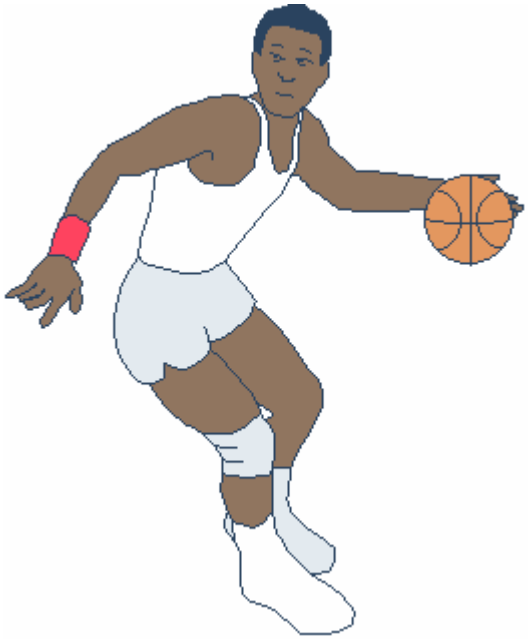
Mathematics Science Strand

Health and Physical Education

Module
H4

Human movement



Student Support Material

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PASTEP

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Contents

[Notes]

Unit overview

(Based on the National Curriculum Guidelines)

The shaded Module represents the one studied in these materials.

Unit	Code	Module
Health and Physical Education	**H1**	**Human Body**
	H2	**Diseases**
	H3	**Nutrition**
	H4	**Human Movement**
	H5	**Movement Skills**

This module is presented before the module H5 as it deals with fundamental movements and young child, skill acquisition, and fitness and exercise. The understanding of the important contribution of motor skills to children's overall development and factors within the child and the environment which contribute to motor development and skill acquisition.

Symbols used in these materials.

The symbols shown in the table indicate the type of activity to be completed while studying this module.

Read or research

Write or summarise

Activity or discussion

Safety note

First Aid procedure

Why study this module?

This module is designed to provide theoretical framework necessary for understanding skilled movement behaviour. It outlines some of the known underlying movement behaviour and processes that effect motor development. Knowledge of these behaviour and processes should contribute a greater understanding of motor development. It also enables students to identify important aspects to emphasise in developmentally based movement activities and programs for young children. Besides that the module also deals with personal fitness, performance and how people acquire skills in physical activities.

Objectives

At the end of this module students should be able to:

- classify and explain fundamental movement and fitness activities;
- explain movement behaviour of children from a developmental perspective;
- state how people acquire skills in physical education and sporting activities.
- Research and discuss the definition of fitness and exercise
- Perform varieties of fitness activities
- Plan and teach fitness activities in sequence
- Plan and teach the content in their Physical Education

Module content

Fundamental movement

The importance of motor skills and fundamental movement patterns

Analysis of fundamental movement patterns

Observing the fundamental movement patterns

Fitness

Physical fitness for health

Physical fitness for sport performance

Fitness and quality of life

Skill acquisition

Learning and skill performance; motor performance

Organisation of a skill, pacing and anticipation

Fine and gross motor skill; open and closed skills

Phases of skill learning

1. Fundamental movement

Introduction

Many movements involve in a similar manner in nearly all children. Nevertheless, the rate of progress and final behavioural appearance of the movement sequence may differ from child to child because it has now been accepted that skills develop at different rates and the elements or components of the skill may appear in different order in many children.

Changes in fundamental movement patterns are more likely to be observed in the components or elements of the movement pattern, some of which change more rapidly than others. For example, in the throwing pattern a child may be more mature in his or her upper arm action than in the lower limb action. A conflicting view of how fundamental patterns progress is that the total configuration changes abruptly from one level to the next because the child has developed more efficient movement coordination.

While this view may be valid, teachers will observe that children who are at a similar levels of development may not all have the components of their fundamental movement patterns because of different rates of development of coordination in the body parts that contribute to the patterns. There are, however, enough similarities between elements of a movement pattern to justify a child's movement patterns at a particular developmental level.

An important reason, for classifying fundamental movement patterns according to total body configurations, is that such a system can be used by teachers and professionals in the field to readily identify aspects of developmental delay or movement dysfunction in certain children. This is achieved by noting marked discrepancies in levels of postural stability, between coordination of the upper limbs or lower limbs, or in motor control.

The importance of motor skills

Children progress through the various stages of sensory – motor, perceptual - motor and cognitive - motor development by participating in a variety of movement experiences.

These processes increase their knowledge about their movements and help them develop a greater awareness of their bodies. This knowledge also improves their motor learning and motor control. Additionally, successful movement experiences enable children to develop a feeling of motor competence, which helps them to have a more positive attitude towards their physical ability. **Competent movement** is important to young children because it enables social contracts and interactions.

Competence in **fine-motor** and **gross-motor** skills is important because it enables children to:

- develop basic cognitive and cognitive-motor function
- physical changes in children;
- enhances emotional development in young children through successful movement experiences;
- Play games that incorporate large body movements provide real-life experiences;
- provide the opportunity for creativity through movement experiences.

Factors contributing to individual differences in motor development.

Factors within the individual that influence motor development include genetic or inherited potential, neurological functioning or neurological status and type of personality.

Genetic or inherited potential is an important factor because:

- it largely determines physique, rate of growth and maturation;
- genetic abnormality often results in a different sequence of motor development thus placing constraints on motor potential.

Neurological functioning or neurological status forms the basis for normal motor development since:

- normal reflex development and neural functioning is needed for normal motor development;
- reflexes constitute early movement patterns and form the units of movement; many of the fundamental gross - motor and fine - motor skills.

Cognitive functioning is important for the processing of movement - related information including:

- processing and motor memory, all of which become more efficient due to maturation and learning;
- improvement in cognitive - motor processes is demonstrated by more fluent and complex movement.

Personality often affects how much movement experience a young child will gain. For example:

- Many children enjoy meeting new movement challenges, which in turn means that they participate in a wide variety of movement experiences
- Over anxious children may miss out on normal play experiences because they withdrawn from new movement challenges.

- Children who are hyperactive or have attention-deficit syndrome (ADS) may have not learned as much as other children from free-choice movement situation.

Some environmental and learnt factors

Environmental stimulation is important because a stimulating movement environment encourages children to achieve their potential in physical and motor development.

Play and games are important learnt skills because:

- research has shown that children are accepted by other children in play situations on the basis of skill development rather than chronological or mental age;
- they allow children to practice previously learnt movement skills and attain others

Sport, dance and gymnastics are important external influences because

- games, dance and gymnastic skills enable children to practise the fundamental movement patterns and basic underlying movement processes;
- body control (i.e., postural stability, interlimb coordination, hand-foot-eye coordination, timing, sequencing and force of movement) is needed for game skills is first developed in informal childhood games and activities;
- complex sports skills require specific learning and practice.

Nutritional and health status is another important factor because:

- good nutrition should ensure that children grow normally and have sufficient energy and strength to participate in physical activities;
- malnutrition stunts growth and causes apathy and irritability.

Hierarchy of observable movement behaviour

Observable developmental changes can be ordered in a hierarchy progressing from relatively simple movement behaviours to complex skills. Table 1 summarizes this movement - behaviour hierarchy.

Hierarchy of observable movement behaviour

The hierarchy of movement behaviours starts with reflexes which the infants cannot control and progresses to highly skilled movement which are dependent on cognitive-control factors, a well - developed knowledge about the body and extensive learning in specific movement situation.

Progressive movement behaviour

1. **Reflexes** - neurally predefined movements trigged by a stimulus, e.g., grasping, sucking and balance reactions.

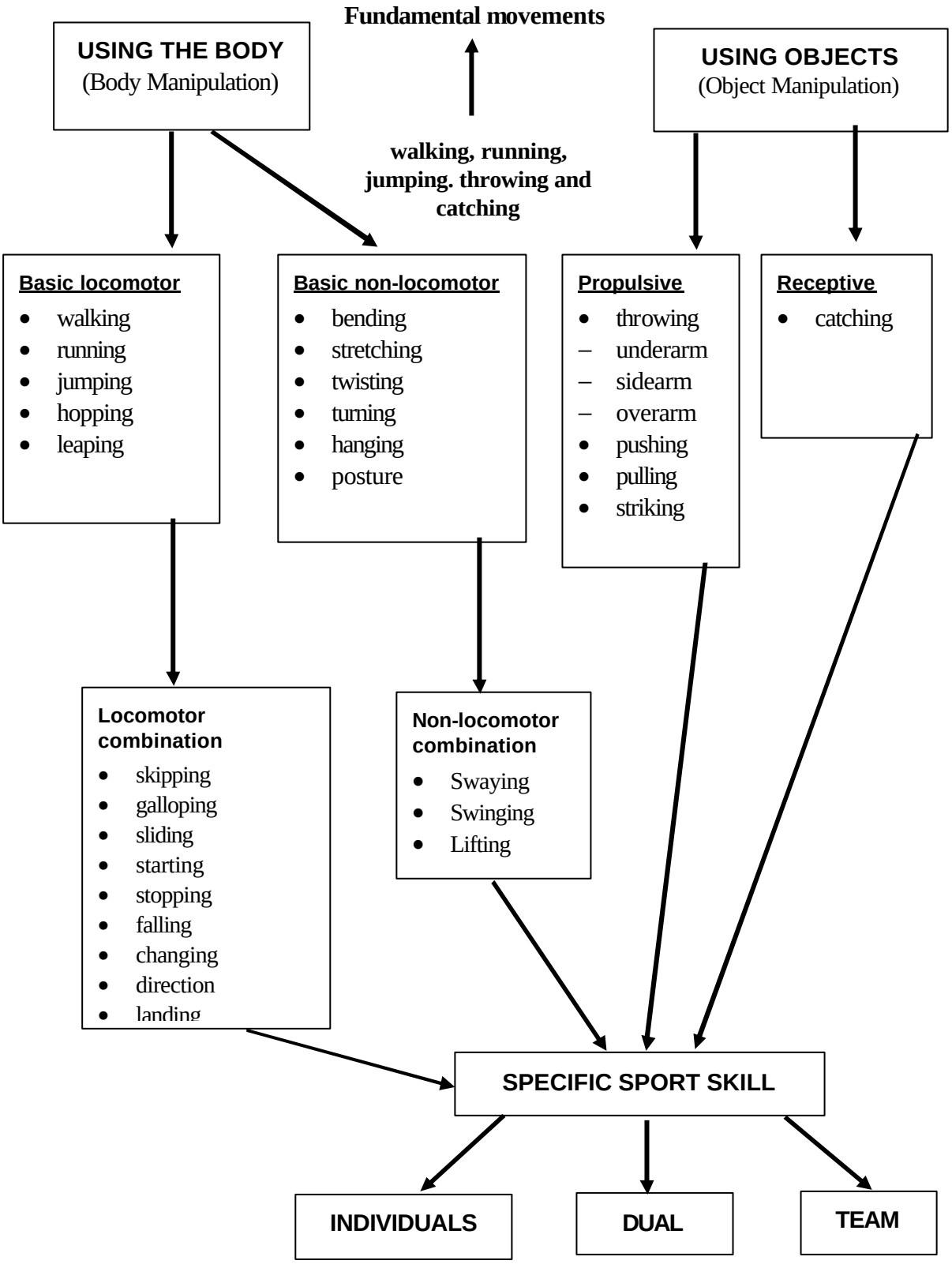
2. **Movement patterns based on reflexes** - automatic patterns incorporated into a movement sequence, such as those used in walking, prehension and maintenance of postural stability of the body against gravity.

3. **Intertask movement sequences** - a transition phase between early reflex - based movements and voluntarily controlled movements, e.g. by using developmental milestones, the child might change postures by rolling from the supine (back) to the prone (front) position, to sitting then standing to attain an upright posture.

4. **Intratask movement sequence** - the child acquires and refines movements within clearly defined movements such as walking, running, jumping, catching and throwing.

5. **Complex movement skills** - learnt movement sequences such as those used in ballet, windsurfing, gymnastics, cricket and tennis etc.

Figure 1. Fundamental movement pattern



Fundamental movement patterns

Early levels of fundamental movement patterns are more representative of early childhood (4 - 7 years); while more mature patterns are generally characteristics of middle childhood (8 - 12 years). Once the fundamental movement patterns are integrated into a child's movement behaviour, they are performed in an automatic fashion to achieve particular movement goal.

It must be remembered, though, that patterns are developmental so that the mature form represents a level of skill that is not only dependent upon a range of environmental and experimental factors, in particular, the extent of practice. This suggests that although mature levels in a movement sequence represents the most complex form of a particular movement pattern that generally may be achieved sometime during middle childhood, this mature form may never be attained by many people because of insufficient practice or physical, neurological or cognitive limitations.

Knowledge of the developmental progression of fundamental movement patterns is considered important for teachers and other professionals because it provides a qualitative measure of children's motor development. It also extends the understanding of children's movement behaviour beyond performance tests, which only gives a score of relative standing of children in comparison with age-referenced norms.

Knowledge of the developmental progression of children's movement patterns provides teachers with an observational tool, which can use to determine a child's level of development while he or she is playing. This is preferable to testing motor performance in more formal situations in which may not move normally.

Walking

Alternate movements of the lower limbs achieve walking or bipedal erect locomotion in humans, with one foot in continuous contact with the ground (Wickstrom 1983).

Running

Running is a fundamental locomotor pattern similar to walking in terms of limb pattern and in the transfer of weight from one foot to the other. The distinctive characteristic of running is that there is a period during the circle of the leg movement when neither foot is in contact with the ground (non-support or air borne phase). Running is actual a series of jumps with the body weight supported on by one foot, followed by an air borne phase, then supported on the opposite foot (Wickstorm 1977, 1983).

Jumping

Jumping is characterised by the ability to extend one or both legs with enough force to catapult the body into the air. Jumping is more complex locomotor movement than running, mainly because the body is airborne for a longer time.

Catching

Catching is defined as the action of the hands and upper body to stop an object that is travelling through the air (Wickstrom 1983). It is a fundamental gross - motor manipulative skill.

Throwing

Throwing is a cross motor manipulative skill that involves projecting an object into space by using one or two arms (McClenaghan & Gallahue 1978; Wickstrom 1977).

Analysis of control changes in the fundamental movement patterns

Changes in fundamental movement patterns can be analysed in terms of:

- increased development of stability control (postural and balance);
- interlimb control in terms of moving individual limbs, limbs on one side of the body (unilateral), both legs or both arms in a different action (bilateral), or limbs on one side of the body counteracting the movement of the limbs on the opposite side (contralateral);
- motor control (in terms of timing, force and sequences of movements).

In addition, there are observable changes in motor performance, from jerky inconsistent movements to organised sequences of movement skill. This partially explains why a young child's movements are often inaccurate and jerky. Despite the constraints on skilled movements, most people attain a high degree of movement skill in many areas.

The changes in stability control, interlimb control and motor control that can be observed in the fundamental movement patterns of walking, running, jumping. Catching and throwing are discussed in following paragraphs.

Stability control

Stability control refers to the ability to maintain alignment of body parts while stationary and during movement. Initial postural stability is the result of normal maturation of postural reflexes and normal muscle tone. This is followed by the ability to integrate visual, kinaesthetic and vestibular information with increasing cortical control over balance.

Interlimb control

Increasing control over upper and lower limbs can be traced in children as they progress through the levels of the fundamental movement patterns. For example, in the early levels of walking and running, the upper limbs may move slightly but they are not moved to counterbalance opposing bodily forces, yet at the same time there is increased consistency in the movements of the lower limbs. In the early levels of running and walking it is apparent there is greater control first in coordination of the lower limbs. There is also evidence of separate upper or lower limb control, which precedes unilateral control (control of both limbs on the same side of the body). These come before bilateral control (upper and lower limbs performing a different movement pattern) and contralateral control of the upper and lower limbs as a unit from opposite sides of the body.

Motor control

Advanced motor control, which is necessary for all skilled movement, is demonstrated in more mature levels of fundamental movement patterns. Motor control factors also can be studied by examining such parameters as spatial accuracy, timing and force components of the movement and the child's ability to sequence movements. By using these components to analyse children's fundamental movement patterns, teachers can gain more precise description of the quality of children's movement.

Conclusion

Changes in the fundamental movement patterns are largely due to the control factors which have been outlined: better stability control, improved interlimb control and improved motor control as shown by consistency of action and ability to generate novel movements. Additionally, motor control is demonstrated by more consistent phasing (internal timing of the components that make a pattern of movements) and increased ability to incorporate more movements in sequence and more appropriate external timing of the movement to meet the environment demands.

Guide lines for observing the fundamental movement patterns

As discussed previously, the fundamental movement patterns can be used as an assessment tool in a contextual setting. The following guidelines are presented to help teachers effectively observe the fundamental movement patterns.

To collect reliable data, observe children in natural play settings whenever possible. Children may become nervous if they know they are being tested.

☞ *Activity 1. Observing.*

1 *First, observe the child's general body appearance to ascertain an overall level for each of the child's fundamental movement pattern.*

2 *Next, observe the action of the upper and then the lower limbs to ascertain if there are any discrepancies between levels in these elements.*

3 *Try to ascertain the child's level of stability, interlimb and motor control*

4 *Note whether the child has reached similar developmental levels in all of the movement patterns or whether there are marked discrepancies in levels of locomotor skills in comparison with manipulative skills and practices both types of skills, then it is possible that the child is demonstrating a hand-eye coordination problem. Similarly, if the manipulative skills are markedly more advanced than the locomotor skills, then the child may have stability-control or interlimb-control problems.*

5 *To observe the true level of developmental movement patterns, encourage children to run as fast, jump as far and throw as hard as they can.*

6 *When you want a more objective assessment of a child's developmental levels you may use the observation summary, which is detailed in the next section, for each of the levels of walking, running, jumping, throwing and catching.*

7 *Use your observations of the children's developmental levels and stability, interlimb and motor control to help you plan developmentally appropriate activities.*

Observational check lists of the fundamental movement patterns

Each of the fundamental movement patterns has been divided into four levels. It is important, however to remember those children may not always progress through these levels in a set sequence. For example, you may find that a child has a less advanced lower-limb action and a more advanced upper-limb action than you would have expected for his or her age. Furthermore, you may find that a child is consistently above or below the developmental levels of his peers in some or all of his movement patterns. This information will be important for your subsequent movement-program strategies for that child.

Developmental levels of walking

Level 1: Approximate age 12 - 14 months

General body appearance: The body is held rigid and forward progression is jerky. There also is marked side-to-side sway as the child tries to maintain a balanced position.

Lower limbs: The child takes short steps, usually with a bent knee and a high, stepping action and heavy flatfoot contact with the ground. The forward leg is bent at the knee on contact with the ground. There may be out-toeing of the feet. *Upper limbs and trunk:* The child's trunk is inclined forward at an angle from the hips. Arms are held well above waist level, bent at the elbow and are usually rigid (high guard position).

Observational summary

1. Stiff movement, frequent falls, large amount of sideways sway.
2. High, bent-knee, forward-stepping action; flat-foot contact with ground
3. Wide base of support.
4. Out-toeing of feet.
5. High, rigid, bent-arm position.

Performance criteria

- Stride length measured heel-to-heel is about 25 cm.
- The width between the placement of the feet is much greater than the width of the trunk.

Level 2: Approximate age 2 years

General body appearance: Less muscle tension evident so progression is far less jerky.

Lower limbs: Base of support is about the same width as trunk. There is greater consistency of stride both in action of each leg and length of stride. The exaggerated high-stepping action has disappeared. The forward leg 'locks' at the knee on contact with the ground. Heel-to-toe foot contact with the ground has developed and there is no marked out-toeing of the feet.

Upper limbs: The arms are held at the side but there is very little arm swing.

Observation summary

1. Body held erect; absence of marked sway with each step.
2. Knee 'locked' on ground contact of forward leg; moderate width base of support.
3. Heel-to-toe foot contact with the ground, moderate out-toeing.

4. Consistency in walking speed, stride length and action on each leg.
5. Arms held by side with little swing.

Performance criteria

- Stride length approximately 30 cm.
- Base of support equivalent to shoulder width.

Level 3: Approximate age 4 - 5 years

General body appearance: All elements of the mature pattern should be present. There is consistency of leg action and only a small up-and-down action with each step.

Lower limbs: Smooth transfer of weight owing to heel-to-toe contact of the forward leg. On contact with the ground the knee of the forward leg is slightly bent. This is immediately followed by extension or straightening of the forward leg. The knee also is locked, i.e. straight, during the support phase. There is a small amount of pelvic rotation to facilitate transfer of weight.

Upper limbs: There should be arm swing in the opposite direction to the forward leg (contralateral action), though synchronised arm action may not be very well developed at this level.

Observation summary

1. Body held erect with little sideways or up-and-down movement.
2. Base of support narrower than the trunk. Heel-to-toe contact with the ground.
3. Double knee lock during two steps, i.e. a knee lock of the forward leg after contact with the ground and on the support leg during the forward-swing phase.
4. Consistency in action of leg movement and stride width.
5. Arms by side, some contralateral swing.

Performance criteria

- Stride length approximately 40 cm.
- Walking on a balance beam is an extension of this basic locomotion pattern.

Level 4: Mature pattern (approximate age 7 years onwards)

The mature pattern of walking is characterised by a smooth rhythmical action. There is a consistent stride length. Arms and legs move opposite to counteract lateral rotation of the body. The feet swing close to each other, i.e., narrow base of support with only slight out-toeing.

Observation summary

1. Cadence, i.e., stepping speed, is slower than in earlier levels.
2. Support phase, when each foot is in contact with the ground, is for a longer period than earlier levels.
3. Muscles of the lower limb are controlled as a unit.
4. The lower-limb patterns (ankle-knee-hip mechanisms) rapidly adjust to changes in environment conditions.
5. Smooth contralateral arm swing.

Developmental levels of running

Level 1: Approximate age 18-24 months.

General body appearance: Stiff gait; probably not a true run because there is no period in the leg cycle when both feet are off the ground (airborne).

Lower limbs: Legs seem stiff because there is little knee bend in the movement. There is flatfoot contact with the ground and stride length is uneven and fairly short (about the same distance as the width of the shoulders). When viewed from behind, the recovery leg is swung outward then around and forward, slightly across the midline of the body. This causes the characteristic out-toeing of the forward swinging leg. The trunk is inclined forward. There is quite marked pelvic rotation as the child tries to maintain balance.

Upper limbs: Arms are held at shoulder height, with little or no arm swing. There is more forward arm swing, if present, then backward swing but there is only a slight amount of elbow bend on the forward swing.

Observation summary

1. Airborne phase.
2. Stiff bouncy action.
3. Small amount of knee bends.
4. Feet remain close to ground with appearance of out-toeing.
5. Marked pelvic rotation.
6. High arm position, little or no swing.

Performance criteria

- Cannot stop or turn very well.
- Steps are uneven and the base of support is narrower then the width of the child's shoulders.

Level 2: Approximate age 2 - 3 years

General body appearance: A smoother movement progression is achieved at this level. The child exhibits a true running action since there is a period in the leg cycle when both feet are off the ground (airborne phase).

Lower limbs: Leg action appears more fluent; mainly because there is greater knee bend of the leg moving forward and stronger push-off from the support leg which propels the body further than in level 1.

Hence there is increased stride length. There may still be flatfoot contact with the ground, but less evidence of out-toeing as the forward leg swings in more of a backwards-and-forwards action than previously. Leg action is quite proficient. When viewed from behind, there is still marked pelvic rotation at the start of the forward swing of the leg, but less obvious out-toeing of the foot.

Upper limbs: The arms are held at about waist height and are used less for balance. Arm swing is not as proficient as the leg action in terms of amount of backward-and-forward swing, Trunk position is similar to that of the mature level.

Observation summary

1. An airborne phase.
2. Longer stride and fluent action
3. Greater knee bent as leg moves forward. Flat-footed contact with ground.
4. Still marked pelvic rotation but foot position is straighter than before.
5. Arms waist-height, but generally there is a restricted range of movement.

Performance criteria

- Some ability to stop and turn
- Each stride is about the same length; base of support is narrower than the width of the child's shoulders.

Level 3: Approximate age 3 years 6 months - 5 years 6 months.

General body appearance: Efficiency in running performance is characterised by effective use of arms and legs, greater forward progression and little up-and-down action of the body. The child can now stop and turn while running.

Lower limbs: A powerful fast action of the back leg on pushing off from the ground increases stride length but also causes rotation of the body so that the back foot appears to swing into the middle of the body in many children. Other children have a maturer pattern than the previous level but less powerful push-off and show less rotation, they also cover less ground with each stride. The foot action on ground contact is usually from the heel to toe. On the forward swing

phase the knee is bent at 90 degrees. **Note:** The more powerful the run at this level the more marked the pelvic rotation.

***Upper limbs**:* Arms are below the waist level and are swung effectively, both backwards and forwards, in opposition to the leg movement though one arm is often swung more than the other.

Observation summary

1. Long airborne phase.
2. Smooth forward progression, i.e. less vertical movement than horizontal.
3. Knee bend to 90 degrees. Feet lifted high off the ground. Back leg may appear to swing in towards the middle of the body.4. May still be marked pelvic rotation in some children, especially those with a powerful action.5. Arm swing forward and backwards with slightly bent elbow. The arms are used to counterbalance the leg action. One arm may be swung more than the other.

Performance criteria

- Normal speed for 5-year-olds is 3.5 m per second for girls and 3.7 m per second for boys.
- Can accomplish a 180-degree turn in four to eight steps (3/4 of these reversals is to the left).

Level 4: Mature pattern (approximate age 7 years onwards)

In the mature pattern there is maximum forward progression with a slight forward lean of the trunk. There is extension of the back leg at an angle of about 45 degrees to the ground, followed by high knee-raise during the swing phase of the forward leg, which causes the back foot to lift high off the ground. The arms counterbalance the leg action and are swung in almost a straight line forward and back with a bent elbow.

Observation summary

1. Extended airborne phase.
2. Long stride with decrease in relative vertical movement with each stride.
3. Marked flexion of ankle, knee and hip joint during the swing phase. Heel-toe or sometimes toe-first contact with the ground. Marked extension of back leg during take-off phase.
4. Little pelvic rotation and an increase in amount of time spent in non-support phase.
5. Arm swing initiated at the shoulder joint and moved in an action with a bent elbow.

Developmental levels of the two-foot jumping pattern

Level 1: Approximate age 18 - 30 months

General body appearance: Body is held in upright position as the child steps down from a low height. At this level the child is really stepping, not jumping. The arms also are still being used in opposition to the leg movements as in the walking and running pattern. This is followed about 2 years to 2 years 6 months of age, by the child coordinating a two-foot take-off with an initial lean of the body at the start of the jump. This is the first true jumping pattern

Lower limbs: Legs extended almost together in the take-off phase of the jump. Landing on both legs some of the time, with the force of the jump on landing being absorbed by a deep squat. After landing at this level, the child regularly falls forward.

Upper limbs and head: After take-off, the child's arm are slightly retracted in a 'winging' action (almost birdlike appearance) and brought back to the side of the body on landing. There is little head-tilt adjustment throughout performance of this pattern.

Observation summary

1. Body held upright during the jump.
2. One-foot take-off to a one-or two-foot landing.
3. Brief airborne period (true jump).
4. The beginnings of the 'winging' arm action, when both arms are moved slightly back during airborne phase.
5. Little or no head movement.

Performance criteria

- Jump from one foot to the other from a 60 cm height by 2 years.
- Jump off floor vertically with both feet and land on both feet by about 2 years 3 months.

Level 2: Approximate age 2 years 6 months - 3 years 6 months.

General body appearance: Before take-off the child assumes a squat position with the upper trunk inclined forward. Body is projected more at an angle and higher in the air than level 1.

Lower limbs: From the crouch position, the legs are straightened quickly and simultaneously to propel the body into the air. Then the legs are bent back approximately 45 degrees during the flight phase of the jump. Legs are swung forward still bent in preparation for a squat landing (often with the hands and arms place on the ground on landing)

Upper limbs and head: There is a distinctive pattern with the arms, called 'winging'. After the squat take-off, the arms are swung backwards and sideways to resemble bird wings. The forward movement of the arms only occurs as the child is about to land. The head may be tilted backwards during the flight phase of the jump, apart from this action there is little adjustment of head position to counterbalance changes in body position.

Observation summary

1. Squat position before take-off.
2. Trunk inclined forward throughout the jump.
3. Legs straightened on take-off and then bent backward during flight and bent on landing.
4. The jump is from a two-foot take-off to two-foot landing.
5. Characteristic marked winging action of the arms.

Performance criteria

- By 3 years of age, children can jump from a 30 cm height with both feet together.
- Standing long jump 36-60 cm.
- Over 50 per cent of children can handle jump approximately 9 cm.
- Approximately 33 per cent of children can hurdle jump a height of 25 cm.

Level 3: Approximately age 4 years 6 months - 6 years

General body appearance*:* Greater lean forward of trunk during take-off and fight phase of jump (especially good jumpers). Children of this age still find it difficult to synchronise leg and arm action. The arms in particular show less degree of mature coordination pattern than the legs.

Lower limbs: Well-coordinated take-off from two foot, with straight legs, followed by legs bent backwards to almost 90 degrees during the flight phase. Legs are swung forward bent and this is followed by straightening before landing in the squat position (unlike the easier level). Some children still do not coordinate a two-foot landing when trying to jump forcibly.

Upper limbs*:* Although not coordinated as well as the legs, the arms are swung forward to take-off. They are then held in varied positions during flight, such as arms straight in front, at about shoulder height, or extended sideways in a 'semi-winging' action. Head tilt is well synchronised to counterbalance changes in body position.

Observation summary

1. Body inclination of about 45 degrees on take-off from squat position.
2. Generally well-coordinated leg action from two-foot take-off, but on a forcible jump, the two-foot landing may not be so well coordinated.
3. Legs straightened then bent backwards to about 90 degrees during flight, then swung forward and extended before squat landing.
4. Arms swung through from beside the body to front horizontal or slightly sideways position.
5. Head adjustment to body position changes.

Performance criteria

- Standing jump a distance of 60 - 85 cm.
- By 4 years of age, 50 per cent of the children can hurdle jump an obstacle of approximately 25 cm.
- By 5 years of age, nearly 70 per cent of children can hurdle jump an obstacle of approximately 35 cm.

Level 4: Mature pattern (approximately 7-10 years onwards)

The mature two-foot jumping pattern is characterised by complete synchronisation of arms, legs and head. There is marked trunk inclination during flight. Arms are extended above the head during flight while the legs are bent, then extended forward to give a balanced landing. Legs are swung forward from the flight phase to full extension before landing.

Observational summary

1. Nearly half the time taken to perform the jump is spent in movements made preparatory to take-off, during flight and on landing.
2. Less body angle at take-off and landing than the previous level.
3. Marked hip and ankle flexion and knee and ankle extension, when compared with previous levels.
4. More effective use of arms in the jumping pattern.
5. Head adjustment to counteract changes in body position.

Developmental levels of catching

Level 1: Approximate age 2-3 years

General body appearance*:* Note: Before 3 years of age, most children will not respond to a ball thrown at them unless they are told how to position their arms. The following description applies to catching a large, light ball. The child stands

facing the thrower with arms extended at waist level, palms facing upwards and hands about shoulder-width apart.

***Lower limbs**:* There is little or no lower-leg movement.

***Upper limb**:* If the ball is tossed gently into the child's outstretched arms he or she will scoop it in towards the body.

Observation summary

1. Child faces thrower and scoops the ball into the body in a robot-like action.
2. Hands and arms are outstretched at waist height ready to receive the ball.
3. There is little or no leg movement.
4. Feet are placed slightly apart and parallel.
5. The ball is scooped in and trapped against the body.

Performance criteria

Can only catch large, light ball, which is tossed slowly and accurately into the child's arms.

Level 2: Approximate age 4-5 years

General body appearance: Stance similar to level 1. At this level, characteristically the arm extended wide apart ready to be brought forward to catch the ball in a clapping action.

Lower limbs: Little or no movement.

Upper limbs: The arms are held out sideways at about waist level, they are relatively straight, with palms upward and fingers spread apart. Contact with the ball is made by a clapping action, and then the ball is scooped in towards the body.

Observation summary

1. Child faces thrower in a stiff stance.
2. Arms held out sideways at waist level, with the fingers spread apart.
3. Little or no leg movement.
4. Feet slightly apart or parallel.
5. Ball caught with a clapping, then a scoop action.

Performance summary

- Can catch a large, softball if it is thrown accurately and slowly.

Level 3: Approximate age 5-7 years

General body appearance: There is some body movement during the action, though generally the body is straight, with arms extended and higher than waist level. The elbows are bent and hands held close together at about chin height.

Lower limbs*:* Feet are slightly apart, one foot may be in front of the other. The knees are bent, so the child assumes a semi-squat position to catch the ball.

Upper limb*:* Before catching the ball, the arms are extended, elbows are bent and hands are held at about chin height and close together. On contacting the ball, the hands are drawn in closer to the body.

Observation summary

1. Child faces thrower in an alert but relaxed stance.
2. Arms are held higher than waist level, elbows bent, hands together.
3. Legs are bent at the knees to assume a semi-squat position to catch the ball.
4. On catching the ball, the hands are drawn in towards the chest and the trunk is inclined forward.
5. In the final position, the ball is held in front of the body, the trunk is inclined forward, with the legs in a semi-squat position.

Performance criteria

- Children can generally catch a tennis ball, thrown at a distance of 2 m about two to four times out of the five tries.

Level 4: Mature pattern (approximate age 8-10 years)

The mature catching pattern is characterised by the person moving forwards with outstretched hands to a position where he or she will intercept the flight of the ball. As the ball is caught there is a backward or sideways movement of the arms and shoulders in line with the flight of the ball to absorb the force of the ball.

Observation summary

1. Person faces thrower, alert and with knees slightly bent and feet apart.
2. The arms are held at the waist level, elbows bent and fingers angled ready to receive the ball.
3. There is extensive leg movement to ensure the flight of the ball is intercepted. The ball is often caught with legs wide apart, or one leg in front of the other but either way the ball is caught in a semi-squat position.

4. The ball is caught with extended arms well away from the body.
5. The ball is caught with a symmetrical arm action and an asymmetrical or sideways leg action.

Developmental levels of throwing.

Level 1: Approximate age 2-3 years

General body appearance: Child faces target and performs the throwing action mainly with the arms. Slight body sway may occur at the end of the backswing and on release of the object.

Lower limbs: Characterised by little or no movement; the feet stay parallel and slightly apart throughout the throw.

Upper limbs and trunk: The force of the throw is dependent upon the upper-arm action. At the start of the throw, the throwing arm is lifted either sideways or upwards and is then moved behind the body, the elbow is bent so a small object is held about level with the ear. The arm is swung forward and down from this position to release the object.

Observation summary

1. Child faces square on to the target.
2. Slightly sway of the trunk, forward and back in synchrony with arm action.
3. Little or no leg movement.
4. Feet slight apart and parallel to the target.
5. The force of the throw is dependent on the backward and forward movement of the throwing arm.

Performance criteria

- Can stand and throw a 22 cm circumference ball about 1.5 to 2 m.

Level 2: Approximate age 3 years 6 months - 5 years

General body appearance: Child still faces the target squarely to initiate the throw. The throwing sequence has changed so that (for a right-handed throw) there is marked trunk rotation to the right on the backswing and to the left on the forward swing.

Lower limbs: Legs are generally straight and feet are parallel and together throughout the action.

Upper limbs: The right arm is swung backwards and sideways (right-handed throw). The backswing is accompanied by rotation of the upper body to the right. The actual throw starts with a forward swing of the arm, the trunk rotates to the left and the forearm is extended forward before the object is released from the hand.

Observation summary

1. Child faces square on to the target.
2. Little or no leg movement. Feet together and parallel.
3. Moderate amount of trunk rotation: to the right on the backswing and to the left on the forward swing (right-handed throw).
4. Main throwing action is confined to the trunk and arm movement.
5. Forearm is extended in front of the body before the object is released.

Performance criteria

Can throw a 22 cm circumference ball a little more than 2 m at 3 years 6 months and about 4 m at 4 years 6 months.

A 40 cm circumference ball is generally thrown a little less than 2 m at 3 years 6 months and about 2.5 m at 4 years 6 months.

Level 3: Approximate age 5-6 years

General body appearance: Preliminary movements are similar to level 2. The characteristic feature of this level of throwing is a step forward on the foot on the same side as the throwing arm, accompanied by release of the object.

Lower limbs: Feet parallel and together at the start of the throw. The throwing action starts with a forward step on the same side as the arm being used to throw the object.

Upper limbs: The backswing is accompanied by rotation on the same side of the body, as the arm that is used in the action, then there is rotation to the opposite side on the forward swing. In the throwing action the forearm is swung through further than the previous level, before the object is released.

Observation summary

1. At the start of the throw the body faces square on to the target.
2. Feet parallel and together at the start of the throw; apart at the end of the throw.
3. Characteristic step forward in the throwing action is on the same side as the throwing arm.
4. Arm action is accompanied by trunk rotation.
5. Forearm is extended straight in front of the body before the object is released.

Performance criteria

- Can throw a 22 cm circumference ball about 10 m.
- Can throw a tennis ball to hit a 25 cm diameter target placed at eye level 1.5 m away, two to three times out of the five throws.

Level 4: Mature pattern (age 7 years in boys, older in girls)

In the mature pattern, the body is side-on to the target, with the same leg back as the throwing arm. At the start of the throw the weight is rocked onto the back foot, the arm is swung backwards with marked trunk rotation and the elbow is bent at right angles. The throw forward is initiated by a step forward of the leg on the opposite side to the throwing arm. The upper trunk is rotated around towards the front foot, the arm is whipped forward with the elbow bent at right angles, and then the forearm is straightened prior to the release of the object.

Observation summary

1. Unilateral, side-on position of the person to the target prior to the start of the throw.
2. Feet apart at the start and at completion of throw.
3. Contralateral stepping action, in opposition to the throwing arms.
4. Marked trunk rotation and horizontal adduction of the arm during the throwing action.
5. The forearm is parallel to the ground and the elbow is flexed at about 90 degrees during the forward swing and is the fully extended before the ball is released.

Summary

In this review the fundamental movement patterns have been analysed according to observations of changes in stability, interlimb and motor control. Observational guidelines, in form of checklists have been presented for walking, running, jumping, catching and throwing. The information to be gained from observing children's fundamental movement patterns can help teachers and other professionals determine the developmental status of children, as well as provide information which can assist in the choice of developmentally appropriate movement activities for children.

2. Fitness

You hear the word 'fitness' used everyday, either in conversations, on television or radio, or in newspapers or magazines. Yet probably you are not quite sure what it means, how do you know if you are fit, anyway. This part of module will answer questions such as ;

** what is fitness? * Am I fit? * How can I become fit?*

☞ *Activity 2. Fitness*

Read the following examples that use the words 'fit' or 'fitness'. Discuss what the word means in each case.

Examples:

- Nick must be fit. He is a good runner.
- George plays soccer, so he must be fit.
- Luke is a top swimmer, so his fitness is excellent.
- Mark is fit. He chops piles and piles of firewood.
- Mike's fitness is excellent. He lifts weights at the gym.

As you see, fitness can mean many different things. The fitness that Mike develops at the gym is completely different to Nick's fitness, while George is developing a different fitness again.

What is fitness?

You need to stop using the word 'fitness', because it is too vague. Instead you need to refer to **'fitness components'** (parts). They are the types of fitness you can develop by exercising in different ways. From now on, we will use the names of the fitness components, not the general word 'fitness'. Before exploring each fitness components in detail, you need to understand how your muscles produce energy.

Energy production inside your body

Your muscles need energy to contract (shorten) and therefore produce movements. There are two ways your muscles can make this energy.

- Anaerobic energy production (without oxygen)
- Aerobic energy production (using oxygen)

Anaerobic energy

When your muscles need quick, explosive energy for sprints, jumps, or throws, they use the carbohydrates from the food you have eaten. That energy is stored in your muscles. Unfortunately, explosive energy production often leaves you feeling sore, because anaerobic energy production leaves, a toxic waste called lactic acid in your muscles.

Aerobic energy

When your muscles need for steady-paced, long activities such as jogging or cycling, they create aerobic energy. The muscles use their stores of carbon-hydrates and fats taken from the food you have eaten and combine them with the oxygen you breath in to make the energy.

Since physical fitness means different things to different people. We can talk about two types of physical fitness:

1. **Physical fitness for health (health related)**
2. **Physical fitness for performance in sports.**

Physical fitness for health

Physical fitness for health means:

- having our body systems work efficiently
- having able to move with ease and enjoyment.

There are several ways in which physical fitness improves the functioning of our body systems.

- **cardiovascular system,**
- **respiratory system.**
- **muscular system.**

Cardiovascular system

Fitness increases the strength of the heart. Fit people tend to have hearts that beat more slowly, lessening the strain on this vital organ over a lifetime. Blood vessels are usually in better condition, which increases the supply of blood to muscles and tissues, thus increasing the body's food supply and creating energy and endurance.

Respiratory system

Fit people tend to have stronger muscles to aid the lungs, thereby increasing oxygen supply to the body

Muscular system

All muscles perform better in fit people giving them greater endurance, strength and agility and improving the functioning of the digestive system and other body system.

The components of fitness for health

To achieve physical fitness for health, the following components are essential:

- **cardiovascular endurance**
- **muscular endurance**
- **strength**
- **flexibility.**

Cardio-vascular endurance is sometimes referred to as cardio-respiratory endurance because it involves the lungs, the heart and blood vessels. Cardiovascular endurance *is the ability to exercise for a long period of time without running out of breath or becoming tired.*

Our health depends on the heart, lungs and blood vessels to deliver oxygen and nutrients to the muscles and organs of the body and to remove carbon - dioxide and wastes. An athlete with good cardio-vascular endurance has:

- a strong heart
- a slower pulse rate, which means the heart does not have to beat as often
- lower blood pressure
- larger lung capacity, allowing more oxygen to be taken up by the blood

Muscular endurance *is the ability to use the muscles repeatedly without getting tired.* Muscular endurance is needed for good posture and everyday activities such as carrying your bag to school and working in the garden. In sports such as cross country running, football and netball, the muscles are continually being worked. Long distance runners, swimmers, rowers and cyclists must also have good muscular endurance. Muscular endurance relies on aerobic energy.

Strength refers to the maximum force exerted by a muscle against a resistance - for example when weightlifting, shot putting, doing chin-ups or jumping to take a spectacular mark. Strength and power relies on anaerobic energy. This depends on:

- size of muscle
- ability of the nervous system to activate the muscle
- good co-ordination

Flexibility is the ability of your muscles, ligaments and tendons to stretch so that your joints allow large movements with ease or move through its full range of movement. Being able to bend, stretch or twist easily indicates a high level of flexibility. This improves performance and lessens the risk of muscle injury and soreness. Flexibility is very important if you are to avoid injuries when playing sport or performing domestic jobs.

Physical fitness for sport performance

Although every sport has some particular components that is more important then another, to achieve all-round fitness the following components are essential:

- muscular endurance
- speed
- agility
- balance
- reaction time
- co-ordination

Plus the other four components that have being stated earlier (cardiovascular endurance, muscular endurance, strength and flexibility).

Muscular power. *The ability to release maximum force (strength) very quickly*. It's a combination of speed and strength. High jumpers, discus throwers, and sprinters all need to have power.

The muscular power that you can produce depends on:

- The anaerobic energy supply
- The muscular strength
- The speed of contraction

Power is calculated as the time rate of performing work. Power is measured in as **watts**.

Speed (anaerobic power). The ability to put body parts into motion quickly and to sustain high-intensity efforts, where the energy is supplied anaerobically (without oxygen)- for example during sprints, rely on anaerobic energy for your muscles to contract.

Agility. *The ability to move and change the position of the body quickly and precisely* - for example, when dodging, weaving and turning. Wrestlers, netball players, footballers, gymnasts and fencers must all be agile. To be agile, you also need muscular power, speed and flexibility.

Balance. -*The ability to remain stable even when the body is moving.* Gymnasts, skiers, skaters and surfers must have a high level of balance.

Reaction time. - *The amount of time it takes a physical response once you see the need to take an action.* Good reaction time is needed in starting blocks, in fencing and karate and when defending a penalty in soccer or hockey.

Coordination. - The linking of the senses such as sight and hearing through the brain to parts of the body to produce smooth, quick, and efficiently controlled movement. Good co-ordination is necessary in all sporting and is essential in bat and racquet sports.

Why fitness?

Look the figure below, which shows how the average adult treats his or her body. This is called Bodily abuse. We expect our bodies to put up with all kinds of maltreatment and yet we cannot understand it when something goes wrong with them.

Where does fitness fit into this problem? Why does the government now have a special federation called 'PNG Sports Federation' and also have Provincial Recreation/Sports offices. Why does this office spend time and money per year on encouraging people to be active? Why are so many people entering fun runs, jogging in the parks or working out at the gym?

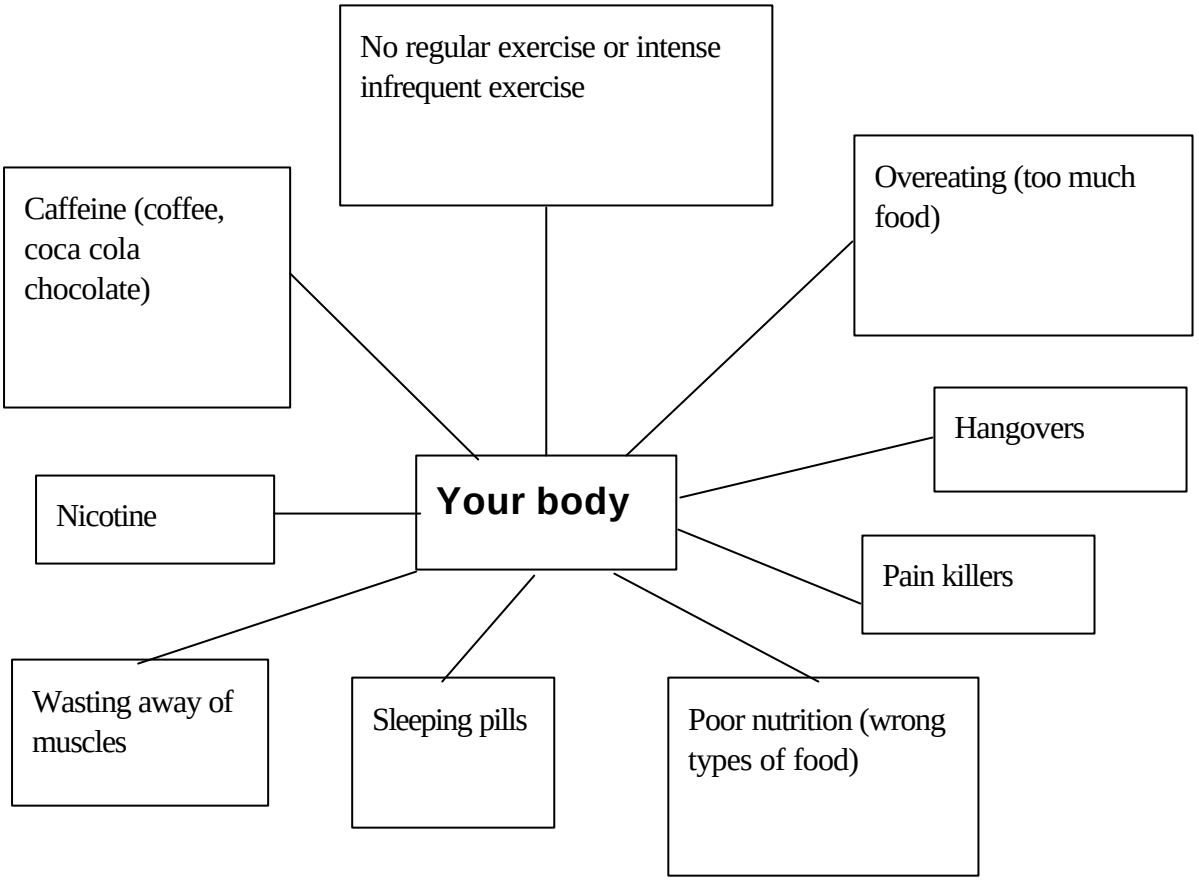


Figure 2. Body Abuse

The reason? Because the research shows that being physically fit (that is, developing all your fitness components) gives you such benefits as:

- An increased ability to perform physical work - this is essential for competitive sport and active leisure;
- Increased heart, blood vessel and lung efficiency;
- Decreased risk of coronary heart disease.
- Spontaneous control of weight;
- Delay of physiological ageing effects;
- Positive psychological effects such as reduced stress levels and increased self - confidence.

Giving your body a better chance

In other words by exercising to improve your fitness, you either eliminate body abusers, such as lack of sleep or too much food, or you give your body a better chance of coping with them. You need to be fit for two reasons:

- **To increase your quantity of life**
- **To increase your quality of life.**

Fitness and quality of life

The disappearance of activity from everyday living

We live in a modern world (industrialised and automated society). When you see around, jobs in industry, whether in a blue-collar or white-collar job, machines now do most of the work. It's the age of computers and pushbutton labour-saving devices.

A working week was once 60 hours - latter it decreased to 45 hours, then to 40 hours.

Lifestyle risk factors

If you could eliminate the following six lifestyle risk factors, you would reduce your chances of getting heart disease. On the hand, if you really want a good dose of heart disease, here's how to go about it. The factors are:

- Physical activity
- High stress
- Smoking
- Overweight
- High levels of fats and cholesterol in the blood
- High blood pressure

How can you get the quantity of life that you deserve?

Most of you are likely to die of heart disease - which's what the statistics say. Heart disease is caused by risk factors. By performing regular aerobic exercises you eliminate:

- Physical inactivity
- Overweight problems
- High blood levels of fat and cholesterol
- High blood pressure

In other words, aerobic exercise gives you the best chance of avoiding heart disease.

Excuses for not exercising regularly

Excuse 1: 'I do not have time.'

The aerobic formula is:

20 minutes per session, 3 times per week.

This is one hour of aerobic activity each week. There are 168 hours in a week. No one has all his or her hours booked up, especially when you consider the fact that by 15 years of age the average adolescent has watched 20 000 hours of television.

Lack of time is no excuse. ***Which is more important? An hour of activity for your life or another hour of watching television.***

Excuse 2: Who cares if I die of heart disease, anyway?

Apart from your family and friends, the taxpayers should care whether or not you die of heart disease and since you will all be taxpayers, you should care.

Excuse 3: 'I am too lazy.'

Now you are getting to the truth of the matter. It's your life and how long your life could be.

Seven ways to burn up an extra 2 000 calories a week.

Try one of these programs.

1. One-hour-walk (310 calories) five days a week, one hour of tennis (430 calories).
2. Half-hour walk (155 calories) six days a week; two hours of vigorous disco dancing (800 calories; half-hour swim (300 calories).
3. Run five kilometres (300 calories); three days a week; one-hour walk (310 calories); two hours heavy gardening (900 calories).
4. Run eight kilometres (500 calories); three days a week; two-hours walk (620 calories).
5. One-hour cycling at 15 km/h (390 calories); five days a week.
6. Two hours horse riding at trot (430 calories); four hours of cricket (1 200 calories).
7. Half-hour squash (830 calories); two days a week; swim half an hour (300 calories) three hours of walking (930 calories).

Fitness and the quality of life

You have just seen how aerobic fitness is the key to avoiding heart disease and having a long life.

Now we will see how developing your fitness components will help you live in the fast lane without too many hiccups.

Exercise improves your quality of life by:

- Maximising your physical appeal.
- Bring out the best in your personality.
- Keeping you safe and injury free.
- Protecting you against chronic illness.
- Allowing you to fulfil your sporting potential.

General health benefits associated with regular physical activity.

Major health benefits	Associated factors
Improved health and well-being	▪ Feeling of better health ▪ More energy available to perform daily tasks. ▪ Increased ability to meet emergencies ▪ Increased general vitality
Reduced mental and emotional stress	▪ Reduced tension ▪ Able to relax more ▪ More adequate sleep and rest ▪ More positive work attitude.
Improved personal appearance	▪ Reduced body weight ▪ Decreased body fat ▪ Enhanced self concept and body images ▪ Delay of ageing process ▪ Decreased amount of food ▪ More selective in type of food ▪ Improved posture and appearance.
Decreased incidence of degenerative disease and common health complaints	▪ Less chance of heart attack ▪ Greater chance of surviving a heart attack ▪ Improved fat metabolism ▪ Decreased levels of cholesterol ▪ Decreased blood pressure.
Improved cardiovascular endurance	▪ Increased musculature of the heart so it can contract more forcibly ▪ Decreased resting heart rate ▪ Ability to perform more work before becoming fatigued ▪ Ability to recover faster following a strenuous task ▪ Less stress placed on heart during the performance of a sub maximal task
Improved strength and muscular endurance	▪ Less chance of muscle or joint injuries ▪ Reduction of low back pain problems ▪ Increased muscle tone
Increase in flexibility	▪ Decreased incidence of low back pain.

☞ *Activity 3. The fitness component test*

1. For each of the following fitness tests, fill in your **personal fitness profile** in the table below.
2. Use figure 3 to calculate your rating for each result. Fill in the rating in the column next to the results. Make sure that you write month of your testing above the results/rating column.

Fitness test	Fitness component	Month ----------		Month ----------		Month ----------	
		Result	Change	Result	Change	Result	Change
Sit up							
Sit and reach							
Shuttle							
50 metre sprint							
Standing long jump							
Push ups							

Test 1 Speed sit ups

Purpose:

This test will give you an indication of the strength and endurance of your abdominal muscles.

Equipment:

Stop watch, gym mat, and partner

Method:

1 *Lie on the mat with your knees bent at 90 degrees, your fingers locked behind your head and your partner holding your ankles*

2 *When your partner says 'Go' sit up to the vertical position, then return to the mat until your hands and back touch the mat.*

3 *Repeat the movement as many times as you can in 60 seconds.*

4 *Rules: Your partner counts. Your fingers must stay locked behind your head. Your hands must touch the mat at the end of each sit up. You may rest between sit-ups.*

5 *Score: Maximum number completed in 60 seconds.*

Test 2 Sit and reach

Purpose:

This test will give you an indication of the flexibility of your lower back and hamstrings.

Equipment: • A one metre ruler and gym bench or box.

Method:

1 *Place the ruler parallel to the floor, with the 50 centimetre mark level with the front edge of the bench.*

2 *Sit on the floor with your knees straight, soles against the bench and feet either side of the ruler.*

3 *Place one hand on top of the other, with your fingertips level and* slowly *slide your hands down the ruler as far as possible. • Hold your maximum distance for 3 seconds.*

4 ***Rules:*** *You must not bend your knees. You must hold for 3 seconds.* ***Score:*** *Imagine that the 50 centimetre mark is zero. Any distance past 50 centimetre is positive - for example 57 cm = +7 cm. Any distance less than 50 centimetre mark is negative - for example 35 cm = -15 cm*

Test 3 Shuttle run

Purpose: This test will give you an indication of your agility.

Equipment: • stop watch, • Two lines 10 metres apart.

Description:

1 *Start this test lying in a push up position with your forehead on the start line.*

2 *On the signal 'Ready... Go', jump to your feet and sprint to the opposite line.*

3 *Touch the opposite line with your fingers and sprint back to touch the start line.*

4 *Sprint back to touch the opposite line, and then finish by sprinting across the starting line.*

5 ***Rule:*** *Each line must be touched with your fingers, except as you finish.* ***Score:*** *Time to the nearest 0.1 of a second.*

Test 4 Standing long jump

Purpose: This will give you an indication of the strength and power of your hip and leg muscles.

Equipment: Take-off line, tape measure and partner.

Description:

1 *With your toes behind the take off line and feet still, swing your arm and jump forward as far as you can.*

2 *Land on both feet and keep moving forward*

3 *Your partner will mark where your heels landed.*

Rule: There is no run up allowed.

Score: Your maximum distance from take off line to heels.

Test 5 Push-ups.

Purpose:

This test will give you an indication of your upper body strength and muscular endurance,

Equipment:

Standard 46 cm chair, Stopwatch and Marker.

Method:

1 *To find the right position for your feet lie down face up, with the sole of your feet in line with the front of the chair. A line will be marked at your elbow level,*

2 *Standing on this line, reach forward and place both hands a shoulder-width apart on the front edge of the chair.*

3 *Keeping your body straight all the time, lower yourself until your chest touches the front edge of the chair. Raise yourself until your arms are extended.*

4 *Do this as many push-ups as possible in 30 seconds.*

5 ***Score:*** *The maximum number of push-ups you can complete in 30 seconds.*

Test 6 50 metre sprint.

Purpose: This test will give you an indication of your speed and anaerobic capacity.

Equipment: Measured 50 metre track, stopwatch, and start and finish lines.

Description:

1 *Follow the commands, 'On your marks', 'Set' and 'Go'.*

2 *Sprint the 50 metre as fast as possible.*

3 ***Score:*** *The time it takes to cover the 50 metre.*

Fitness Ratings

Study your fitness profile chart. Use the ratings table (Figure: 2.4) to rate each result and complete your fitness profile chart. If on any fitness component test you scored an ok or worse, try to incorporate into your lifestyle the recommended exercise in order to improve that fitness component.

RATINGS
E = Excellent, stay as you are.
OK = Room for improvement.
P = Problems; you need to improve.
R = Risky; you are likely to suffer injury.

Fitness test	Male rating				Female rating			
	E	OK	P	R	E	OK	P	R
Sit ups (no.)	42+	36 - 41	31-35	0-30	32+	27 - 31	21 - 26	20 or less
Sit and reach (no.)	+10 or more	+4 to +9	-1 to +3	< -1	+7 or	+1 to	0 to -3	< -3
Shuttle run (sec)	10.6 or faster	11.3 - 10.7	11.7 - 11.2	11.8 or slower	11.7 or faster	12.5 - 11.8	13.1 - 12.6	13.2 or slower
50 metre sprint (sec)	7.30	7.61 - 7.31	8.06 - 7.62	8.10 or slower	8.18 or faster	8.64 - 8.20	9.1 - 8.65	9.15 or slower
Standing long jump (cm)	211 +	195 - 210	180 - 194	<180	175 +	160 - 174	145 - 159	<145
Push ups (no.)	23 or	19-22	16-18	15 or	13 or	10-12	3 - 9	0 - 2

Figure 3. Ratings Table for Male and Female

3. Skill acquisition

In physical education, skill acquisition involves the learning of *motor control*. Therefore, in this section we are concerned with:

- **motor control itself and**
- **how it is learned.**

What is a motor skill? What is the difference between a skilled movement and an unskilled movement?

Skill involves certain criteria:

- The task involves sequences of movement that are reasonably complex to the individual performing them
- The individual must undertake a period of learning.

☞ *Discussion*

1 *Compare the complexity of the action of standing up for a ten - month - old baby and the same action for a normal healthy teenager.*

2 *In terms of the learning period, compare the actions of jumping out of a widow to escape a fir and performing a long jump.*

What is a skill?

Discuss definitions from "Knapp, Robb & Welford". In simple terms:

A skill is the learned ability to do something well and expertly.

Learning

Skill acquisition implies learning. Learning can be defined as **'a more or less permanent change in behaviour that is reflected in a change in performance'.**

There are three types of learning:

- Cognitive learning
- Affective learning
- Effective learning

Learning of motor skills

Motor skills do not depend solely on physical ability, but also on an individual's ability to:

- **think**
- **interpret** the condition of his or her environment
- **select** accordingly, the correct course of action.

Terms such as, perceptual motor skill, sensory motor skills and cognitive motor skills are therefore commonly used.

Skill performance

Skill performance involves:

- a goal **(**the action is performed with a specific purpose in mind);
- a complex sequence of activity;
- organisation of time, space and muscular movement.
- Learning through practice.

Skill performance is also characterised by:

- The performer seeming to "have all the time in the world"
- The performer having smooth, perfectly timed movements
- The performer doing "the right thing at the right time."

Motor performance

What is the difference between motor performance and skill learning?

Motor performance is the simple the action of a large muscle group, an action that may be temporary in nature. It is any change in behaviour that is not permanent - for example, jumping over a pool of water on the road.

Skill learning is affected by factors that influence efficient communication between the sense, the brain and the muscles.

Factors affecting motor performance

Motor performance is influenced by:

1. *Physiological factors*. They include fitness, strength, endurance and flexibility.

2. *Age:* These factors include bodily growth and development and deterioration, as a person grows older. For example, a ten-year-old can jump three metres in a long jump and when thirteen can jump four metres. This improvement may be attributed to growth and not to an increase in the required skill.
3. *Requirement of the task:* Physical requirements of a task may promote or limit motor performance. They include:
   - Limits of the rules of the game;
   - Weather condition
   - • The design of modern equipment. - for example, the advantages and disadvantages of an aluminium bat and wooden bat in softball.
   - • Condition of the equipment. - for example, a grip on a cricket ball or a poorly inflated ball.
4. *Motivation:* The greater the level of motivation, the more likely it is that performance will be at its best. Although the same would be said for skill learning, there are many examples of performers who excel on one occasion because they are highly motivated, but cannot repeat the performance.

Organisation of a skill

A skill act may be seen as a whole plan that specifies the temporal and sequential properties of the total movement. This is known as an executive program or motor program.

Subroutines

Motor programs are made up of a number of related parts called subroutines. When you have already learned particular subroutines, it makes it much easier to learn a motor program. For example, the high jumper involves such subroutines as running, jumping and landing. The more subroutines that you learn in childhood, the more resources you will have as an adolescent or adult to perform motor programs.

Many individuals are prevented from performing particular skilled movements because they do not have enough subroutines on which to draw.

Example of subroutines

Motor performance	Subroutines
Tennis serve	▪ grip ▪ Footwork ▪ backward swing ▪ forward swing ▪ follow through ▪ angle of racquet head ▪ watching the ball ▪ contact
Swimming backstroke	▪ arm movement ▪ leg kick ▪ breathing ▪ start ▪ turn

Co-ordination of subroutines

Although subroutines can quickly become automatic when practised in isolation, all motor programs depend on the proper co-ordination of all the subroutines in relation to each other. In other words, you cannot successfully perform an executive program if you have not already mastered any one of the necessary subroutines

Example

You cannot be a successful footballer unless you can efficiently perform the subroutine of running.

Relegating executive programs to subroutines.

As you become more skilful, you relegate motor programs to the subroutine level. For instance, holding a softball bat correctly is an executive program for the beginner, but becomes an automatic subroutine to the experienced player.

☞ *Discussion*

Compare the way in which a five-year old child bounces a ball compared with the bouncing action of a basketball player.

When an executive program has been relegated to the subroutine level:

- You can concentrate on the wider range of activity around you - for example, a basketball player can take his or her eyes off the ball and pay attention to the actions of other players.
- You can attempt to increase the complexity of the motor program - for example, when you have become reasonably proficient at hitting a table tennis ball over the net, you can work on hitting it with topspin.

Correct sequence of subroutines

To perform a motor skill successfully, you need to perform all the subroutines in the correct sequence and with the correct timing. If you perform any of the subroutines incorrectly, in the wrong order or with wrong timing, you affect the whole movement.

Example

When performing a drive in basketball, you must know what foot to use to assist you to drive closer to the ring and backboard.

Pacing and anticipation

Skilled movement requires that all the subroutines should be joined together smoothly and with continuity. This is called **temporal patterning**. You can recognise that a person is unskilled because he or she shows jerky or poorly timed movements. Pacing and anticipation influence this continuity of movement.

Pacing

Pacing refers to how you time the whole movement. In some activities, you have no control over pacing and must time your moves in relation to external factors.

Examples

1. A basketball player times his or her moves in relation to the movements of other players and the ball,
2. A gymnast, however, can completely control the pace of his or her movements.

Very skilled performers can control the pace of the opponents or opposition by slowing down the game or speeding it up. A good example is the pacesetter in a race.

Anticipation

If you can anticipate what is going to happen next in a game, you have an added advantage in terms of timing your movements.

Skill classification

There are several different ways of classifying skill types:

Discrete, continuous and serial skills

A discrete skill is one with a distinct beginning and an end. Examples include a baseball throw, a football kick and switching on a light.

Continuous skills. When a motor skill has no distinct beginning or end, it is said to be **continuous**. Examples include driving a car, running or basketball dribbling - all activities that can continue for an unspecified time.

Serial skills are those that string together several discrete tasks to form an apparently continuous performance. They include a number of distinct elements, the order of which is very important.

Examples include:

- Starting a car; sequence of ignition-clutch-accelerator.
- Playing a tennis stroke on a run.
- A complete football move: sequence of mark, run, and handball.

Fine and gross motor skill

This is a common type of classification that is based on the amount of movement and force required to perform a skill:

What is a gross motor skill? It is a skill that involves large parts of the body or the movement of the whole body - for example, a somersault, or kicking a ball.

What is a fine motor skill? It is a skill that involves the movement of small muscle groups - for example, writing or painting. They are generally not included in the field of physical education.

A problem with this classification is that some skills undoubtedly employ both large and small muscle groups.

For example:

- Balancing on a beam with one foot requires the strength of the muscles of the whole body as well as the fine adjustments of the foot and ankle muscles.
- Bowling a cricket ball employs great force from the whole body but requires skilful manipulation of the fingers.

Open and closed skills

This classification, suggested by Poulton (1957) and Knapp (1964), distinguishes between open skills and closed skills. It is based on the extent to which a performer needs to adjust to the environment.

Open skills are **externally paced** - the timing of them depends on factors external to the performer.

For example:

- The skill of fielding a cricket ball varies according to the speed and height of the ball, the positions of fellow field persons and whether the bats-men or women are running.
- The timing of a football tackle depends on the opponent's speed and direction and his or her ability to change either or both.

Closed skills are **internally paced** - performer is in full control of the timing of the movements. Examples include the handstand and the golf swing.

Skills for unpredictable environments

Skills performed in an unpredictable environment are **open skills.**

Examples include:

- Team games are played in an ever-changing environment that makes it difficult for a performer to predict what will happen next.
- The skills needed for sailing in rough weather.

At every instant the motor activity must be regulated by and appropriate to external situation (Whiting).

Skills for predictable environment

Skills formed in predictable environments are ***closed skills.*** In such an environment, the performer can go through a prelearned motor program without having to consider environmental changes. - for example, diving, archery or the shot put. 'Conformity to a prescribed standard sequence of motor acts is all important' (Whiting)

Closed skills	Open skills
▪ Predominantly habitual	▪ Predominantly perceptual
▪ Performer controls pacing	▪ External environment controls pacing.
▪ Stable or fixed environment (space and time)	▪ Changing environment.
▪ Stereotyped movement patterns	▪ Movement patterns must be adapted.

The main consideration for learning skills under these classifications is that **closed skills** can be learned more easily because it is simply a matter of mastering, through practice, a specific movement pattern and repeating it.

Open skills, however, are not so easy to master, because they are rarely repeated exactly and their performance depends on the circumstances of the time.

Therefore, a beginner will learn the skill of kicking a ball more quickly if he or she learns it as a closed skill. Once the closed skill has been mastered, the player can learn to adapt it to an open environment.

Sometimes the same skill can be open or closed, depending on the circumstances,

Phases of skill learning

According to Fitts and Posner, there are three main phases through which an individual progresses in learning a skill:

- Cognitive phase (plan formation)
- Associative phase (practice)
- Autonomous phase (automatic execution)

Phase 1. Cognitive phase

During this phase, the individual learns what is to be done. In other words, you find out what is expected in order to perform a skill. During this phase, you must identify the subroutines involved and their correct sequence. You need to see and experience the feel of the movement required.

The exploratory nature of **cognitive phase** leads to a large number of errors and a great deal of very specific feedback is needed in order to recognise and correct these errors.

The best way to achieve phase 1 is through demonstration. You or the coach can show what is required, either by carrying out the actions personally, asking another person to show what is required, or by showing videos or films.

On the other hand, you could achieve this phase by reading information or listening to a description of the skill. Phase 1 is usually completed in a short time.

Phase 2. Associative stage

After you, as the learner, have received and understood information about what is required in performing a given skill, you must **practise** in order to become familiar with the sequence of subroutines and the timing required.

The amount of practice needed, will depend on the complexity of the activity, your abilities and past experience and how ambitious you are.

Demonstrations and coaching can be very useful for correcting errors during phase 2. As you refine your skills, you make fewer and smaller errors and your ability to recognise errors and make the necessary adjustments improves.

Phase 2 usually takes place over a long period of time. Some performers remain within the associative stage for many years and never reach the autonomous stage.

Phase 3. Autonomous stage

During the autonomous stage, the skill becomes much easier to accomplish and your level of anxiety is reduced. Practice has enabled you to reach a stage where you can organise the required movements into the correct sequence and time your movements without thinking. The skill can be relegated to a lower level, leaving the central nervous system to deal with skills that have not yet reached Phase 3.

Having reached the autonomous stage:

- The temporal and sequential patterning of subroutine becomes automatic.
- The likelihood of being distracted by interference from the environment is reduced.
- Less cognitive control is required.
- Your speed and efficiency is increased.

Once having reached this stage, you can concentrate on more detailed aspects of the skill. For example:

- When playing tennis, if you have mastered the forehand drive you can work on placing your shot.
- Once you have perfected your shooting at basketball, you can work on ways of evading opponents in order to get into a better shooting position.

Note: In order to maintain a skill at Phase 3 level, you must bring Phase 2 repeatedly into operation and it might even be necessary to go back to Phase 1 to check that you are performing a skill correctly.

☞ Activity 4. Tennis ball throw and bounce

Hypothesis: *Learning can be distinguished from performance.*

Apparatus: *Tennis ball, target*

Procedure:

1. *Stand facing a target on a wall. Hold a tennis ball in your non-dominant hand. Between you and the target is a restraining line on the ground.*
2. *Bounce the ball on your side of the restraining line so that it hits the target.*
3. *You don't score any points if the ball lands on the floor between the line and the target.*
4. *Do not practice before the commencement of the task.*
5. *Follow the sequence of 10 test trials - 20 practice trials -10 test trials.*
6. *Record all results in the table on the next page.*

Results:

1. *Add up each column in your results table. Find the average score in each column.*
2. *Plot the averages on the graph.*

Conclusion:

1. *Has learning occurred?*
2. *Why, or why not?*

Results Table

Subject	Trial A									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1										
2										
3										
4										
5										
6										
7										
8										
Average per trial										

Trial B									
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*