standard temperature normally quoted in weather observations and forecasts. A mercury or electronic thermometer is required to accurately record the temperature. If it is very cold, a very good warm up is required for the muscles to perform to their potential. In very hot conditions, give the athletes plenty of rest, water, and shade between tests.

Humidity

Humidity is also important for determining the effect of the heat on fitness test participants. Temperature itself does not always give an indication of the heat stress for the athletes - there is an index called the Wet Bulb Globe Temperature (WBGT), which is a composite temperature measure used to estimate the effect of temperature, humidity and solar radiation on humans. See more about WBGT. Humidity can be measured using some electronic devices. A more manual method is to use a wet-bulb temperature gauge, which consists of a thermometer with its bulb covered with a wet cotton wick supplied with distilled water from a reservoir. A table is used to calculate humidity by comparing the wet bulb temperature to the dry bulb temperature.

Wind

Wind can greatly affect the results from outdoor fitness testing. If indoor testing is not an option, then sprints and throwing tests should be conducted with a cross wind, though this is not always possible if you are using a pre-marked track. For tests that involve backwards and forwards running, or running around a track, then the net effect of the wind should be even, though it is generally more tiring running in windy conditions. Small hand held wind gauges are available for measuring the wind speed. In track and field events, a tail wind of greater than 2.0 meters/second disallows all records. This is a good benchmark for determining if the fitness test has been greatly affected by the wind.

Barometric Pressure

The atmospheric pressure is important in the calculations for VO₂, as the amount of oxygen in the air is affected by this value. As you increase in altitude, atmospheric pressure decreases. Not only will there be less oxygen in the air, the air will be thinner (reduced resistance) and gravity will be less - so



sprinting and throwing tests may also be enhanced. If you are not able to measure barometric pressure directly, you may be able to get a reading from the local bureau of meteorology.

Other Effects

Testing outdoors also poses other problems, such as after or during rain making surfaces slippery. Some equipment may be adversely affected by the conditions, and may not work at very low or very high temperatures. Also be aware that moving some electronic devices between cool dry and warm damp places may cause condensation and damage equipment.

Test Assistants

All test assistants should be adequately trained prior to testing, to ensure correct administration of the tests, and reduce error between testers.

Session Organization

Good organization will ensure the testing session runs smoothly. If testing a large group, you may want to set up testing stations with a different tester at each station, or with one tester following the same group around the stations.

Interpretation of Results

Relative Importance

The first step in the interpretation of test results requires you to determine how important each of the components that were tested are to the overall performance in the sport. For example, while a poor result in a body fat test for a basket baller may be of concern, it is not as vital as a poor result in an endurance test. The relative importance of each fitness component normally requires a good understanding of the physiology involved, and so is best done by a qualified exercise physiologist.

Comparison to Norms

If the results are being compared to normative values (norms), you must consider if the norms used the same protocol, and the subject population and age group are similar. Also, published norms and rating charts may give the averages for a certain population, but this does not always indicate what is the desirable level for that particular parameter.

Fitness Testing Norms

Fitness testing normative data (norms) can be found associated with many fitness tests. Norms are very useful to help guide you in the interpretation of the test results, but it is important for you to understand what they are and the possible limitations of using them.

Use with Caution

If you are using norms to compare and interpret your test results, you must consider if the norms are derived from a test using the same protocol. It is not always clear what the test procedure is by the name of the test, for example a sit up test can be performed in numerous ways, and norms for one procedure may not be relevant for another. It is also important to consider if the norms were derived from a subject population and age group that is similar to your test group. Many tests were developed in a university setting, and university students make up the population group for many test norms. This group may not always reflect the general population (or your group of teenagers, athletes etc). Look for norms based on a similar large homogeneous population, which are up to date, and preferably be of local origin.

Average Values versus Desirable Values

Published norms are generally based on group averages and the range of scores around the mean. Comparing your test results to these norms may tell you how it rated compared to the population average (above average, below average), but it does not indicate if such a score is desirable. For example, a bodyweight norm table from the general population would give average scores and even above average scores that are not very desirable in terms of health. Another example is when testing

athletes, they may wish to be at least in the well above average category for many fitness parameters, and above average may actually be a very poor result.

Significance

Are the changes seen from test to test significant? There is normal variation in results from test to test due to factors such as biological variation, tester error, equipment calibrations, conditions, etc., so you must decide if the differences recorded are significant to affect performance, and are greater than can be expected from general sources of error.

Presentation

Following correct and thorough testing, the presentation of results to the athlete or coach can be the most important step if any recommendations are implemented. A good way of illustrating the results is with a chart or plot, where initial and subsequent tests can be overlaid or compared side to side so that changes over time can be easily determined.

Monitoring training load



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Introduction

Accurate monitoring of the training load can help coaches improve the preparation of their athletes for competition. In this article, we focus on the importance of monitoring training load and we also examine a simple method for the monitoring of training loads of your athletes. We start by providing a general overview of the important training variables that a coach manipulates to control training stress (that is, training volume, training intensity and training load) and we will then discuss some practical applications of monitoring training load.

Basic training variables

Training volume

Training volume usually refers to the duration of training. Generally coaches report training volume in terms of time (that is, minutes per day, hour per week), however, it can also be reported in terms of distance covered (that is, 80 kilometres per week for a runner or 300 kilometres per week for a cyclist).

Training intensity

Training intensity refers to how hard you are training. There are many different methods that can be used to measure intensity. Some of the more common methods are heart rate, oxygen consumption, weight lifted, power output, blood lactate concentration or the athlete's perception of effort during training.



Most coaches manipulate both training intensity and volume in their training programs. Therefore, taking measures of volume and intensity independently to measure training may not truly reflect the training stress imposed on the athlete. It is suggested that the training stress be measured using the training load calculation.

Calculating training load

Training load is simply the function of training volume and training intensity and it can be expressed by the following formula:

$$\text{Training load} = \text{training volume} \times \text{training intensity}$$

Fortunately for the coach, a simple method for quantifying training loads from a variety of different training modalities into one simple arbitrary number has been developed (Foster et al. 1996; Foster 1998; Foster et al. 2001). This method is commonly known as the session-rating of perceived exertion (RPE) method. Although the session-RPE method for assessing training load has previously been presented in Sports Coach (Coutts 2001), this article will discuss more practical ways in which coaches can use this information to improve their coaching.

This method of monitoring training load requires each athlete to provide an RPE for each exercise session (see Table 1 in the related links below) along with a measure of training time (Foster et al. 2001). To calculate a measure of session intensity, athletes are asked within 30-minutes of finishing their workout a simple question such as 'How was your workout?' A single number representing the magnitude of training load for each session is then calculated by the multiplication of training intensity (RPE from Table 1) by the training session duration (minutes).

$$\text{Training load} = \text{session RPE} \times \text{duration (minutes)}$$

For example, to calculate the training load for a 30-minute training session with the athlete's RPE being 5 (HARD), the following calculation would be made:

$$\text{Training load} = 5 \times 30 = 150 \text{ units.}$$

The major advantage of the session-RPE method over other reported methods of quantifying training load is that it is simple to measure and relatively easy to interpret. Recent studies have reported that the session-RPE method compares favourably with the more complicated methods of quantifying training loads in both endurance sports (Foster et al. 2001), team sports (Coutts et al. 2003; Impellizzeri et al. 2004) and resistance training (Day et al. 2003; Sweet et al. 2003). These recent findings allow us to conclude that the session-RPE is both a valid and reliable method for monitoring training in most sports. In addition, these results also show that the session-RPE method may be useful for comparing training loads from different types of activities.

Using the session-RPE method to your advantage

The most value a coach can get from accurately monitoring the training load is a better understanding of each individual athlete's tolerance to training. This is of particular importance as previous research and anecdotal evidence have shown that each athlete has a different tolerance to training load. For example, if two athletes complete the same training program, one may be able to tolerate the training load, resulting in an improved performance, while the other may not tolerate the training load, leading to an impaired performance. This is evident when comparing our recent findings showing that experienced triathletes are able to tolerate training loads up to 7200 AU per week (that is approximately 24 hours of 'hard' training) whereas other trained triathletes show signs of over-training when their training load is increased to approximately 6000 AU per week (that is approximately 20

hours of 'hard' training). It is most likely that factors such as fitness levels, training experience, age, environmental influences, athlete size, nutritional factors and recovery practices will influence an individual's training load tolerance. Therefore we recommend that coaches prescribe training loads according to an individual's tolerance level.

Another benefit of accurately monitoring the training load is that coaches can determine if athletes are implementing training stress according to their plan. An example of how measuring training load can be used by a coach to assess if the athlete has implemented training according to the training plan is shown in Figure 1. You will notice how the training load for this team was quite high during the pre-season when the focus on improving general fitness capacity was high. Conversely, the training loads completed during the in-season were relatively lower as greater recovery periods were required between the stressful games. This trend of reduced training loads in the in-season is also apparent in Figure 2, which shows the average training loads completed by an Australian Football League team at different stages during the training year.

Other practical uses

For a coach, the real value of monitoring training loads in athletes comes with tracking individual rather than group or team scores. Close monitoring of an individual's training load may provide a greater understanding of their tolerance to training, allowing coaches to modify future loads that best suit individual athletes. Listed below are a number of ways in which the session-RPE method can be used to improve the training of athletes:

- monitoring player loads compared to intended loads — this is a simple way to check that you are implementing your training as planned (see Figure 1 in the related links below)
- ensuring that you have appropriate periodisation — it is well reported that alternating hard and easy reduces training monotony and may assist in the prevention of over-training and illness (Foster 1998). By monitoring daily training loads, you can keep a close eye on the actual periodisation of training
- detecting athletes who are not coping with training — experience has shown that younger 'rookies', older and heavier athletes tend to report higher RPE scores for similar sessions during periods of arduous training. By closely monitoring these athletes, you may be able to detect if your athletes are not coping with their training
- monitoring loads of different groups within a team/squad — in some sports, different playing positions/types of players can tolerate, or are required to complete, different training loads. This method can allow you to accurately monitor training loads of different groups within a team
- monitoring training loads during rehabilitation after an injury — you can use this to ensure loads are not progressed too quickly and/or appropriate training has been completed prior to return to sport.

Summary

Training load is influenced by both training volume and training intensity. A precise understanding of training loads completed during training can be beneficial for both the coach and the athlete. The coach can use feedback from training to systematically modify future training so that performances can be improved. Athletes can use this feedback for motivation for future training. Training load can be monitored in many different ways, however, we recommend the session-RPE method for quantifying training load because it is simple to use, easy to understand and relatively easy to implement. From a sports science perspective, a valid and reliable record of training load allows the effectiveness of different training to be assessed. It can be used to ensure that both sufficient training loads are implemented and that excessive loads are not. Finally, over time and with some practice, accurate monitoring of training load will enable the coach to better understand the best training methods for individual athletes. Ultimately, this may lead to improved performance in competition.



Coaching

Self-awareness is the recognition of one's behaviours, strengths, weaknesses, beliefs and values and how these help create your experiences in life. Coaches who are more self-aware can control and exhibit the types of behaviours that create great and consistent performances.

Exceptional coaching is about much more than technical knowledge. Did you know that:

1. Technical knowledge is not a determining factor in coaching performance.
2. Everything you say and do as a coach impacts your athletes' performance.
3. Physical training can only get you so far.

A case in point:

Coach John Wooden of UCLA is America's most successful college basketball coach, with an unassailable record of winning statistics in his 40-year career, including:

- An unequalled 885-203 overall win-loss record.
- An unprecedented 10 NCAA championships.
- 38 straight NCAA tournament victories.
- All time winning-streak record of 88 games.
- 19 conference championships.

Wooden was a truly exceptional coach, and took a different approach from others in two vital aspects:

1. **He knew himself.(was self-aware)**
- Wooden's focus was on setting an example for young men and preparing them for life after they departed from his care - the most effective teaching tool was his consistent example.
2. **He understood his individual athletes**
- He never coached his teams to try to be better than their opponent.. He taught his athletes to prepare themselves to be the best they could be and the result would take care of itself.

*"Consider the rights of others before your own feelings,
and the feelings of others before your own rights."*

- John Wooden

Types of plans

These planning tools may include;

- _ Training session plan
- _ Micro-cycle plan
- _ Macro-cycle plan
- _ Annual plan
- _ Long term plan (2,3,4 years)

In some cases sports such as gymnastics and tennis will use 'whole of career' plans which may span 8-16 years since selection of children in these sports occurs at a very early age for high performance programs.

It will be of benefit to have a brief look at these various plans although this Unit will concentrate of the annual plan since this is the most widely used, particularly by coaches of club, regional, state and national level athletes. Although long-term plans, beyond one year, are not uncommon for coaches of club and regional teams and athletes, it would be fair to say that these are a more common occurrence with Institute of Sport/Academy and national coaches.

Most coaches of Olympic sports have long terms plans at least of four year duration, quadrennial plan, to match the Olympic cycle.

1. Training session/lesson plan

While the development of physical fitness is an essential component of training sessions, the major emphasis of these sessions is skill development both technical and tactical. The skill learning capacity is influenced by the individual's state of fitness. Indeed, for any skill learning to occur, the fitness elements that are required for the performance of a skill need to exist in order to allow the skill to be performed satisfactorily.

Skill learning is therefore dependent upon appropriate levels of fitness to support the technique.

However, many coaches either do not plan effectively enough or understand the relationship of the body's physiological state with conditions necessary for skill learning to occur. It is not uncommon to see skill practices done late into a training session when athletes may be tired or fatigued. Although it is true that athletes need to maintain skill level under conditions of fatigue which may be experienced late in a game, in overtime or in a final, the underlying principle for skill learning is to have the athlete fresh.

A rested, unfatigued athlete has the capacity for better skill learning due to such conditions favouring optimal neurological patterning. Remember, **fatigue impedes skill learning**.

Structure of a training session

By referring to any major coaching textbook, you will find the elements for an effective training session. These are:

1. General warm-up
2. Learn techniques and tactics
3. Practice techniques and tactics
4. Develop speed
5. Develop power
6. Develop specific strength
7. Develop muscular endurance
8. Develop anaerobic endurance
9. Develop aerobic endurance
10. Warm-down and recovery

It is highly unlikely that all training sessions will be made up of all of these elements. However, the order of sequence should be followed no matter what the emphasis of the training session. The particular components to be stimulated in any one session will depend on the athlete, the sport and its relationship to a period in a microcycle plan or macrocycle plan.

Tips for training sessions

Tudor Bompa is one of the world's leading authorities on the theory of planning and believes that the organisation of specific training items in training session should be based on the following:

- _ Exercises should be alternated between each training objective and training segment to allow within session recovery and regeneration
- _ The greater the training intensity, the less will be the volume of training in a standard time period
- _ The duration of a training session is inversely proportional to the intensity of the training stimulus
- _ The more intense and stressful a training session, the simpler should be its organisation
- _ The heavier and more intense the overall load of one training session, the lighter should be the next session.

The great Australian swimming coach, Forbes Carlisle, provided this advice: ***"It is better to undertrain than to overtrain"***

The following is an example of a Training Session Plan.

Training session plan

Date:		Micro cycle session #
Objectives: <i>Stance for defence and ball handling</i> <i>3 key points for basketball stance</i> <i>positive communication to other players and coach</i>		
Training schedule 5.00-5.10 warm up, stretch 5.10-5.20 passing drills 5.20-5.30 body fundamentals/no ball. Jump stop, stride stop, forward, reverse pivot 6.30-6.40 body movement w/ball 5.40-5.50 catch ; shoot drink break 5.50-6.05 defence stance 6.05 –6.10 pass ; cut 6.10-6.20 add defence 6.20 –6.30 3 on 3	Equipment 12 basketballs 12 witches hats	Major things to remember Injury – David knee Remind of skills test next week Club newsletter Parent consent form for trip
Drills and Activities		

Microcycle

A microcycle usually refers to a weekly training program. The typical structure of a microcycle comprises of two or three overload training sessions followed by an unloading session. In Example 1 below, speed and power sessions are conducted on Monday and Tuesday, followed by a rest or unloading session on Wednesday. Since training sessions contain more than one training stimulus aimed at developing different fitness and learning capacities, the design of the overall training program requires the integration of fitness components. Fitness components develop and recover at different

rates and the effectiveness of respective fitness components rely on both **intensity** and **volume** of the training stimulus.

To this end, it is important that a balanced approach to respective training stimuli is maintained. The integration of fitness components in a week long microcycle is provided in the Example 1 below.

Each component is presented a number of times with progressive overloading followed by an unloading cycle or recovery periods

Example 1

Week-long microcycle showing integration of fitness components

Fitness Component	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Power and speed	X	X X		X X X	X X X X		X X X
Muscular endurance	X	X X	X X X		X X		
Flexibility	X	X X	X X	X X	X X	X X	X
Endurance	X		X X	X X X		X X X X	X X X

The integration of fitness components into a training microcycle is part of the art of effective coaching. An understanding of overloading from each component for each individual athlete needs to be done. What one athlete can cope with another one may not. It is more difficult for the coach of a team of athletes whereby individualised training microcycle for each athlete or player is not possible. The severity of each training item in a microcycle can only be determined following tests for fitness components, sport specific tests, monitoring of training performances with increasing loads and recovery capacities. The use of training logbooks will provide more information about training Responses and stress

Macrocycles

The term, macro, comes from a Greek word, makros, meaning something of large size. In training methodology, a macrocycle represents a phase of training with duration of between 2-6 weeks or microcycles. A distinct feature of a macrocycle is that it is planned to achieve specific objectives. Usually fitness tests are used to determine the success of achieving these specific objectives. The use of physiological testing in this manner is now becoming a more commonplace practice with elite coaches since it serves for both diagnostic purposes and for motivation. The information gained from such testing allows the coach to gauge the progress of training objectives and make changes should any weaknesses be exposed.

Periodisation

Periodisation is the process of dividing an annual plan into smaller training phases. Tudor Bompa, the ex-Romanian coach now resident in Canada, suggests that the aim of periodisation is two fold:

- It enables the coach to work with manageable segments of an annual plan
- It helps the coach to ensure correct peaking for main competitions during the calendar year.

Further, periodisation allows for the best mix of training load/recovery to ensure optimal development.

The annual plan

The annual plan is based on the concept of periodisation (that is the division of an annual plan into phases of training) and the principles of training. In order to achieve an athlete's optimal performance, the entire training program has to be properly periodised and planned so that the development of skills, biomotor abilities and psychological traits follow in a logical and sequential manner. The annual plan is made up of macrocycles (2 to 6 weeks periods) and microcycles (1 week period). Essentially, the annual plan provides the athlete with a monthly, weekly and daily plan for all of the elements necessary for elite performance.

The annual plan is divided into three main phases of training:

- 1. Preparatory - general**
 - specific
- 2. Competitive - pre competition**
 - competition
- 3. Transition**

The periodisation of an annual plan is the means of integrating the various sport sciences (ie, exercise physiology, biomechanics, psychology, nutrition) and practical coaching experiences into an overall plan.

Collect data to develop training plan

A training plan must be objective and based on the athlete's performance in tests or during competitions, progress history in all training factors, and in consideration of the competition schedule. Data must be collected to form a basis for future comparisons in order that the athlete's progress can be measured. Data may be obtained from:

- _ Competition records
- _ Performance tests
- _ Training logs or diaries
- _ Competition schedules

Example 2

The AFL conducts a comprehensive recruiting program that involves the collection of records and data on over 300 players during the year. The program involves the collaboration of coaches involved in the TEAC Cup squads each with 30 players, coaches of National U18 Championship teams and the participation of over 100 players in an annual Draft Camp.

The AFL invites feedback from these coaches on details regarding performance and other aspects relevant to recruitment. The AFL recruitment program provides two progressive reports to all AFL clubs throughout the year with the culmination of on-line information available on the AFL website for the official draft.

Long term plans

During the 1960s and early 1970's, it became apparent that long term planning of athletic performance was a pre-condition to the achievement of international success. The Germans and the Soviet Union were the first to recognise the importance of annual and quadrennial planning and the concept of multiple periodisation. It is now widely recognised that in individualised sports such as gymnastics and athletics, it takes six to eight years, and often more, of training to produce elite athletes. Some sports such as rowing may take less time, and team sports have many variables to consider. Despite the length of time that may be required to produce an elite athlete, a well-established and monitored training plan must be in place as early as possible in order to maximise an individual's talents. Bompa (1994) suggests that an individual that has been scientifically selected for sport based on their specific qualities and who follows a precise long term training program, will have a higher probability of reaching top performance than individuals involved in natural programs.

Former Romanian gymnast Nadia Comaneci and current women's star Martina Hingis demonstrated outstanding abilities as youngsters and engaged in a long term training program as part of their rise to stardom. Becoming a champion was the result of a long term, well organised and scientifically monitored training program

A long-term training program has to consider four elements (Bompa, 1994):

1. The number of systematic training years necessary for a prospective athlete to obtain high performance
2. The age at which top performance is achieved
3. The level of natural abilities that a prospective athlete starts with
4. The age at which one starts specialised training

Quadrennial Plan/ Olympic Cycle Plan

For coaches who are involved in the preparation of athletes for the Olympic Games and Commonwealth Games, the use of a Quadrennial Plan or an Olympic Cycle Plan is an essential component of long-term planning.

Discuss testing methodologies with the client

Sports performance is the result of the interactions of physiological, biomechanical and psychological factors. The assessment of an athlete in regard to these major determinants of performance will provide the coach with an idea of possible strengths and weaknesses. This knowledge will enable the coach to develop future training programs.

The types of tests and methodologies to be used to collect athlete data should be discussed with the athlete. The specific tests and procedures to be followed should be explained clearly to the athlete so that he or she understand what the tests will measure and why the tests are being conducted. Explaining the test procedure to the athlete will ensure that the data collected is valid. A typical battery of tests may include anthropometric tests, skills tests, physiological and psychological tests.

Battery of Tests

The battery of tests conducted in a testing session may comprise of the following:

- _ anthropometric profiling
- _ sport specific performance/skills tests
- _ physiological profiling procedures and protocols
- _ psychological profiling procedures and protocols.

Anthropometry

One of the fundamental assessments conducted on athletes prior to commencing a training program is anthropometric measurements. These are measurements of stature, mass and sum of skinfolds that provide a clear picture of the structural status of athletes at any given time. In addition, athlete profiles are also beneficial in describing the characteristics of high performance athletes across sports, at various stages throughout a yearly training program and within sports by positions.

The data collected by anthropometric measurements, in particular the sum of skinfolds, can provide valuable information to be used as a basis for dietary counselling and training modification. In activities

that are aerobic or anaerobic, increased fat mass will be unfavourable to performance. Also, in sports requiring speed or explosive power, excess fat will decrease acceleration.

For example, the anthropometric data related to sum of seven skinfolds for males and females, junior and senior can be found in the *Test Methods Manual*.

Example 3

Anthropometric data for sum of seven skinfolds (mm)

	Female	Male
Junior	95	60
Senior	75	65

(triceps, subscapular, biceps, supraspinale, abdominal, thigh, medial calf)

Test Methods Manual, Sport specific guidelines for physiological assessment of elite athletes, 3rd edition, Ed Chris Gore, Australian Sports Commission and Laboratory Standards Assistance Scheme, 1998

Medical screening

It is advisable that athletes entering a long term training program consider a medical screen prior to any preliminary testing. The medical screen is a device to provide information to the coach on the general health status of the athlete. Many athletes have medical conditions which require medications and some may have had illnesses in the past that may compromise their participation in a training program.

Typically, the medical screen will provide information of family history, past illnesses or medical problems, current health status, and any drugs, food supplements and other agents. Vital information for medical and emergency contacts should also be obtained.

Example 4

Prior to the 1991 World Cup Rugby, the players were subjected to a screening process. The athletes were assessed for biomechanical problems, previous injury, flexibility of appropriate joints and strength.

The biomechanics of the foot were screened which resulted in 22 out of 32 players being recommended to use alternative footwear to the sponsors brand. The alternative footwear was not available so the athletes used the sponsors footwear. All 22 players suffered from overuse injuries as a result of not using the right footwear as prescribed.

Popov, V., The Physiotherapists role in performance enhancement, *Proceedings of the Australian Sports Medicine Federation's 1991 Sport Medicine Workshop, Care of the High Performance Athlete on Tour, 1991*

Ensure testing methodologies conform with accepted best practice principles of the sport/activity

Before any testing session is conducted with athletes for the purpose of collecting performance data, the testing methodologies must be checked to ensure that they conform with accepted best practice principles of the sport.

Many different tests have been designed to test the physiological capacities of the athlete both in the laboratory and in the field. Coaches often face the problem of selecting tests that are appropriate to their sport.

The selection of tests must be based on the principles of **specificity, relevance, validity and reliability**.

The following sources may provide guidance for test compliance

- _ the sport/activity's coaches or instructors code of conduct policy
- _ the Australian Coaching Council's coaches code of conduct policy
- _ national activity organisation regulations and guidelines
- _ relevant national, state/territory or local government regulations and guidelines
- _ employer organisations policies and procedures
- _ the culture of the sport/activity
- _ accepted preventative practices adopted by self or peers to minimise safety hazards and risks in the same or similar situations.

In addition, it is advisable to obtain current and past good practice demonstrated by self or peers in the same or similar situation.

A primary resource for testing methodologies for sports specific tests is *Test Methods Manual, Sport specific guidelines for physiological assessment of elite athletes*, 3rd edition, Ed Chris Gore, Australian Sports Commission and Laboratory Standards Assistance Scheme, 1998. This resource contains comprehensive notes, details of testing procedures, and information about the tests and standards required for selected sports. Protocols for physiological assessment are available for cricket, water polo, cross country skiers and biathletes, track, road and mountain cycling, golf, netball, rowing, rugby union, running, sailing, softball, swimming and tennis.

As part of the AFL Draft Camp held each year in early October for aspiring young footballers, players undergo a battery of tests specific for AFL under the supervision of AIS Sports Physiologist David Pyne.

Players have their height and weight and body skinfolds measured. They are tested for endurance on the 20m shuttle run test, speed and acceleration is tested over five, 10 and 20 metre intervals. Power is measured by an anaerobic run tested over increasing distances over four stages. Vertical jump tests are conducted both standing and running. Strength is measured by bench press and agility by sidestepping obstacles.

In addition, athletes complete a psychological test called the TAIS, Test of Attentional Interpersonal Style. The test has been used by American sporting bodies since 1975. The test looks at a player's potential concentration capacities. This translates into how they can read play, to what degree they can really focus their concentration, particularly if someone was having a set shot at goal. It can also indicate exactly what type of feedback they're likely to give team-mates. The test can determine whether they are people who are likely to contribute to team morale.

Example 5

A brief summary of a test battery for basketball:

Anthropometry

Anaerobic power	Counter movement jump test Vertical jump test 10 sec and 5x6 sec cycle ergometer tests 20 m sprint test
Aerobic power tests	maximal oxygen consumption test 20 metre multistage shuttle run test
Muscular strength tests	upper body strength test lower body strength tests

Flexibility

Case study 1

The importance of the need to discuss test and training workload with athletes can be illustrated by an example involving the intake of young netball players into a residential elite training squad.

As part of the training program the squad trained twice daily or 12 session per week which represented about a four times increase in the amount of previous training workloads for the girls.

In addition, as part of the strength and conditioning program, the players participated in speed work sessions conducted over extended distances beyond court size.

The increased workload, frequency of training sessions and unfamiliarity of specific speed training contributed to an increased number of the players suffering from acute injury and overuse injury.

After discussion with coaches, strength and conditioning coaches and support personnel, the training program was adjusted to include cross training methods such as hydrotherapy. Workouts in the pool were able to maintain similar levels of volume and intensity for the players but with decreased incidents of injuries.

Organise, resource and implement sport specific tests

Once the sports specific tests have been selected and checked for compliance to best practice methodologies, the testing session must be organised and implemented.

The tests may need to be conducted in a specific order to ensure specificity, relevance, validity and reliability. Static tests such as anthropometric measurements, flexibility, and strength should be conducted before dynamic tests such for speed, agility and endurance.

Resources for tests such as equipment, recording sheets, test personnel, venues, test distances must be organised, checked and set up. All equipment should be given functional and operation checks prior to use in order to avoid unwanted delays during the testing session.

Test recording sheets must be completed with date, venue, time, name of athlete, sport and name of test personnel. Test protocols may require more than one test trail eg anthropometric measurements, speed and agility tests.



RECORD RESULTS AND SUBMIT FOR ASSESSMENT

Record and file information for future use

Information for each athlete obtained in the testing session should be recorded in Laboratory and Field Test Data sheets. Copies should be made and distributed to appropriate personnel. Test session data is filed for each athlete for future use.

Test information may be included in the coaches record book for quick daily reference. Data may be transferred to computer files for planning purposes. It is recommended a hard copy be filed, marked with athlete's name.

There are several computer CD programs that enable data to be entered and statistical functions to be used by the coach.

Apply principles of client confidentiality regarding handling information

Information regarding athlete status and /or well-being should not be passed on to other individuals without the permission of the athlete.

In many cases, particularly in testing junior athletes and female athletes, the athletes may not wish test data to be made public. Female athletes are especially sensitive to information of skin fold measurements. In addition, if athletes are under the age of 18 years they require consent from a parent or guardian.

It is advisable to consult particular requirements for confidentiality that may apply such as:

- _ Sporting organisation guidelines
- _ Child protection laws (NSW)
- _ Coaching code of ethics
- _ Criminal protection policy
- _ Harassment sport guidelines
- _ State/Territory Confidentiality laws

Consideration of the topic anti-harassment in sport is provided below since the testing of athletes by coaches and support personnel may be subject to confidentiality issues.

Anti-harassment in sport

Anti-harassment in sport strategy has been developed with the aim to create a safer sport environment by developing a system for dealing effectively and appropriately with these matters and preventing harassment in sport.

Resource materials have been developed that will assist the understanding of individual and organisational obligations to handle harassment issues effectively. The coach must be aware of the sport's policy regarding harassment since in recent time there has been several cases of coaches found guilty of sex offences and harassment offences with athletes in their care.

Confidentiality

The data obtained from testing session is confidential information. The use of individual test information by the coach, administration or anyone else in the organisation must first seek a waiver of such confidentiality from the subject or athlete. The AFL must deal with the issue of confidentiality regarding such data obtained at the AFL draft camp.

Example 6

The Australian Football League draft is an event conducted each year whereby club administrators study the credentials of young players including details of test results by players on the selected sports specific battery of tests conducted during the draft camp. For example, the individual player's data recorded for sum of skinfolds, speed, endurance and strength can be assessed and compared against other players in the draft to assist clubs to make player recruitment selections. The data is put on-line for clubs to access.

Consent forms

It is appropriate practice to invite athletes to give their consent to participate in the testing session prior to the conduct of the testing session. Athletes under 16 years of age require the consent of a parent or guardian. The consent form provided reinforcement about the need to consider dietary and activity leading up to the testing session.

Discuss procedural protocols for testing

Prior to the conduct of testing session the procedural protocols must be discussed with the athletes. In particular, procedures regarding invasive and non-invasive testing methodologies, draping, state of undress, clarification of areas to be touched and the need to clarify any variations to these factors as they arise during the testing session.

Explanation of test procedures

Prior to the testing session it is advisable to provide the athlete with a written and oral explanation of the physiological testing procedures. Information about each test provides the athlete an insight into the science associated with his or her training and helps them to understand the significance of the tests. In addition, the explanation will help to remove or lessen possible anxiety about the testing session. The explanations should be kept simple and brief and the coach and support staff should be prepared to answer questions about any procedures.

Example 7

When an athlete has to complete a drug test, there is a strict procedure to follow by the testing agency. The athlete must know the procedure so that they are in a position to recognise any breach of protocol during the testing procedure. Any aberration to the procedure has the potential to make the test invalid.

Swimmer Ian Thorpe raised the alarm during a FINA sanctioned drug testing session the international World Cup Berlin meeting in February, 2000. Thorpe was one of five swimmers from four countries who refused to sign over urine samples because officials had not sealed them in tamper-proof containers as required.

The training program can be evaluated and monitored only if benchmarks are established prior to or early in the program. Valid and reliable data is collected from sources including sports specific tests. Appropriate tests are implemented and test results recorded and filed for use in future comparisons. Any data collected is dealt with in confidence as appropriate.

Undertake formative/ongoing evaluation

The test battery has been selected based on athlete needs and best practices principles for the sport. Methodologies have been discussed with the athlete and procedures agreed. The next step is to apply testing and analyse information for evidence of progress.

In this section we will cover:

- _ Apply testing as agreed to by the athlete/client
- _ Apply testing methodologies systematically and analyse at appropriate times throughout the coaching/instructing program
- _ Collect, record and analyse data in relation to long term program goals and objectives.

Apply testing as agreed to by the athlete/client

The test session has been preceded by an explanation of testing procedures to the athletes both orally and in written form, consent forms have been distributed and returned with signatures and a medical screen has been completed by a medical practitioner.

The test session can be conducted as planned subject to the following requirements:

- _ sport specific performance tests
- _ physiological procedures profiling protocols
- _ psychological profiling procedures and protocols

- _ discussions, and/or
- _ observation

It is advisable to schedule athletes to attend the testing sessions at appropriate intervals depending on the number of tests to be completed. It may be necessary to arrange to have several testers available to facilitate an efficient testing process so that athletes are not inconvenienced by waiting around to be tested.

Apply testing methodologies systematically and analyse at appropriate times throughout the coaching/instructing program

The battery of tests developed for the testing session may be systematically applied at predetermined times throughout the planning period. The same testing methodologies are maintained throughout any subsequent testing session to ensure reliable test data.

The test data collected systematically throughout the planning period will be available for analysis.

Systematic testing may be weekly, monthly, quarterly, or mid-season, depending on the rationale and relevance of the tests to training and evaluation.

Notational performance analysis

In sports, such as Australian Rules Football and the National Rugby League, many clubs use player performance statistics and game video-analysis to provide feedback to a player on performance. The Head Coach or specialist coach will conduct a discussion with the athlete regarding skill/game analysis.

Gordon Clarke, technical coach for the Australian men's hockey team, the Kookaburras, uses one of the world's leading systems for notational performance analysis. Each international game is recorded on video that enables the analysis of player performance and strategic plays such as penalty corner variations, defensive hitting patterns for both teams. Video records are kept on all international teams and logged to a laptop computer file for in-game access by the head coach pending situational game requirements.

Kookaburra players may access video files for each country to study opposition profiles and prepare game tactics to counter specific opposition player patterns.

Routine testing

The following sports conduct regular physiological assessments on athletes throughout the training program cricket, water polo, cross country skiers and biathletes, track, road and mountain cycling, golf, netball, rowing, rugby union, running, sailing, softball, swimming and tennis.

In rowing for example, a subjective assessment is made at the beginning of each week to assess the training effect of the previous week. Rowers will complete a distance or timed effort every Monday during the first session of the week. The coach and the athletes determine a subjective evaluation of the effort produced and training workloads and intensities for the week's microcycles are subsequently planned or adjusted.

Collect, record and analyse data in relation to long- term program goals and objectives

Hopkins (1991) describes various methods for the quantification of training in competitive sports. The training of competitive athletes can be assessed by training diaries, physiological monitoring, direct observation and the use of questionnaires. These methods will be discussed later.

Data collected from various sources such as performance data, training data and testing data provides necessary information for the coach and athlete to analyse and apply in the development of long-term goals and objectives.

Coaches and athletes collect and quantify training data for purposes of motivation, training prescription and systematisation of training. The coach and athlete may consider game by game reviews, periodic reviews or end of season reviews as part of the planning process. Strategic reviews or evaluations should be considered as part of the plan.

Long-term training goals

The data collected will be used to evaluate the training program particularly in relation to the long-term goals and objectives. These are agreed to by the client/athlete in consultation with the coach or instructor, other specialists, siblings and relevant personnel in relation to:

- _ physiological targets



- _ psychological goals
- _ lifestyle adjustments
- _ tactical and strategic approaches
- _ skill performance or technique development targets
- _ competition/performance targets
- _ training diary

In addition, valuable subjective data may be obtained from other sources to assist the athletes interpretation of athlete performance status. This can be obtained from:

- _ feedback for other team members/athletes/training partners
- _ feedback from parents
- _ feedback form other 'support staff'

The coach will have objective and subjective data available to make the right planing decisions. However, any experienced coach will also apply the "coaches' eye" to the situation. Often it may be intuition of the coach that assesses the mental toughness of the athlete regarding the necessary volume and intensity of the training program.

Case study 2

The following newspaper by article McGregor, A., Why girls love Volkens, *The Weekend Australian*, January 15-16, 2000 provided an example of the experienced coach applying the 'coach's eye' to the situation.

Scott Volkens, swimming coach of Australian champions Susie O'Neill and Samantha Riley says "I make a rule when someone joins my squad that it's compulsory to wear a smile".

"I make an assessment every day my swimmers arrive to train. What mood are they in? My job is to train them hard and I can't if they're unhappy".

Volkens was responding to a situation where he noticed Susie O'Neill agitated at training. She exploded next morning, smashing her plastic water bottle against the pool edge over and over, her face grimacing with anger. She had participated in an interview for Burke's backyard and Don Burkes provocative quip during filming, suggesting she only swam for the limelight, had upset her.

Volkens use direct observation and calmed O'Neill by suggesting: "They are his words and you can choose whether to accept them. If you make the right choice, you'll brush them aside and you'll feel better."

Hopkins (1991) suggests that motivation and systematisation of training are probably best achieved with diaries. Direct observation is the best method for ensuring compliance with a training prescription, and heart rate monitoring is a useful method for prescribing endurance training intensity.

The athlete undergoes a series of tests to determine progress based on data that is collected for analysis and compared with benchmark information. Testing methodologies have been applied at strategic times in the training program.

Obtain and evaluate information from other sources regarding athlete/client progress

Sports specific tests have been applied to seek data. This information is decisive and may reflect physiological, biomechanical, psychological and other scientific aspects of the athlete's status. Other information may be obtained from valid and reliable informal sources for evaluation purposes in consideration of the athlete's progress during the training period.

In this section we will cover:

- _ Obtain information
- _ Check information for validity and reliability
- _ Collect information within the coach's responsibility
- _ Carry out negotiations in a professional manner
- _ Record information for future use
- _ Maintain confidentiality of information where appropriate.

Obtain information

Information is obtained in relation to long-term program goals and objectives, from all appropriate, competent and approved sources within the limitation of available resources.

One of the most valid and reliable sources of information upon which to develop and monitor the training program is the athlete's and coach's diary.

Coaches should encourage athletes to complete a training diary of all sessions and to use a weekly recovery planner that helps them to manage their time so they can balance training and school or work commitments with social life and family life.

In some cases the athlete may have several sources of training records such as training diary, weekly recovery planner and strength and conditioning training diary. All of these will contain vital information for the coach in monitoring and developing the training program.

Sources of feedback for training progress information

Feedback on the athlete's competition or game performance and training performance may be sought from support personnel. These may include:

- _ administrators
- _ other coach/es
- _ sports scientists
- _ sports medicine providers
- _ other health professionals
- _ agents
- _ parents/guardians
- _ other involved/appropriate personnel

Type of information from other sources

Information is collected about these any or all of the following resources that may have an impact of the design of the training program:

- _ physical
- _ equipment
- _ materials
- _ health and safety provisions
- _ indoor facilities
- _ outdoor facilities
- _ provisions for sessions
- _ supporting material
- _ grants and/or sponsorship

Check information for validity and reliability

For information to be relevant it must be valid and reliable. Validity refers to the accuracy the information to the characteristics describing the athlete's performance. Is the information reporting on what it is supposed to be reporting on?



For example, some field tests have been used to measure physiological characteristics to allow estimation of such characteristics otherwise measured directly in the laboratory. eg, the distance run in 12 minutes is a valid measure of maximum oxygen uptake (VO₂ Max)

A test of reliability is the degree to which consistent reproducible results are obtained. Information can be reliable without being valid, but cannot be valid if it is unreliable.

Example 7

Records may be obtained from the strength and conditioning coach for the purposes of recording frequency of training, duration of training, workloads, volume and intensity. Training records for strength and conditioning are usually recorded systematically showing session by session entries of weights, exercises, sets and repetitions.

The evaluation of strength and conditioning records will provide important feedback to the coach on strength, hypertrophy and power cycles in the training program as related to training objectives.

Collect information within coach's responsibility

Any arrangements for the collection of information within the coach's responsibility must be carried out correctly and efficiently. The coach can collect information related to training such as from training diaries and competition data.

The coach may keep training records noting volume and intensity of training loads, response of athlete to training load, athlete's psychological status for each training session, other conditions such as weather and physical conditions.

Competition data can be obtained from event organisers or national sporting organisations. For example, in the recent national Track and Field championships, held at Stadium Australia as an Olympic test event, the organisers implemented a full system of electronic timing by Swatch which will be used during the Olympics. The starting system included a paper trace record of competitors reaction time as measured by pressure applied in the starting blocks.

ACT sprinter Patrick Johnson was left at the start of the 100m and was defeated by fellow speedster Matt Shirvington. Johnson's coach Esa Peltola obtained the electronic reaction times from the start and found that Shirvington got the best start in the field with a reaction time of .153secs and Johnson got the worst with a reaction time of .230secs.

Carry out negotiations in a professional manner

To obtain and evaluate information from other sources may involve appropriate negotiations. It is advisable that all negotiations be carried out in a manner likely to engender good working relationships.

Fostering good working relations is important if such information is required from other sources at again in the future or on a more consistent basis other than once-off.

Record information for future use

All athlete performance and training data related to the development of the long-term plan should be recorded appropriately for future use.

Many coach's use computer based systems to both record information, analyse according to standards or criteria and design appropriate training sessions

Maintain confidentiality of information where appropriate

Information regarding athlete status and /or well-being should not be passed on to other individuals without the permission of the athlete.

It is advisable to consult particular requirements for confidentiality that may apply such as:

- _ Sporting organisation guidelines
 - _ Child protection laws (NSW)
 - _ Coaching code of ethics
 - _ Criminal protection policy
 - _ Harassment sport guidelines
 - _ State/Territory Confidentiality laws

Often information is required from medical personnel regarding the health or injury status of an athlete for selection in a team or reintroduction into training. Medical records are sacred in medical practice and practitioners risk a breach of professional confidentiality if disclosing such information. The origin of this standard can be found in 350BC with Hippocrates who said: "Whatever I see or hear, professionally or privately, which ought not to be divulged I will keep secret and tell no-one". This has been known as the Hippocratic oath. The coach must trust the advice provided by the medical practitioner since there is no access to medical records.

Today, practitioners do not get involved in the selection of athletes. The practitioner may provide advice verbal or written about the health and medical status of an athlete giving prognostic advice. The coach and selection panels may use this information. Often selectors have the problem of naming a key player for selection although the prognosis is 80% game fit in the knowledge that the player's absence from the field of play would be more damaging to the team than his/her reduced capabilities due to injury. This may be more frequent during finals times.

Watch the office gossip!

Like many office environments, there may be opportunity for conversations to be overheard, telephone and fax messages left on desks, reports open, incidental conversations that could accidentally breach confidentiality of the athlete should the athlete be injured, sick or compromised in some manner that should otherwise be held in confidence.

Define clients' progress towards improved and/or high performance levels

Now that comprehensive information has been collected from scientific and related sources and analysed against benchmarks to assess progress towards performance objectives, it is necessary to define the athlete's progress.

In this section we will cover:

- _ Check information for validity and reliability
- _ Define progress
- _ Measure information against agreed performance objectives and priorities
- _ Check unpredicted results for possible errors
- _ Record results for future use
- _ Identify new agreed performance objectives for achievement
- _ Maintain confidentiality where appropriate.

Check information for validity and reliability

All information must be checked for validity and reliability. In particular, sports specific tests should be checked against best practice standards and testing methodologies to ensure compliance. Failure to conduct validity and reliability checks may allow erroneous data to influence training programs.

Case study 3

The release of classified documents saved after the collapse of the German Democratic Republic (GDR) in 1990 describes the promotion by the government of the use of drugs, notably anabolic steroids, in high performance sports. Prior to the collapse, strength coaches in the western world studied the strength and conditioning regimens of the GDR and applied them enthusiastically to their athletes. The results were most harmful, as athletes training under these heavy workloads soon broke down. It was realised in hindsight that the training volumes and intensities were administered to athletes who were undergoing training workloads supported by supervised doping. Such intensities could not be replicated by athletes not using drugs.

Top secret doctoral theses, scientific reports, proceeding from scientific experts and reports from physicians recorded meticulously by the Ministry for State Security (Stasi) for over 30 years provided valid and reliable evidence of systematic administration of androgenic-anabolic steroids to hundreds of male and female athletes in the GDR from 1960's-1990.

Define progress

The athlete's current performance status is assessed against performance standards to provide an indication of progress. Progress may be assessed at specified points during the planning period. The athlete's performance is clearly defined in terms of progress towards improved high performance

levels.

Progress can be relative as well as absolute

Although progress will be measured against target outcomes, it is important to always keep in mind that in many sports objective goals may not be achieved because of the unpredictable nature of the sport or event. The best prepared team physiologically may not win the contest although each individual may have attained target outcomes in all physiological or sport related tests. The athlete must be able to apply and adapt the improved physical attributes achieved by training in specific modalities in the game situation. For example, a Rugby league player involved in a strength and conditioning program in the gym may be able to bench press 120kg. Strength in the gym must be able to be applied into a fend during a tackle in the game. In rugby, strength for the forwards or the props is different to the strength required for the winger.

Strength plays an important part in most sports. However, it may not be maximal strength that eventually wins the day. In the case study below, Edward Sarul provides evidence of applying optimal strength rather than maximal strength to win the event.

Example 8

In many explosive sports that require speed and power, athletes must train to gain genuine strength. It is not uncommon for track sprinters and track cyclists to demonstrate considerable strength in performing the Half Squat and bench press. Typically, athletes may lift up to three times body weight for the half squat and twice body weight for the bench press. An example is provided below for an 80kg athlete:

Half squat 5 reps x 200kg
1 rep x 220 kg
4 reps x 270kg
Bench Press 3 reps x 150kg
1 rep x 170kg
6 reps x 160kg
3 reps x 166k

Case study 4

National Strength and Conditioning Association Journal (1987), 9 (3). Edward Sarul, the 1983 World Champion in the shot put illustrates the point of having optimum strength compared to maximal strength.

“In the half squat I can do 275 kilograms and in the bench press, 182 kilograms, while American David Laut produced 300 kilograms and 250 kilograms respectively. Other throwers have similar results. The inescapable conclusion can be drawn that in putting the shot, strength is not the most important factor. And I was fortunate enough to beat these strong men in Helsinki”.

One of the best examples of maximising both physical attributes and skill is illustrated by the win of Australian rowers Anthony Tompkins and Peter Antonie in the coxless pair at the 1992 Barcelona Olympics. Antonie and Tompkins were lightweights competing against heavyweights. At the medal presentation the Dutch silver medallists dwarfed the Australian pair.

Measure information against agreed performance objectives and priorities

The athlete's progress is evaluated against critical checkpoints in the long term program. The coach and athlete can assess progress towards agreed performance objectives and priorities.

For example, a sprinter's times for the summer competition may be reviewed. Results may be compared against predicted times and actual times. The achievement of milestones targets can be highlighted and celebrated by both coach and athlete.

In track and field many early season performances provide an indication of end of season potential. Traditionally, athletes coming off a heavy and intensive training program as part of the preparatory preseason component of the Annual plan will look upon early fast times with some optimism.

Example 9

The Canberra Times, 22 January, 2000

The ACT's Patrick Johnson, one of Australia's leading sprinters, showed early season form with a scintillating victory in the Canberra Grand Prix over Australia's 100m record holder Matt Shirvington with the fastest time recorded in Australia.

"With a personal best of 10.15 sec, set last week, Johnson is not deterred by the task of breaking 10 seconds for the first time to make the Olympics".

"People say under 10 seconds or 10 seconds flat but who knows what will happen, especially with the Olympics and with the preparation of each athlete".

Check unpredicted results for possible errors

Occasionally unpredicted results occur that may indicate either positive or negative influences on progress. Although information gained from various data sources are expected to be valid and reliable, in the event of unpredictable results, it is always advisable to check results that do not conform to predicted outcomes for accuracy.

The importance of checking unpredicted results is clearly illustrated in the case study below:

Case study 5

A specificity of training study was being conducted into the effects of treadmill running and performance on the rowing ergometer in a group of rowers. Subjects had been tested previously and results recorded to rank the athletes and place them in ranked pairs. One athlete of each pair ran on the treadmill and the other athlete trained on the rowing ergometer. All athletes were monitored so that training intensity in either training mode was similar. So the runners trained at the same intensity as the rowers but were using a different training mode.

At the end of 6 weeks of training the matched pairs all completed 30 training sessions and were booked into a schedule for testing.

In the final test session performance output on the rowing ergometer and physiological characteristics were measured for each athlete. The data was analysed and conclusions considered regarding the specificity of training.

In one pair, the tester noticed significantly poor and unexpected results from an athlete who had trained hard in all sessions and was expected to demonstrate performance improvements. Tests results on rowing output and physiological test scores appeared to be compromised.

An investigation discovered that the athlete had not read or signed the consent form advising of dietary and activity pre-requisites prior to testing. The athlete had celebrated with friends the night before and had withheld this information. The subsequent set of paired results was aborted and not considered in the determination of the training study.

The moral to the story for budding researchers is to ensure that athletes understand they need to present themselves to a testing session according to both dietary and activity requirements.

Record results for future use

Results are recorded accurately and clearly and stored for future use.

Identify new agreed performance objectives for achievement

The coach and athlete have reviewed the performance data, analysed it according to performance criteria and established a progress status. Following this, both then coach needs to establish new performance goals and objectives in consultation with the athlete in line with the evaluation results. Any new agreed performance objectives and priorities must be within the athlete's potential to achieve.

Maintain confidentiality where appropriate

Information regarding athlete/client status and/or well-being should not be passed on to other individuals without the permission of the client

Information collected from all sources is checked to confirm it is valid and reliable for consideration as part of the evaluation of the athlete's progress. Progress may be defined in terms of quantitative data, relating to test results, and qualitative data obtained from various sources including training diaries and coach observation. The athlete's progress is determined against performance benchmarks and

towards agreed performance levels. All documentation is recorded and filed for future reference and considered in confidence as appropriate.

Evaluate the program

The training program is now considered in the light of achieving program performance outcomes. Positive progress to agreed performance objectives may be considered as a satisfactory match of training to performance objectives. Alternatively, a negative evaluation outcome indicates a poor match of training and performance outcomes that may require an explanation or further investigation. It may also stimulate consideration of the athlete's relationship with the coaching style to achieve desirable outcomes.

In this section we will cover:

- _ Measure program outcomes against agreed program objectives and benchmarks
- _ Conduct evaluation of the program with the athlete
- _ Evaluate the content, structure, balance and processes of the program
- _ Evaluate teaching methods and coaching styles
- _ Evaluate the contributions of support personnel
- _ Evaluate the suitability and safety of facilities and equipment
- _ Seek feedback from athlete and support personnel
- _ Respect the views of the athlete and support personnel
- _ Identify program deficiencies.

Measure program outcomes against agreed program objectives and benchmarks **Does the training program match performance objectives?**

With a commitment to a training plan, both the coach and the athlete have established agreed program objectives and performance outcomes. In order to assess how well the training program is going it is necessary to measure the program outcomes periodically against the program objectives and benchmarks.

Critical periods during the training program may need to be recognised and the appropriate training stimuli introduced during each period to achieve the desired outcomes.

It is therefore important that program objectives, agreed to by the client/athlete in consultation with the coach or instructor, other specialists, siblings and relevant personnel, are measured against training outcomes to date.

Programs objectives are not only performance targets, but may include:

- _ Physiological targets
- _ Psychological goals
- _ Lifestyle adjustments
- _ Tactical and strategic approaches
- _ Skill performance or technique development targets
- _ Competition/performance targets

Conduct evaluation of the program with the athlete **Athlete and coach check program together**

The coach must conduct an evaluation of the program with the athlete. It is essential that the athlete becomes involved in assessing the outcomes of the training program. Not only does this reinforce the critical process of designing the training program to meet performance objectives, but it helps to educate the athlete and encourage their full involvement in the preparation of their training plan. If the athlete understands the training process better, they will understand the need to keep to training session workload schedules.

How to check the program?

The evaluation process with the athlete may be conducted by:

- _ Questioning and discussions
- _ Observations throughout the training program
- _ Cross-referencing with session and/or agreed program objectives, and/or



- _ Ongoing functional assessments of skill performance, physical performance and athlete/client well-being as part of the formative evaluation of training program
- _ Consultation with other support personnel or specialists.

Questioning and discussions

Questionnaires represent an economical and comprehensive method but are the least accurate. Questions should be asked about training volume such as weekly distance, weekly duration and training intensity such as training pace as a speed or as a percentage of maximal effort. The use of the Borg scales of perceived intensity may be helpful. Sessions with a variety of intensity should record time spent in categories of hard, moderate and easy intensity.

Training Diaries

Diaries are more valid but have the disadvantage for long-term quantitative study of poor compliance and difficulties in processing the data they generate. In addition to resources for training dairies available from the Australian Coaching Council, various software/CD Rom materials on coach logbooks and training plans may be found at the Human Kinetics (US) website listed below.

Physiological monitoring

Physiological monitoring such as oxygen consumption, heart rate and blood lactate provides objective measures of training intensity. The use of wristwatch type heart rate monitors such as Polar Sports Tester and portable blood lactate analysers provides opportunities to monitor a session while it is progress. Heart rate monitors can be used to measure intensity of session workload with application for gauging recovery between intervals. Heart rate monitors store data that can be downloaded into a computer and analysed with simple software programs.

Neil Craig, a physiologist with the South Australian Institute of Sport, devised an effective system of maximum heart rate training based upon different training thresholds. Further readings and information on a training plan based on heart rate may be found below:

Observation

Direct observation by the coach and support personnel gives valid measures of training but may be impractical for continuous long-term use. All aspects of training can be quantified by direct observation.

The measures usually obtained by direct observation are the mode, duration and intensity of individual training sessions. In addition, the coach may use a subjective measure of whether an athlete is overtrained, injured or fatigued. Training intensity can be observed as a percentage of the athlete's personal best time.

Example 10

Sample evaluation form for athlete/players

1 poor 2 satisfactory 3 average 4 above average 5 excellent

Did the training program:	1	2	3	4	5
help you to develop physically					
develop your skills					
teach you strategies					
increase your desire to play					
allow you to have fun					
improve your self-confidence					
distribute awards fairly					
provide proper and safe equipment					
show concern for injured player					
provide good injury care					
have appropriate and fair team rules					
require too much from players					
Was the coach:					
Organised					

planned use appropriate teaching methods fair worthy of respect flexible easy to talk with good at giving praise honest reasonable in demands concerned about players					
Comments about training program:					
Comments about coach:					

Evaluate the content, structure, balance and processes of the program

Consideration of whole program

The extent of the evaluation must include the content, structure, balance and processes of the program.

The evaluation will comprise of a written assessment against performance indicators. Achievement of agreed performance indicators will illustrate congruity with the training program whereas lack of achievement will indicate possible incongruity with the training program.

The content and structure of the training program is evaluated. Consideration is given to volume, intensity, frequency, recovery, rehabilitation and competition schedules to assess the balance and relative contribution performance outcomes.

Other components of the training program such as psychological, strategic and tactical elements, lifestyle issues are considered as part of the overall evaluation.

Evaluate teaching methods and coaching styles

The evaluation may involve consideration of teaching and coaching styles and the compatibility of these styles with achieving performance outcomes.

Teaching or coaching styles are those instructional or coaching approaches adopted by the instructor or coach to convey instructional content to the client/athlete.

Coaching styles

Depending on the situation the coach or instructor should be able to incorporate a range of combinations of the following approaches and/or any associated variations:

- _ whole, part, whole approaches
- _ shaping approaches
- _ modeling approaches
- _ command and response approaches
- _ directive approaches through specific set tasks
- _ reciprocal or peer tutoring approaches
- _ feedback and refinement approaches
- _ guided discovery approaches (setting problems and allowing athletes to discover solutions)
- _ experiential or problem solving approaches.

Evaluate the contributions of support personnel

360° feedback includes support personnel

In any training program there are many people besides the coach who contribute to the ongoing



development of the athlete within the respective training cycles. The input of the support personnel must therefore be sought if 360 degree feedback is required in the evaluation of the training program.

The support personnel; may include:

- _ administrators
- _ other coach/es
- _ sports scientists
- _ sports medicine providers
- _ agents
- _ other health professionals
- _ parents/guardians
- _ other involved/appropriate personnel

The feedback from the support personnel will contribute to the evaluation of not only the training program but of the coaching effectiveness.

Coaches may need to educate support personnel in providing specific feedback related to the training program and the athlete.

Evaluate the suitability and safety of facilities and equipment

Training facilities and equipment

The safety of the training environment can influence to training program. It may be necessary to conduct an evaluation regarding the suitability and safety of facilities and equipment used by the athlete or team.

The training facilities and equipment may include:

- _ fixed pieces of apparatus for use by all clients
- _ individual equipment required by each client in order to undertake the sport/activity (eg, tennis racquet)
- _ personal protective or non-protective clothing or attire
- _ technical equipment
- _ audio-visual equipment

Seek feedback from athlete and support personnel

As part of the evaluation process for the training program. the coach should seek feedback from the athlete and support personnel. Feedback can be:

- _ verbal
- _ written
- _ visual, and/or
- _ tactile

The feedback should be an information exchange between the athlete/support personnel and the coach regarding training progress.

The feedback should address:

- _ agreed and evolving program objectives
- _ information pertinent to technical adjustments

Respect the views of the athlete and support personnel

The feedback provided by the athlete and support personnel has been provided with the purpose of making a contribution to the effectiveness of the training program. As such the feedback provided by the athlete and the support personnel should remain confidential.

Such feedback will provide more information for the coach to consider along with his personal evaluations. The feedback provided by the athlete and support personnel should be respected and taken into consideration as part of the evaluation. It may contain vital information or issues that should not be ignored.

Identify program deficiencies

With access to a full range of evaluation material, the coach is in the position to identify any program deficiencies. It may be obvious that things need to change if the athlete is not progressing well enough

and failing to meet performance outcomes. It may be more difficult to find deficiencies if the athlete is progressing well and meeting performance outcomes.

The training program is evaluated comprehensively. It is examined against performance outcomes, in context of all components parts, coaching styles are examined, and contributions from support staff evaluated and facilities and equipment. All parameters have been viewed in light of assessing the athlete's progress towards performance objectives and any deficiencies are noted.

Evaluate rehabilitation programs

Training programs are constantly being compromised by unexpected injuries. The circumstances of any injury acute or chronic must be considered in terms of the training program. An athlete returning to activity as part of a rehabilitation program cannot be expected to resume full training loads upon resumption of training duties. The history and extent of the injury must be factored into frequency, load and duration of the training plan as part of a dedicated rehabilitation program.

- Evaluate rehabilitation programs.

Evaluate rehabilitation programs

The training of the competitive athlete may be interrupted overtraining or injury either acute or chronic for which a rehabilitation program will be conducted.

The coach and support staff may use the direct observation method to determine symptoms of overtraining and injury through overuse. Chronic injuries are due to lack of adaptation to an increased training workload or overuse such as in the high intensity endurance sports such as running, triathlon and swimming.

Overtraining can be recognised by various identified symptoms such as poor performance, inability to meet previously achieved training targets, negative mood states, disturbed sleep, chronic muscle soreness and high heart rate. Overtraining may be remedied by reduced training load, rest, recovery and rehabilitation

There is some evidence to indicate that hard training by endurance athletes may suppress the immune system and increase the risk of infection. Infection may be recognised by fatigue and lethargy in response to training workload.

In the case of sport-related injury, rehabilitation programs may be considered in relation to benchmarks achieved by screening and evaluation at start of program.

The coach and athlete should discuss the implementation and progress of any rehabilitation program in relation to pre-existing physical data obtained by earlier screening. The application of the screen recommended by Sports Medicine Australia will be helpful.

Example 10

Swimming is a sport in which athletes demonstrate extreme rotation ranges and range of motion by the shoulder.

Sports medicine practitioners will test the shoulder rotation range, thoracic extension range and muscle tightness around the shoulder. Failure to be able to achieve these ranges without stress often leads to overuse injury around the shoulder.

Further, in returning from injury or surgery, the practitioner will look to re-establish these extension abilities to benchmark standards. In addition, it's the extremes of range that if not matched with strength in the extremes of range can result in problems. Problems may show as performance decreases. They can't get quite as good feel for the water. A good swimmer who has good hand position, rotation, movement and acceleration through the water gives the swimmer the 'feel'.

Communication with AIS Physiotherapist, Craig Purdam, February 2000

In regard to range of motion-strength relationship, gymnastics is another sport like swimming where athletes have extreme rotation and range of motion around the shoulder. Whether during rehabilitation or in regular training the coach in these sports needs to understand the demands of the activity and liaise with strength coaches and practitioners to ensure the athletes achieve a balanced strength and flexibility level.

The progress of any rehabilitation program must be discussed with relevant support personnel. This may be by direct discussion or access to written reports provided by support staff in relation to the

rehabilitation program. It is advisable to place all reports, both observed and written on the athletes file for future reference.

If coaches have in their training programs athletes who are pre-pubescent or pubescent, or inexperienced in terms of training volume and intensity, it is advisable to monitor the athlete's physical condition carefully since injury or over-training may be linked to growth and development conditions. In addition, in endurance related sports, several studies have reported lowered iron stores particularly in women. The effect of low iron status may be guided by lowered serum ferritin. Other trace elements such as zinc, chromium and copper may also be affected by training volume. Coaches must be aware of the possible influence of excessive training loads on various trace elements that may be monitored through regular blood tests.

The training plan must take into consideration any injury to the athlete and subsequent rehabilitation program. This may result in reviewing performance objectives.

Evaluate selection procedures

The goal of high performance athletes is to achieve the best from their abilities. Every athlete seeks to achieve representation at the highest level appropriate to his or her performance whether at club, state, national or international level. The successful inclusion and notification procedure is examined and both the organisation and the coach must also consider the management of non-selected athletes.

In this section we will cover:

- _ Evaluate notification procedures using feedback from selected and non-selected athletes
- _ Evaluate management of non-selected athletes.

Evaluate notification procedures using feedback from selected and non-selected athletes

The selection of athletes for teams either for local, domestic, state, national and international purposes should be based upon specific criteria. The selection criteria should be available from the organisation for public scrutiny.

The selection criteria should be made available early in the training program in order to assist the establishment of performance goals, particularly if selection is sought in representative teams such as World Championships, Commonwealth Games and Olympic Games.

The procedure for selection must be transparent. The lead up to the Atlanta Olympics provided several examples of poor selection process with cases involving cyclist Lucy Tyler-Sharman and Kathy Watt and iron-man turned kayaker, Trevor Hendy. Further selection controversy arose in the lead up to the Kuala Lumpur Commonwealth Games selections with hockey gold medallist, Nova Peris-Kneebone challenging the selection of fellow sprinter Tania Van Heer in track and field.

In many sports, the selection for representative honours is profoundly simple. In swimming and track and field, athletes must meet qualifying standards before gaining selection. For example, in track and field for the Olympic Games, each event may have two athletes entered. To gain selection, an athlete must meet an A qualifying standard. If only one athlete meets the standard, consideration may be taken for a lesser B qualifying standard. An athlete who has gained only a B qualifying standard will not gain selection over any athletes with higher A qualifying standards.

Evaluate the management of non-selected athletes

"All those with mother's one pace forward!". Where are you going Smith?"

This old joke about the subtlety of the Army's method of informing personnel of bad news is certainly not a desirable approach. Often teams are selected for state, national or international representation and attention is only centred upon the athletes who were successful in gaining selection.

The management of athletes who have not been successful in gaining selection to representative teams is as important. The consequence of poor management may be a loss of motivation, poor commitment to training, frustration and perhaps the loss of the athlete from the sport.

The selection panel should provide feedback to the athletes who failed to gain selection either by direct personal contact or through the coach or state association or local club. The selection criteria may address objective and subjective criteria that may need further explanation.

Example 11

Plan for unlucky Olympic athletes By John Salvado



Every Australian athlete who misses selection for the 2000 Olympic team will be offered psychological help and the right to appeal their omission.

With the extra pressures of competing in front of a home crowd at the Sydney Games and Australia certain to field its largest team of up to 650 athletes the stakes are higher than ever before.

"It's going to be a big team but for every one of those there's going to be one or more that misses out and we have been very anxious to make sure that they aren't lost to sport," Australian Olympic Committee president John Coates said yesterday.

Coates was speaking at the launch of the AOC's formalised selection process, which gives every athlete the right to appeal to an internal tribunal and the Court of Arbitration for Sport if they are overlooked.

The AOC and the local sports institutes and academies will also offer psychological counselling to athletes who narrowly miss out on a berth in the team or perform below expectations at the Games.

"It's a bit different to the way it was in the past," said 1960 1500m champion Herb Elliott, who is now the AOC's director of athlete services. "The pressures are different and the amount of athletes' life consumed by their sport is greater, so therefore there is the likelihood that for non-selection the consequences for some of them will be far worse."

Elliott is working with the sports institutes and academies to identify athletes who could react badly at being overlooked.

"Usually there are indications in the way athletes have behaved in the past where things haven't turned out quite the way they wanted," he said.

After cycling and sailing were hit by legal challenges from athletes disappointed at being overlooked for the 1996 Atlanta Games, the AOC also decided it needed to formalise its selection policy.

Each sport has been required to clearly state its selection requirements, while every athlete who feels they have been unfairly left out will be able to appeal to an independent tribunal and then to CAS. The AOC will also be able to take up an aggrieved athlete's case with CAS if it feels they've been discriminated against by selectors.

"Because we've insisted that sports set out in writing an unambiguous selection criteria and because we've insisted it meet all the principles of natural justice . . . [and] it be brought to the attention of the athletes upfront we would hope that there will be fewer disputes," Coates said.

As the procedures were spelt out clearly, Coates did not believe that athletes would have further legal recourse to the Supreme Court.

Of the 28 Australian summer Olympic sporting federations, only handball, women's soccer and women's hockey had yet to sign off on the nomination criteria.

Swimming and athletics are the only sports which do not have their numbers capped, relying instead on strict qualification standards.

"I don't envy sports that are more political when it comes down to someone else's selection," breaststroke champion Samantha Riley said.

Source: *The Canberra Times*. Thursday February 17, 2000

The two sides of the coin regarding selection must be handled with an equal counselling. The most difficult part in any athlete's life is failing to make selection.

Section 8: Identify personal development objectives through self-evaluation

Successful coaches will have a good understanding of the sport sciences, sport management and technique and tactics. In addition, successful coaches plan effectively and rank their program objectives in the right priority. One further attribute of successful coaches is empathy. 'The coach must demonstrate an ability to readily understand the thoughts, feelings and emotions of athletes and to convey sensitivity to them.

In this section we will cover:

- _ Conduct self-evaluation
- _ Review self performance against agreed program objectives
- _ Apply self-reflection tools
- _ Check effectiveness of coaching/instructional style
- _ Identify gaps in teaching methods
- _ Implement changes as result of self-evaluation process



- _ Seek advice from other support personnel regarding personal development objectives
- _ Identify personal development objectives
- _ Establish or revise development plan to achieve personal development objectives

Conduct self-evaluation

The coach and athlete can review the training program through self-evaluation. The evaluation may be conducted through various processes such:

- _ questioning and discussions
- _ observations throughout the training program
- _ cross-referencing with session and/or agreed program objectives, and/or
- _ ongoing functional assessments of skill performance, physical performance and athlete/client well-being as part of the formative evaluation of training program
- _ consultation with other support personnel or specialists

The following resource *Video Self-Analysis: A Lens on Coaching*-Level 2 from the Australian Coaching Council may be a useful tool for self-evaluation of coaching

Example 12 Coaching Behaviour Self Evaluation

	Rarely 1	Sometimes 2	Usually 3	Often 4	Always 5
Treat everyone fairly within the context of their activity, regardless of gender, ethnic background, colour, religion, political belief or economic status?					
Direct comments at the performance rather than the person?					
Display high personal standards?					
Project a favourable image of the sport and of coaching?					
Provide a role model by abstaining from and discouraging use of drugs, alcohol and tobacco in conjunction with sport?					
Refrain from using offensive language while coaching?					
Provide a safe environment for athletes in training?					
Ensure the activity being undertaken is suitable and justified for the age, experience, ability and					

fitness level of the athlete?					
Cooperate with support personnel in the overall management of athletes' medical, recovery and rehabilitation requirements?					
Recognise and accept when to refer athletes to other coaches or sports specialists?					
Seek ways to increase professional development and self awareness?					
Treat opponents and officials with respect and encourage athletes to act accordingly?					
Recognise and consider the training program knowing that other social and academic pressures may be placed on the athlete					

Source: Adapted from Martens, Rainer. (1990) *Successful Coaching*. Human Kinetics. USA.

Review self-performance against agreed program objectives

The athlete's and coach's performance can both be reviewed against the agreed program objectives. The level of effectiveness of the coaches contribution to the achievement of performance outcomes by the athlete can only be assessed against the program objectives.

In addition, an examination and review of the athlete's self-performance against agreed program objectives will provide an assessment of the athlete's potential to succeed in the training program. Not all coach-athlete relationships that produce successful outcomes are made in heaven. For many different reasons, either coach related or athlete related the training relationship to produce performance objectives may be inappropriate. The following Case Study 7 illustrates the example of an athlete taking action in the circumstances of incompatible objectives.

Case study 6

The Canberra Times, 20 January, 2000

MELBOURNE: Star Collingwood youngster Chris Tarrant has walked out on the magpies and may never play AFL again, citing pressure of the game. Tarrant told the club of his decision on Monday and has returned to his hometown of Mildura to consider whether if he will play again.

A Collingwood spokesman was in contact with Tarrant and had given him a week off training to consider his future. “He’s only 19 and has some issues to sort out.” spokesman Robert Pyman said. Another promising youngster Mark Kinnear also quit the club this off-season. During the AFL pre-season, newspapers will often report the situation of young rookie players coping with the rigours of stepping up to the demands of senior football. Most succeed but some may decide to quit, perhaps finding it too hard to adjust or with incompatible performance outcomes. These young players probably used a self evaluation process to arrive at these decisions. The clubs may provide support personnel and counsellors to help young players, especially those from the country and regional areas who may have to adjust to big city living as well as new demands from training.

Apply self-reflection tools

The coach is encouraged to utilise self-reflection tools during the training program in order to reassure training objectives and coaching methods are mutually compatible.

Several self-reflection tools such as a coaches diary, mentor coaching and video self-analysis may be used.

Coach’s diary

A simple but effective method to assist planning and organisation of the training program is to keep a diary. The coach’s diary may contain the following information:

- _ yearly training program
- _ important dates, competition fixtures
- _ training plan format
- _ team lists
- _ team sheets
- _ results analysis sheets
- _ attendance sheets
- _ record sheets
- _ athlete contact lists
- _ contact list support personnel

Check effectiveness of coaching/instructional style

A review provided an opportunity to consider the effectiveness of the coaching style for the benefit of the coach in applying his or her training methodologies to the training program, and for the athlete to examine his or her compatibility with the coaching style.

The coaching style refers to the presentation style/s adopted by the instructor or coach to communicate with the client/athlete.

Depending on the situation the coach or instructor should be able to incorporate a range of combinations of the following styles and/or any associated variations:

- _ friendly and approachable while maintaining a ‘professional distance’
- _ clear, precise and, if appropriate, directive regarding not-negotiable issues (eg, safety factors)
- _ humorous when appropriate
- _ laissez faire (or casual) when appropriate
- _ organised and efficient
- _ a “critical friend”
- _ motivational and encouraging
- _ disciplinarian, including modification of undesirable behaviours in clients

Identify gaps in teaching methods

In any coaching situations the instructional or coaching approaches adopted by the instructor or coach to convey instructional content to the client/athlete may not suit everyone. There may be gaps in the teaching methods that may or may not impact upon the training objectives.

Depending on the situation the coach or instructor should be able to incorporate a range of combinations of the following approaches and/or any associated variations:

- _ whole, part, whole approaches
- _ shaping approaches
- _ modeling approaches



- _ command and response approaches
- _ directive approaches through specific set tasks
- _ reciprocal or peer tutoring approaches
- _ feedback and refinement approaches
- _ guided discovery approaches (setting problems and allowing athletes to discover solutions)
- _ experiential or problem solving approaches

In swimming, for example, the relationship with the coach is crucial because the sport is more coach-oriented than any other sport. Swimming develops a culture of dependency.

Case study 7

McGregor, A., *Why girls love Volkens*, The Weekend Australian, January 15-16, 2000 , p35
 Queensland Academy of Sport swimming coach, Scot Volkens, has achieved his best results with female athletes. He coaches current swim stars Susie O'Neill and Sam Riley. Volkens has trained Olympic males but is renowned for his results with women. Not every coach enjoys tutoring females. Michael Klim's coach Gennadi Touretski finds them too emotional.

"Maybe my training suits women, kills men," say Volkens. "Men can't handle the same work as women. Just different animals, the break down easier."

During the drug drama, it was asked whether Volkens had made his champions too dependent on his presence. At the time he was coaching O'Neill, Riley, Eli Overton and Angie Kennedy, who comprised the Australian medley relay at the 1995 world titles.

Psychologist Wendy Swift says swimming develops a culture of dependency. "It's more coach-oriented than any other sport." she says. 'He sees them before school, after school, tells them what to swim, what to eat, when to sleep.'

Example 13

Identify gaps in coaching/instructional method

1 rarely 2 sometimes 3 usually 4 often 5 always

Coaching/instructional style	1	2	3	4	5
whole, part, whole approaches					
shaping approaches					
modeling approaches					
command and response approaches					
directive approaches through specific set tasks					
reciprocal or peer tutoring approaches					
feedback and refinement approaches					
guided discovery approaches					
experiential or problem solving approaches					



Implement changes as result of self-evaluation process

As a result of the self-evaluation process the athlete or coach can implement changes to the training program. Once the long term plan or annual plan is made it should not be considered as an inflexible doctrine. Information is collected throughout the athletes preparation that may cause changes to the plan. Changing the training plan does not indicate a weakness or error on part of the coach. It however

demonstrates that the coach is flexible and understands the athlete's needs. It shows that the coach is knowledgeable with an ability to assess all aspects of the athletes training program.

Seek advice from other support personnel regarding personal development objectives

Advice may be sought by the coach or athlete from support personnel regarding personal development objectives. These may include:

- _ administrators
- _ other coach/es
- _ sports scientists
- _ sports medicine providers
- _ agents
- _ other health professionals
- _ parents/guardians
- _ other involved/appropriate personnel

Identify personal development objectives

The athlete may identify personal development objectives as part of the training program.

Personal development objectives may include:

- _ Better listening skills
- _ Communication skills
- _ Cooperation
- _ Commitment
- _ Dedication
- _ Punctuality

Establish or revise development plan to achieve personal development objectives

The training program and development plan is discussed with the athlete and coach. The personal objectives are established and incorporated into the development plan.

Example 14

A club level hockey player, in consultation with support personnel, a physiotherapist, was encouraged to work on a series of stretching exercises order to increase flexibility. The physiotherapist has diagnosed the athlete had tight hamstrings that were inhibiting correct posture for sprinting. The stretching exercises were designed to increase hamstring length.

The athlete set a personal goal to achieve greater flexibility within the training period.

Ongoing evaluation of the training program and coaching/ instructional style from a variety of feedback sources is critical in maintaining the training program on a course to achieve performance outcomes and objectives.

Discuss outcomes of evaluation with clients and support personnel

The feedback obtained from various sources will provide information that may cause the training program to be modified in order to achieve performance objectives. The coach may wish to discuss the results of the evaluation with support staff in order to confirm findings.

In this section we will cover:

- _ Discuss feedback from the evaluation of the program with athlete and support personnel
- _ Use feedback from performance and achievement to encourages future successes
- _ Seek agreement with athlete to changes to future programs based on the outcomes of the evaluation process

Discuss feedback from the evaluation of the program with athlete and support personnel

Feedback provided from support personnel regarding the evaluation of the training program should be discussed with the athlete. This feedback may have been gained by verbal, written, visual, and/or tactile means.

The discussion regarding this feedback should be an information exchange between the coach and the athlete regarding training progress and their perceived well-being.

The discussion should address

- _ agreed and evolving program objectives, and
- _ information pertinent to technical adjustments.

Use feedback from performance and achievement to encourages future successes

The feedback session with the athlete provides an opportunity to confirm performance objectives and milestone achievements to date and to focus on future successes.

The feedback from support personnel will provide information that can be added to the bank of information and performance data collected, analysed and evaluated by the coach. This feedback should be used to assist the coach in reviewing the training program.

Seek agreement with athlete to changes to future programs based on the outcomes of the evaluation process

Any changes to the training program based upon information and performance data collected by the coach and from support personnel must be discussed with the athlete.

Changes to the training program should be discussed in detail with the athlete and agreed upon. The athlete may wish to seek advice and confirmation from support personnel regarding changes to the training program. The coach should encourage this advice and confirmation since it strengthens understanding of the evaluation process by the athlete.

Following the evaluation process, the results of the feedback should be discussed with the athlete and support personnel to reconfirm or modify the training program.

Make program modification

Following discussions with the athlete and support personnel, agreed changes and modifications should be made to the training program. Agreement should be sought from stakeholders in the event of changes and modifications.

In this section we will cover:

- _ Discuss results of the evaluation process with support personnel as necessary
- _ Discuss and seek agreement to future program with the athlete and relevant support personnel
- _ Implement program modifications.

Discuss results of the evaluation process with support personnel as necessary

Once the coach and the athlete have decided to change the training program based on the evaluation and have each agreed to the possible changes, the results of the evaluation process may be discussed with support personnel prior to the final agreement between the coach and athlete. Both the coach and the athlete must be satisfied with changes to the training program. They may seek advice and confirmation from:

- _ administrators
- _ other coach/es
- _ sports scientists
- _ sports medicine providers
- _ agents
- _ other health professionals
- _ parents/guardians
- _ other involved/appropriate personnel



In some cases the coach may seek advice from a coach or mentor in another sport. For example, Bill Sweetenam and Wayne Bennett have been mentors for other coaches. Australian Hockeyroos coach, Rick Charlesworth, has been highly successful with the national women's team and has shared his coaching methods and philosophy with other coaches in many sports.

Example 15

An interesting variation to seeking out a mentor for advice related to training programs occurred during the off-season between personnel involved in the two different Canberra-based rugby codes, the Brumbies and the Canberra Raiders.

The players in the respective Clubs participated in a training switch that exposed the players to different training intensities for a strength training session in the gym and a conditioning session in the field. The players were tutored respectively by the opposite codes' strength and conditioning staff.

Discuss and seek agreement to future program with the athlete and relevant support personnel

The final training program has now been subjected to some discussion with support personnel and recommendations taken into consideration. The changes have been conformed as positive and beneficial to achieve performance objectives. The training program must be agreed to by all parties following input from all stakeholders.

The coach and athlete can now sign off on the training program as the way forward and become recommitted to the future program.

Implement program modifications

The new training program changes and modifications can now be implemented by the coach for the competitive athlete.

Case study 8

Following the outstanding success of the AIS Team in Women's National Basketball League in winning the 1998 Premiership, Head Coach, Phil Brown has made program modifications following the loss of key players at the end of the winning season. A new development training program commenced with the AIS team in 1999 as a consequence of changing personnel.

New AFL Collingwood coach, Mick Malthouse has had to adopt different coaching objectives for his new team following his change from the highly successful West Coast Eagles organisation.

Any program modifications contemplated should be discussed with all relevant athletes and staff. The coach will not achieve any change without the cooperation of the athletes and the support staff. Discussing program modifications provided everyone with a stakehold in subsequent successful outcomes as a result of the changes.

Glossary

Annual plan

The annual plan is made up of macrocycles (2 to 6 weeks periods) and microcycles (1 week period). The annual plan provides the athlete with a monthly, weekly and daily plan for all of the elements necessary for elite performance

Anthropometry

The use of anthropometric measurements. These are measurements of stature, mass and sum of skinfolds that provide a clear picture of the structural status of athletes at any given time.

Macrocycle plan A macrocycle represents a phase of training with a duration of between 2-6 weeks or microcycles. A distinct feature of a macrocycle is that it is planned to achieve specific objectives.

Microcycle plan

A microcycle refers to a weekly training program. The typical structure of a microcycle comprises of two or three overload training sessions followed by an unloading session.

Periodisation

Periodisation is the process of dividing an annual plan into smaller training phases

Appendix ONE: RESISTANCE TRAINING EXERCISE TECHNIQUES

BB SQUAT

Instructions

- Rack should be slightly lower than shoulder height
- Step under bar and position it on upper trapezius muscles and back of shoulder
- Hands as close as possible to shoulders (depending on flexibility) with elbows pointing down
- Stand up and take one step backwards
- Stand with feet shoulder width apart OR shoulder width plus width of foot apart, head and chest up and eyes looking forward- NORMAL POSTURE
- Begin movement by bending at the hips and the knees, keeping the feet flat on the floor, head and chest up, body balanced and spine maintaining normal lordotic curve
- Descend as far as possible while keeping spine in neutral position (slight curve in back)
- Keep knees over toes and heels on the floor
- Reverse movement on way up maintaining correct posture at all times

Teaching Points

- Stable body position
- Head and chest up
- Bend at knees and hips- bum out
- Keep heels on floor

Common Errors

- Heels lifting off floor- trying to keep back vertical (straight)
- Knees travelling excessively forward over toes
- Bending at waist and losing lordotic curve
- Head and chest dropping
- Heels lifting off the floor



SPLIT SQUAT

Instructions

- Rack should be slightly lower than shoulder height
- Step under bar and position it on upper trapezius muscles and back of shoulder
- Hands as close as possible to shoulders (depending on flexibility) with elbows pointing down
- Stand up and take one step backwards
- Assume a split stance position with one leg forward (non-dominant or weaker side first) and the other behind approximately a foot distance apart
- Shift weight forward over the front leg with the trail leg bent at the knee and resting on the toes
- Begin movement by bending at the hips and the knee, keeping the feet flat on the floor, head and chest up, body balanced and spine maintaining normal curve
- Continue to squat downwards keeping the weight on the front leg and the foot flat on the ground
- Descend as far as possible while keeping spine in neutral position (slight curve in back)
- Keep knee over toes and heel on the floor
- Reverse movement on way up by driving up and forward through the front leg, maintaining correct posture at all times, until fully erect

Teaching Points

- Stable body position
- Head and chest up
- Bend at knees and hips- bum out
- Keep heels on floor
- Push through the floor with front leg
- Back leg is for stability only

Common Errors

- Heels lifting off floor- trying to keep back vertical (straight)
- Knee travelling excessively forward over toes
- Bending at waist and losing lordotic curve
- Head and chest dropping
- Heels lifting off the floor
- Pushing weight onto back leg

Variations

- Can be performed with BB, DB or on Smith Machine



SINGLE LEG SQUAT

Instructions

- Rack should be slightly lower than shoulder height
- Step under bar and position it on upper trapezius muscles and back of shoulder
- Hands as close as possible to shoulders (depending on flexibility) with elbows pointing down
- Stand up and take one step backwards
- Stand with weight balance on one leg (non-dominant or weaker side first) and the other leg bent at the knee and lifted off the ground
- Begin movement by bending at the hips and the knee squatting downwards keeping the weight on the front leg and the foot flat on the ground
- Descend as far as possible keeping spine in neutral position (slight curve in back)
- Keep knee over toes and heel on the floor
- Reverse movement on way up by driving up and forward through the front leg, maintaining correct posture at all times, until fully erect

Teaching Points

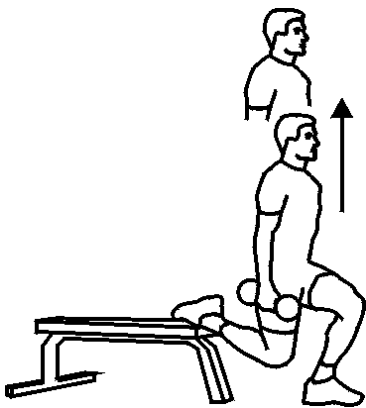
- Stable body position
- Head and chest up
- Bend at knees and hips- bum out
- Keep heels on floor

Common Errors

- Heels lifting off floor- trying to keep back vertical (straight)
- Knee travelling excessively forward over toes
- Bending at waist and losing lordotic curve
- Head and chest dropping
- Heels lifting off the floor
- Pushing weight onto back leg and performing split squat movement

Variations

- Can be performed with BB, DB or on Smith Machine



BB DEADLIFT

Instructions

- Grip the bar with hands in a pronated position and slightly wider than shoulder width apart (can use alternate grip one hand forward / back)
- Feet shoulder width apart with the bar positioned over the mid part of the foot
- Squat down keeping normal curve in lumbar spine, chest up, head facing forwards and shoulders over the bar
- Keep arms straight, hold scapulae down, and pull belly button in to stabilise trunk
- Commence lift by pushing through the floor with the legs and letting hips and knees rise at the same rate
- Keep bar close to shins
- When the bar clears the knees, continue to extend the legs and the lower back until body is fully upright
- Lower the bar under control keeping lower back slightly curved and the bar close to the body until the plates lightly touch the ground

Teaching Points

- Assume squat position over the bar, back slightly curved
- Bar over mid part of the feet and shoulder in front of the bar
- Push through the floor using legs, keeping bar close to the body and back tight
- Lower the weight under control keeping bar close to body

Common Errors

- Poor posture at starting position of movement: lower back rounded, head and chest forward
- Bar too far in front of the feet
- Shoulders not over the bar
- Bending arms to help pull the bar up
- Hips rising faster than knees
- Bar too far out in front of body
- Rounding the lower back at any stage of the lift
- Hyperextending the lower back at the top of the lift
- Head and chest dropping forward during descent phase of the lift





LEG PRESS

Instructions

- Position body in machine so that lower back is in normal posture
- Position feet shoulder width apart, keeping hips knees and toes in natural alignment
- Begin movement by keeping feet flat on the base plate and extending hips and knees
- Extend legs until fully straight but do not snap knees into hyperextension
- Lower weight under control under lower back begins to lose neutral curve

Teaching Points

- Keep lower back in neutral position against seat
- Hips, knees and toes in alignment
- Push through whole foot not toes
- Straighten legs completely BUT don't lock them out forcefully
- Lower weight until back comes off seat

Common Errors

- Lower back not fully supported against seat
- Hips, knees and toes not aligned- most common knees bend towards each other
- Knee joint being forcefully extended
- Pushing through toes and not heels

LEG EXTENSION

Instructions

- Position body so knees are opposite pivot point of machine, leg pad is just above the ankle joint, and back is in neutral position on seat
- Keeping upper body stable, contract quads to extend leg until fully straight
- Keep the toes dorsiflexed (pulled up towards shins) throughout the movement
- Lower the weight under control until knee angle is approximately 45o to the horizon

Teaching Points

- Body stable on machine
- Straighten leg fully under control
- Pull toe towards shin
- Lower pad to 45o

Common Errors

- Knee not fully extended at top of movement
- Lowering weight too fast
- Bending knee too far
- Not pulling toes up towards shins

LEG CURL

Instructions

- Position body face down on the machine so that knees are opposite pivot point of machine, leg pad is just on the Achilles Tendon, and back is in neutral position
- Stabilising the body on the machine, begin the movement by curling the pads towards the gluteals, keeping toes plantarflexed (pointed downwards)
- Curl the weight as high as possible keeping lower back in neutral position
- Lower the weight under control until leg is fully extended

Teaching Points

- Stabilise body on machine, lower back in neutral



- Curl heels up to bottom as far as possible
- Lower until knee is fully straight

Common Errors

- Pulling hips off bench, particularly at top of movement
- Arching lower back particularly at top of movement
- Not fully extending leg
- Using momentum to “kick” the weight up at the end of the movement

FLAT BACK DEADLIFT

Instructions

- Standing upright with bar across thighs, spine in neutral position, knees bent at 15o
- Commence movement by pushing hips backwards, keeping spine in neutral (lordotic) position and knees slightly bent
- Descend until a stretch is felt in the hamstrings or until lumbar spine begins to lose normal lordosis
- Reverse movement by concentrating on using hamstrings to rotate the pelvis / hips forward, keeping spine neutral, until body fully erect

Teaching Points

- Start with normal posture, knees slightly bent
- Push hips backwards, keep back tight / slightly curved
- Stop when spine begins to bend
- Use hamstrings to pull pelvis / hips forward

Common Errors

- Not maintaining normal posture throughout movement
- Knees being locked out
- Knees bending during movement (squat movement)

CHIN UPS

Instructions

- Assume a hand spacing slightly wider than shoulder width with forearms parallel to one another and thumb over the top of the bar
- Position body hanging straight down with spine in a neutral position
- Commence the movement by pulling the body up towards the bar, forearms remaining under the bar and elbows tracking slightly forward in the frontal plane
- Finishing pulling when bar is at chin level and shoulder blades are fully depressed
- Return to start position by following same path downwards with the arms being fully extended at the bottom of movement

Teaching Points

- Stable body position- head in alignment
- Arms fully stretched at bottom
- Pull with forearms underneath bar and elbows tracking slightly forward
- Pull to chin / clavicle with shoulders finishing down and not elevated

Common Errors

- Excessive arching of lumbar spine
- Commencing movement by kicking with lower body
- Elbows not pulling in a straight line
- Protracting chin towards bar at top of movement- taking chin to bar
- Hunching shoulders at top of movement- not depressing scapulae
- Not fully extending arms at bottom of movement

CLOSE GRIP CHIN UP

Instructions

- Straight bar: Assume a hand spacing with palms in a supinated position and shoulder width apart
- V- handle: Grip the handle with palms facing and thumbs over the top
- Position body hanging straight down with spine in a neutral position
- Commence the movement by pulling the body up towards the bar, forearms vertical and elbows being pulled down and back
- Finishing pulling when bar / handle reaches the upper chest and shoulder blades are fully depressed
- Return bar to start position by following same path downwards with the arms being fully extended at top of movement

Teaching Points

- Stable body position- head in alignment
- Arms fully stretched at top
- Pull with forearms underneath bar and elbows tracking forward
- Pull to upper chest with shoulders finishing down and not elevated

Common Errors

- Leaning too far backwards
- Elbows not pulling in a straight line
- Protracting chin towards bar at bottom of movement
- Hunching shoulders at bottom of movement- not depressing scapulae
- Not fully extending arms at top of movement



PULLDOWN TO FRONT

Instructions

- Assume a hand spacing slightly wider than shoulder width with forearms parallel to one another and thumb over the top of the bar
- Position body on machine with body slightly behind bar and knee pad at correct height, arms fully extended overhead
- Stabilise body with a slight curve in the lumbar spine
- Commence the movement by pulling the bar down towards the body, forearms remaining under the bar and elbows tracking slightly forward in the frontal plane
- Finishing pulling when bar is between chin and clavicle height and shoulder blades are fully depressed
- Return bar to start position by following same path upwards with the arms being fully extended at top of movement

Teaching Points

- Stable body position- head in alignment
- Arms fully stretched at top
- Pull with forearms underneath bar and elbows tracking slightly forward
- Pull to chin / clavicle with shoulders finishing down and not elevated

Common Errors

- Leaning too far backwards
- Commencing movement by pulling with lower back
- Elbows flaring out to sides /forearms not under bar
- Protracting chin towards bar at bottom of movement
- Hunching shoulders at bottom of movement- not depressing scapulae
- Not fully extending arms at top of movement

SEATED ROWING

Instructions

- Sit on the on the bench with legs almost fully extended, spine in neutral position with arms fully extended, scapulae slightly protracted
- Commence movement by pulling the handle towards the stomach keeping the elbows close to the sides
- Finish with elbows pulled back past the trunk and scapulae fully retracted and the body in an upright position
- Return the handle to the start position without leaning forward from the lumbar spine

Teaching Points

- Spine in neutral position throughout movement
- Arms fully extended at beginning and end of movement
- Keep elbows close to body
- Scapulae fully retracted at end of pulling



Common Errors

- Leaning forward from lumbar spine
- Pulling handles to chest and elevating scapulae / shrugging shoulders
- Not finishing pull with scapulae fully retracted

BB BENT OVER ROW

Instructions

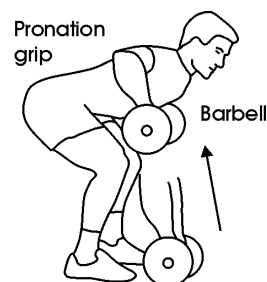
- Stand upright with hands spacing slightly wider than shoulder width on bar
- Assume a bent over position with knees bent at 150 and the trunk at 45-60o to vertical, spine in neutral position and bar hanging straight down
- Pull bar towards umbilicus (belly button), keeping elbows close to sides of body
- Finish pull with scapulae fully retracted
- Lower bar under control keeping spine in neutral position until arms fully extended

Teaching Points

- Body in stable bent over position- SPINE MUST BE IN NEUTRAL POSITION
- Pull bar to stomach, elbows close to body
- Arms fully extended at bottom of movement

Common Errors

- Spine not in neutral position, head looking up
- Pulling bar to chest, elbows out to sides
- Using legs to help commence / finish movement



DB ONE ARM ROW

Instructions

- Place same side knee / hand on bench with spine in neutral position and arm holding DB fully extended with palm facing body
- Begin movement by pulling DB straight up keeping elbow close to body
- Finish with elbow pulled back past trunk and scapula fully retracted
- Lower under control until arm is fully extended and scapula slightly protracted

Teaching Points

- Stabilised body on bench, spine in neutral
- Arms is pulled straight up elbow close to body
- Fully straighten arm at bottom

Common Errors

- Spine not stabilised in neutral position
- Arm pulled out from the side
- Trunk rotated at top and bottom of movement to assist completion



BB BENCH PRESS

Instructions

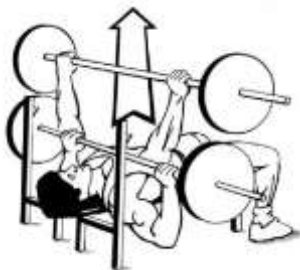
- Position body supine on bench, eyes slightly in front of the bar and feet on the ground UNLESS bench height leads to excessive lordosis
- Grip width on bar should be so forearms are parallel to each other
- Lift bar off rack and position bar above chin / neck and stabilise scapulae
- Lower the weight under control towards the mid chest / nipple line, keeping forearms under the bar and elbows tracking slightly forward
- Gently touch the bar on the chest and return to starting position by pushing the bar upwards and slightly backwards

Teaching Points

- Stabilise body: feet on ground, scapulae tight, head on bench
- Bar moves in a curved path from chin at top to mid chest at bottom
- Keep forearms under the bar and elbows slightly forward during movement

Common Errors

- Bar too far down the body at start or during movement
- Elbows flare out to side, shoulders hunch up during movement
- Head comes off bench
- Grip is too narrow / wide on the bar



DB INCLINE PRESS

Instructions

- Position body supine on bench, and feet on the ground UNLESS bench height leads to excessive lordosis



- Start with the DB together above the body with arms fully extended and palms facing down the body, scapulae stabilised
- Under control lower the DB out to the side of the body keeping the forearms under the DB, elbows moving directly out to the side
- Lower until a stretch is felt in the chest muscles and return to start position by pushing the DB together in an arc above the chest

Teaching Points

- Stabilise body on bench
- Weight stays directly over forearm and shoulder
- DB move in an arc from bottom position to above chest

Common Errors

- Too much elbow bend allowing DB to touch chest at bottom
- Elbows do not stay out to side- come forward
- DB are pushed straight up and then brought together at top rather than moved in a continuous arc

BB INCLINE PRESS

Instructions

- Position body supine on bench, eyes slightly in front of the bar and feet on the ground UNLESS bench height leads to excessive lordosis
- Grip width on bar should be so forearms are parallel to each other
- Lift bar off rack and position bar above chin / neck and stabilise scapulae
- Lower the weight under control towards the upper chest , keeping forearms under the bar and elbows tracking out to the side
- Gently touch the bar on the chest and return to starting position by pushing the bar straight upwards

Teaching Points

- Stabilise body: feet on ground, scapulae tight, head on bench
- Bar moves in a straight line over the upper chest
- Keep forearms under the bar and elbows out to the side during the movement

Common Errors

- Bar too far down the body at start or during movement
- Shoulders hunch up during movement
- Head comes off bench
- Grip is too narrow / wide on the bar

DB FLYS

Instructions

- Position body supine on bench and feet on the ground UNLESS bench height leads to excessive lordosis
- Start with the DB together above the body with elbows slightly bent and palms facing towards each other, scapulae stabilised
- Keeping the wrist, elbow and shoulder in alignment, lower the weight out to the sides of the body until a stretch is felt in the chest muscles
- Return the DB to the start position by contracting the chest muscles and pulling the arms together
- The elbows should remain bent to the same degree and the palms facing upwards throughout the entire movement

Teaching Points

- Stabilise body on bench
- Keep wrist, elbow, and shoulder in a straight line
- Keep elbow bent throughout movement

- Move DB in an arc, in a hugging motion

Common Errors

- Too much bend in the elbow during the movement, particularly at the bottom
- Not maintaining proper alignment of wrist, elbow and shoulder during movement usually DB dropping towards feet
- Palms being turned forward facing the feet during the movement

DIPS

Instructions

- Position body in between parallel dip handles, hands at side of body, arms fully straight and body in alignment
- Keeping spine in neutral position, commence exercise by bending at elbows and shoulders, leaning trunk slightly forward and lowering body towards the floor
- Lower body under control towards the ground, keeping elbows close to sides and weight evenly balanced until upper arm is parallel to ground
- Return to start position by straightening arms until body is fully upright

Teaching Points

- Stable body position, head in alignment, hands by side, arms straight
- Bend at elbows and shoulders, lean slightly forward
- Push through elbows and shoulders
- Body fully upright

Common Errors

- Spine not in alignment throughout movement
- Hunching shoulders
- Elbows flaring to side
- Uneven extension of arms



BB SHOULDER PRESS

Instructions

- Standing, feet shoulder width apart, normal posture
- Bar positioned across clavicles, hands outside shoulder width apart, palms forward
- Inhale breath and stabilise trunk
- Keeping forearms under bar, push bar upwards, keeping close to face, elbows slightly forward
- When bar clears head, start pushing slightly backwards until arms fully extended and bar is balanced over body
- Reverse movement on way down, keeping bar close to head
- Stop at level of clavicles

Teaching Points

- Stable body position
- Keep elbows under bar, elbows slightly forward
- Push slightly backwards when bar clears head
- Finish with bar over centre of balance



- Keep close to face on way up and down

Common Errors

- Push too far away from face
- Finish with bar in front of body / too far behind
- Allow elbows to flare backwards
- Drop bar past clavicles at bottom of movement

DB LATERAL RAISE

Instructions

- Standing, feet shoulders width apart, normal posture, slight bend at hips
- DB in front of the body with palms facing and arms slightly bent
- Keeping the palms facing the floor and elbows slightly bent, raise the DB away from the body in line with the shoulders until the elbow (DB) is slightly higher than the shoulder
- Lower the DB in the same movement arc under control

Teaching Points

- Stable body position
- Take DB out wide from the body
- Keep palms facing down to ground (little finger higher than thumb)
- Elbow (DB) to slightly above shoulder height

Common Errors

- Palm facing forwards during movement
- Swaying body backwards
- Elbow too straight too bent
- Elbows not high enough at top
- Shrugging shoulders too much at top of movement

DB/CABLE REVERSE FLY

Instructions

- Assume a bent over position with knees bent at 15o and the trunk at 45-60o to vertical, spine in neutral position and DB/cable hanging straight down, elbow slightly bent
- Commence movement by bringing DB/cable out to the side of the body in line with the shoulder
- Finish with the arm fully horizontally abducted, scapula retracted and elbow still slightly bent
- Lower under control until DB are straight down or cable is across body

Teaching Points

- Body stable in bent over position
- Arm pulls in line with shoulder / ear

Common Errors

- Spine not in neutral position, head looking up
- Pulling DB / cable handle towards legs
- Using legs to help commence / finish movement
- Rotating trunk to help start / finish movement

DB BICEP CURL

Instructions

- Stable body position
- DB positioned by sides, forearms supinated
- Keeping elbow locked against side, curl DB in an arc upwards until bicep fully contracted
- Lower under control, keeping elbow by side

Teaching Points

- Stable body position
- Keep elbows in and palms facing up, curl weight
- Keep elbows stable when lowering weight

Common Errors

- Body not stable / swaying
- Elbow moves from side, finishing with weight at chin level
- Failure to keep palm fully supinated

BB BICEP CURL

Instructions

- Stable body position
- Hands shoulder width grip on bar, palms supinated
- Keeping elbows locked against sides, curl BB in an arc upwards until biceps fully flexed
- Lower under control keeping elbows by sides

Teaching Points

- Stable body position
- Keep elbows against side and curl BB in an arc
- Keep elbows stable when lowering weight

Common Errors

- Body not stable / swaying
- Elbow moves from side, weight finishing at chin level



BB PREACHER CURL

Instructions

- Position body / arms on bench so that normal posture is maintained
- Using a shoulder width grip on the BB, lower the weight until elbows fully extended
- Curl weight towards body until forearm is 45° to horizon
- Lower bar under control until arms are fully extended, taking care not to hyperextend elbows

Teaching Points

- Keep body stable on bench
- Shoulder width grip lower bar under control until fully arms extended
- Keep elbows in contact with bench
- Raise BB to 45°, keep biceps under tension

Common Errors

- Not stabilising body properly
- Not fully extending arm
- Bringing weight too far up
- Pulling elbows off face of bench

TRICEP PUSHDOWN

Instructions

- Standing, feet shoulder width apart, body slightly leaning forward at hips • Hands shoulder width grip on bar
- Keeping elbows against side, extend forearm until fully straight
- Lower weight under control until elbows fully flexed without moving elbow from side

Teaching Points

- Stable body position
- Straighten arms smoothly until fully locked out
- Fully bend elbow at top
- Keep elbows against side at all times

Common Errors

- Not stabilising body
- Bending forward at hips to help extend arms
- Allowing elbows to come away from sides at top of movement
- Rolling shoulders at top of movement (scapulae elevation / protraction)





LYING TRICEP EXTENSION

Instructions

- Lying on a bench, arms extended, shoulder width grip
- Keeping upper arms stable, lower weight until bar reaches top of forehead
- Keeping elbows pointing straight ahead, return by straighten elbow until weight is positioned above chin

Teaching Points

- Stable body position
- Keep upper arms still
- Lower weight to top of head
- Keep wrists strong
- Straighten arms at elbow not using shoulder

Common Errors

- Not stabilising body
- Flaring elbows out to the side
- Moving upper arm to complete exercise
- Not stopping at forehead level (ouch!)

Variations

DB- As above except

- Allow DB to come down to shoulders

OVERHEAD TRICEP EXTENSION

Instructions

- Standing, feet shoulder width apart, normal posture
- Hands shoulder width grip on bar, arms extended above head
- Keeping upper arms vertical and elbows facing forward, lower the weight behind head until elbows fully flexed
- Contract triceps and extend forearm until weight is overhead

Teaching Points

- Stable body position
- Upper arms stable, elbows forward, lower weight behind head
- Straighten arms using triceps

Common Errors

- Not stabilising body- particularly hyperextension of spine
- Upper arm not remaining vertical
- Elbows flaring outwards

Variations

DB- As above except

- Allow DB to track at an angle behind the head

Cable- As above except

- Bend trunk at 60-70o- keep spine neutral
- Keep elbows close to ears



CLOSE GRIP BENCH PRESS

Instructions

- Lying on a bench, arms extended, shoulder width grip
- Keeping body stable and elbows close to sides of body, lower weight by bending at elbow and shoulder until bar reaches mid-chest
- Keeping elbows close to body, return by straighten elbow until weight is positioned above chin

Teaching Points

- Stable body position
- Elbows close to sides
- Lower weight to mid chest
- Keep wrists strong
- Straighten arms at elbow not using shoulder

Common Errors

- Not stabilising body
- Grip too wide
- Flaring elbows out to the side

Variations

- Lower bar to neck