THE INSTITUTE OF EDUCATION

Physical Education

Brian Gregan

Leaving Certificate

Higher Level

2021/22

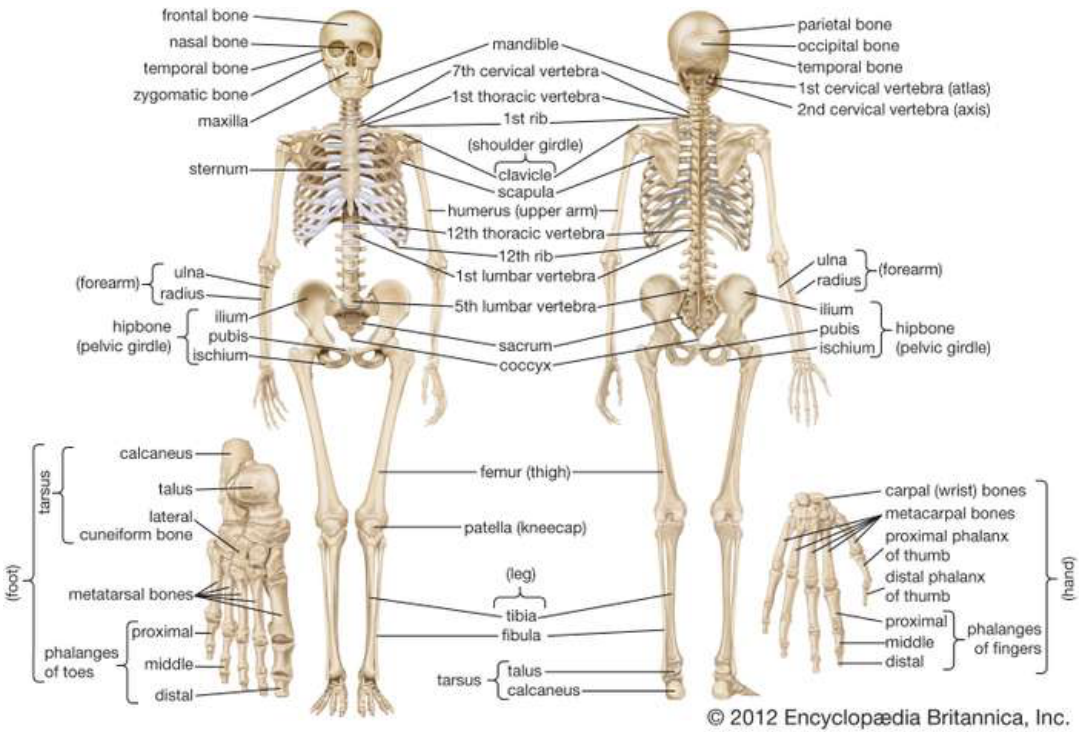
Leaving Cert Physical Education

Brian Gregan

TOPIC 1: LEARNING AND IMPROVING SKILL AND TECHNIQUE

A skilled performance is one in which a sequence of movements is performed in a fluent and controlled manner, the right options are selected and the skills and techniques used fully reflect the performer's ability and experience. Technique is the way in which these skills are executed. In planning for optimum performance, the learner requires a wide range of skills and techniques and the ability to make the right choices about which ones to use, when and where. In this topic, learners examine each of the three physical activities in order to identify the different skills and techniques that are central to a successful performance. They learn to analyse their own level of skill and technique and to plan for improvement.

The Skeletal System
This is useful for analysing skill and technique in the PAP.



The function of the Skeletal system

1. Movement
2. Protection and support
3. Shape
4. Production of blood cells
5. Storage of minerals

1. **Long bones:** These are mostly compacted bone with little marrow and include most of the bones in the limbs. These bones tend to support weight and help movement. Example: Femur and tibia.
2. **Short bones:** Only a thin layer of compact bone, these include bones of the wrist and ankle. Provide support and stability with little movement. Example: Carpals in the wrist and tarsal in the ankle.
3. **Flat**: Usually bones that are thin and curved Flat bones include most of the bones of the skull and the sternum or breastbone. They tend to have a protective role. Examples: Ribs and pelvis
4. I**rregular bones:** As their name implies, these are bones that do not fit into the first four categories and are an unusual shape. They include the bones of the spine and pelvis. They are often protecting organs or tissues. Examples: Sacrum and vertebrae.

Movement of joints and connective tissue

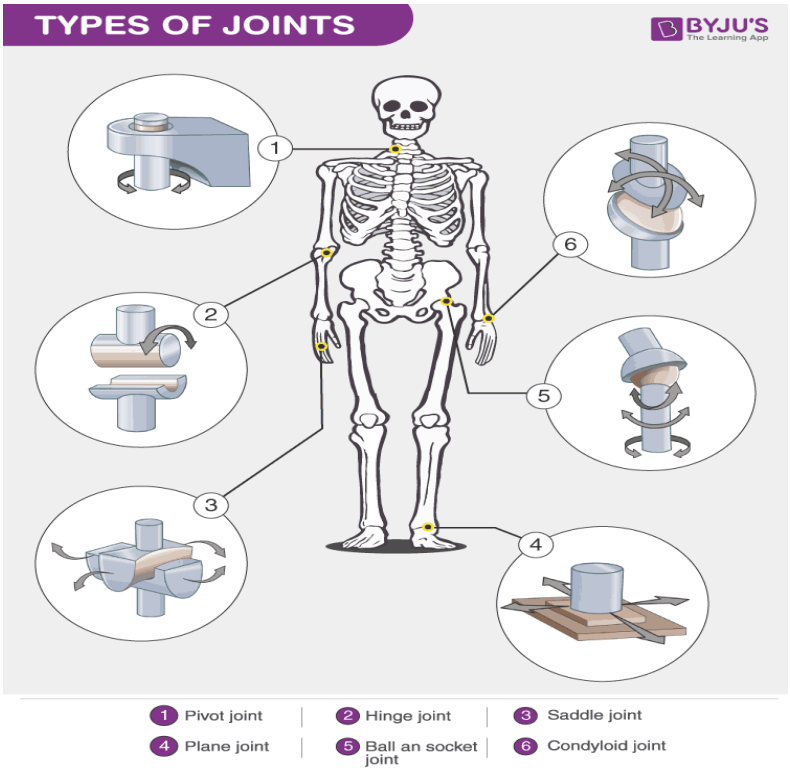
Joints: are when two or more bones meet
Connective tissue is at the meeting points between joints.
There are 3 types of connective tissue

1. Cartilage: is found at the end of the bones. It is the cushion between bones, preventing them from rubbing together.
2. Ligaments: connect bone to bone.
3. Tendons: connect muscle to bone.

Types of joints: (use diagrams) https://byjus.com/biology/types-of-joints/

1. Pivot: In this type of joint, one bone has tapped into the other in such a way that full rotation is not possible. This joint aid in sideways and back-forth movement. An example of a pivotal joint in the neck.
2. Hinge joint: A hinge joint is like a door hinge, where only back and forth movement is possible. Example of hinge joints is the ankle, elbows, and knee joints.
3. Saddle joint: this is a biaxial joint that allows the movement on two planes– flexion/extension and abduction/adduction. For example, the thumb is the only bone in the human body having a saddle joint.
4. Gliding joint: a gliding joint is a common type of synovial joint. It is also known as a plane joint. This joint permit two or more round or flat bones to move freely together without any rubbing or crushing of bones. This joint is mainly found in those regions where the two bones meet and glide on one another in any of the directions. The lower leg to the ankle joint and the forearm to wrist joint are the two main examples of gliding joints
5. Ball and socket: one rounded end of a bone is hooked into the hollow space (cuplike socket) of another bone. This type of joint helps in rotatory movement. An example of a ball and socket joint is the shoulder.
6. Condyloid joints are the joints with two axes which permit up-down and side-to-side motions. This joint consists of two oval shaped bones fitting with one bone fitting into the hollow of another bone The condyloid joints can be found at the base of the

index finger, carpals of the wrist, elbow and the wrist joints. This joint is also known as a condylar, or ellipsoid joint.



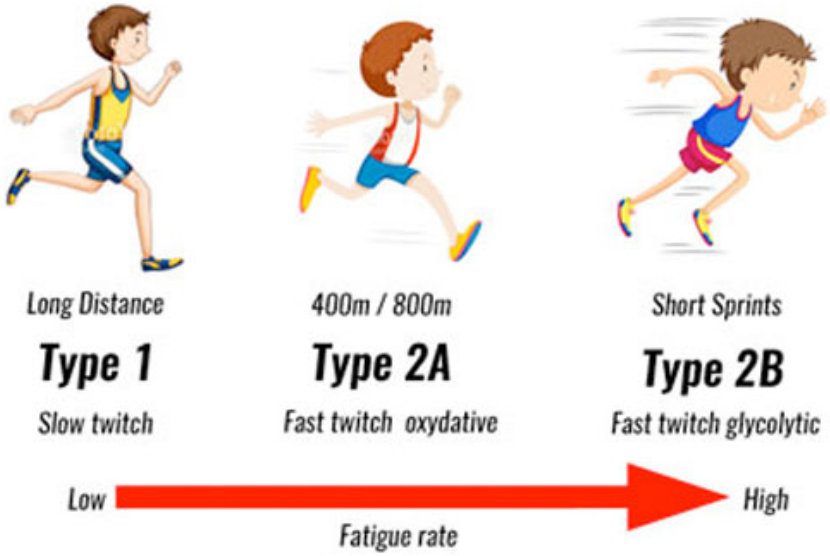
Types of body movement

1. Flexion: bending limbs at a joint (the angle closes/decreases)
    a. Example: The elbow joint when doing a bicep curl
2. Extension straightening a joint (the angle opens/increases)
    a. Example: When standing up the knees are extended. An athlete doing a hang clean (hip extension)
3. Adduction: movement towards the midline of the body. (Adding towards the body)
    a. Example: Moving arms or legs toward the body when performing a jumping jack
4. Abduction: movement away from the midline body.
    a. Example: Moving arms or legs away from the body when performing a jumping jack
5. Rotation: when a limb moves in a circular motion <u>around</u> a fixed point
    a. The hip when driving a golf ball
6. Circumduction: when a limb moves in a circular motion <u>extending</u> a fixed point/joint (ball and socket only)
    a. Bowling in cricket
7. Plantarflexion: pointing the toes downwards
    a. Example: In ballet when a dancer points their toes
8. Dorsiflexion: pointing the toes upwards
    a. Walking on heels, toes pointed upwards (soloing in GAA)

The muscular system

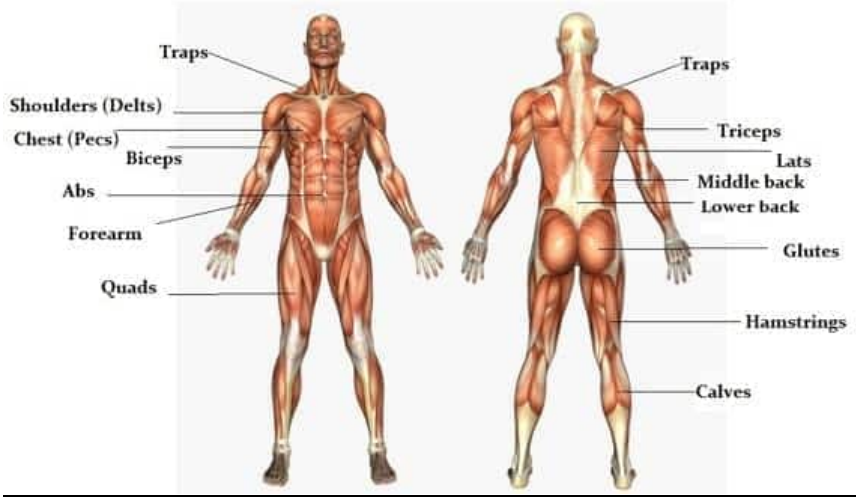
a. Skeletal (voluntary)
b. Smooth (involuntary)
c. Cardiac (involuntary)

Types of Muscle Fibres

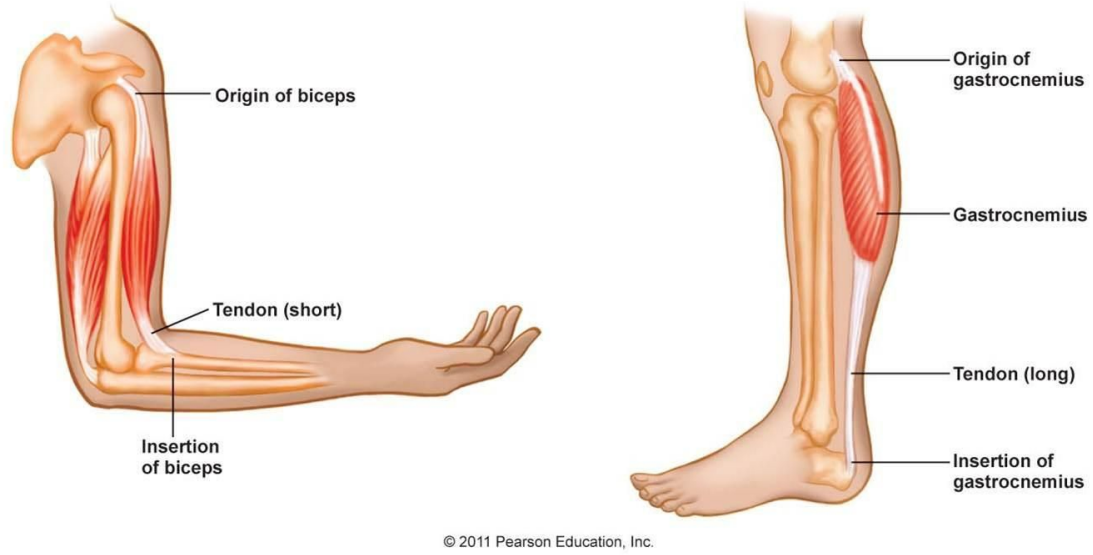


a. Type 1 – slow-twitch – produce low level continual muscle contractions and are extremely resistant to fatigue (aerobic metabolism)
b. Type 2A – fast-twitch (intermediary) - produce strong and fast muscle contractions, but tire more quickly than type 1. (use both aerobic and anaerobic metabolism).
c. Type 2 x fast twitch – Provide short, fast bursts of power but fatigue quickly. The muscle contract rapidly, producing large amounts of force to propel a person forward quickly and over a short distance (Anaerobic metabolism only).

Muscles of the body



How muscles move



Joints can't move by themselves, they require muscles to move bones in the right position. Muscles are attached to bones by tendons, and the end of the muscle is termed either the origin or the insertion.
Origin: is the end of the muscle (or attachment site) that is attached to a fixed bone that **does not** move during muscular contraction.
Insertion is the end of the muscle (or attachment site) that is attached to a bone **does** move during muscular contraction.

Origin – This is the attachment of a muscle tendon to a stationary bone.

Insertion – The opposite end to the origin. The attachment point of the muscle.

Muscles exert their function by either shortening (bringing the insertion closer to the origin) or lengthening (moving the insertion further away from the origin.). Muscles will always move in the way the muscle fibres run, this gives us an even further insight into what function each muscle has.

Antagonistic muscle pairs https://www.bbc.co.uk/bitesize/guides/zpkr82p/revision/4

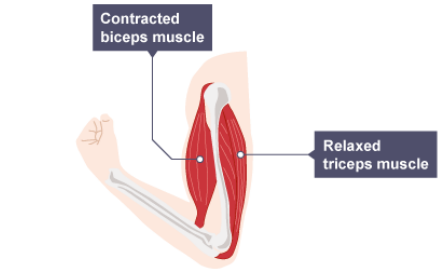
Muscles transfer force to bones through tendons. They move our bones and associated body parts by pulling on them – this process is called muscle contraction.

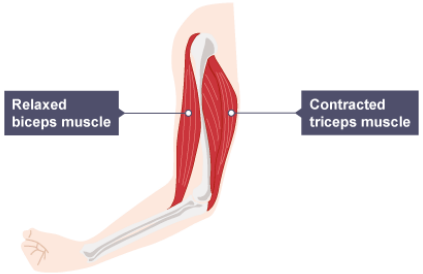
However, muscle contraction cannot act to push the bone back into its original position, and because of this, muscles work in 'antagonistic muscle pairs'. One muscle of the pair contracts to move the body part, the other muscle in the pair then contracts to return the body part back to the original position. Muscles that work like this are called **antagonistic pairs**.

In an antagonistic muscle pair as one muscle contracts the other muscle relaxes or lengthens. The muscle that is contracting is called the **agonist** and the muscle that is relaxing or lengthening is called the **antagonist**.

One way to remember which muscle is the agonist: it's the one that's in 'agony' when you are doing the movement, as it is the one that is doing all the work.

For example, when you perform a bicep curl, the biceps will be the agonist as it contracts to produce the movement, while the triceps will be the antagonist as it relaxes to allow the movement to occur.





The biceps contracts and raises the forearm as the triceps relaxes

Antagonistic muscle pairs

The following groups of muscles are antagonistic pairs:

Biceps	Triceps
Hamstrings	Quadriceps
Gluteus maximus	Hip flexors
Gastrocnemius	Tibialis anterior
Pectoralis major	Latissimus dorsi

To allow antagonistic pairs to work efficiently, other muscles called **fixators** assist by supporting and stabilising the joint and the rest of the body. Some fixators also assist the agonist and act as a synergist.

The trapezius muscle can act as a fixator when the biceps is flexing the elbow joint.

The abdominals can act as fixators to stabilise the body for hip and knee movements.

Antagonistic muscle pairs in action

Preparation and contact phase in football

In the preparation phase, when footballers prepare to kick a football, their hamstrings **contract** to **flex** the knee while the quadriceps lengthens to allow the movement. The hamstrings are the agonist and the quadriceps are the antagonist.

In the contact and recovery phase, the quadriceps **contract** to **extend** the knee while the hamstrings lengthen to allow the movement. The quadriceps are the agonist and the hamstrings are now the antagonist.

The abdominals would be acting as fixators.

Question

Describe how the antagonistic muscle pairs are working at the elbow during the downwards and upwards phase of a press up.

Answer

During the downwards phase, the triceps are the agonist and they contract eccentrically to control the flexion of the elbow so the body is lowered under control down towards the floor. The biceps are the antagonist.

During the upwards phase, the triceps are the agonist and contract concentrically to extend the elbow and the biceps are the antagonist.

Muscular contractions
https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/concentric-muscle-contraction

There are three types of muscular contractions:

Isotonic: the contraction causes the muscle to change length as it contracts it causes movement of the body part in question.

a. **(1) Concentric contraction** the muscle shortens as tension is produced. For example, the upward phase of a biceps curl is a concentric contraction.
b. **(2) Eccentric contraction** occurs when the total length of the muscle increases as tension is produced. For example, the lowering phase of a biceps curl constitutes an eccentric contraction. Muscles are capable of generating greater forces under eccentric conditions than under either isometric or concentric contractions

(3**) Isometric**: when the muscle contracts but stays the same length and shape. For example, during a biceps curl, holding the dumbbell in a constant/static position rather than actively raising or lowering it is an example of isometric contraction

1.1 Defining a skilled performance

Identify the characteristics of a skilled performance

Skilled performers are autonomous performers, and have a particular look to their movement. These observable features are known as the characteristics of skilled performance.

Acronym = TACK

Kinaesthetic sense refers to the skilled performers proprioception, which replies on information from various sensors in the muscles and other organs that provide information about body position and movement without the need to see it. Skilled performers can feel the movement and even correct movements mid-performance. Kinaesthesis develops as a direct result of practice, as it develops "muscle memory". An example would be a basketballer adjusting their shot after being fouled to ensure the shot still is successful.

Anticipation is the skilled performer's ability to read the play, or his opponent and respond accordingly. It refers to the skilled performer's ability to predict their opponent's next move. Good anticipation comes by learning to read an opponent's body positioning and being familiar with their preference of style or shot. This is particularly important for externally paced skills. An example is when a tennis player anticipates a backhand down the line after reading the body positioning of their opponent. This gives the skilled performer more time to cover the court, cover the shot and decide which return they will select.

Consistency refers to the skilled performer repeating good performances. This is easily observed in sports such as basketball and tennis, where a skilled performer continually gets the shot in or hits their shot over the net and near the lines. Roger Federer and Kobe Bryant are examples of skilled performers who are consistent in their performances.

Technique refers to the technical aspects of skill execution; the result is efficient and consistent movement. Skilled performers have good technical execution of a skill, which saves energy, and produces better and more consistent results, holds up better under pressure, provides less chance of injury, and is a large determinant of elite success. Correct technique is particularly vital in sports such as swimming and running, where correct technique helps generate more power and slimline and saving energy for later in the performance, particularly vital for long distance endurance events.

When watching a performer or performance, a skilled performance can be identified when demonstrating the following characteristics:

Rory McIlroy lines up a putt at the PGA Championship

Effectiveness

- Accurate – eg playing the shot to where you want it to go
- Consistency – eg you can repeat the shot over and over again
- Controlled – eg the performer is in full control of the skill
- Confidence – eg belief in ability

Nadia Comaneci on the uneven bars, a performance that was awarded a perfect 10 in the 1976 Olympic Games

Efficiency

- Technique – e.g. good technique that looks effortless
- Fluent – e.g. actions are smooth and controlled
- Aesthetic – e.g. the performance looks pleasing on the eye

Wayne Rooney scores for England against Uruguay

Responsive

- Decision making - e.g. the performer makes correct decisions
- Adaptive - e.g. the performer can change the performance depending on the situation

Indicators of a skilled performance

When watching and analysing skilled performers executing movements, the following indicators will help to identify highly skilled performers.

Remember ACEFACE

Aesthetically pleasing	The performer looks good when executing a specific skill. They delivered the movement pattern with precision and poise, making the movement pleasing for spectators to view.
Consistent	That performer can repeat the performance with a high level of success.
Efficient	the performer uses efficient moving pattern at the particular time with skill execution. Ensuring that energy is not wasted.
Fluent	Performers movements are effortless and smooth. The movements and skills appear easy for the athlete.
Accurate	The performers movements are graceful efficient and effortless. The linking of movements and skills appears easy and there is a floater movement. Accuracy refers to the ability of a performer to execute each aspect of the scale correctly.
Controlled	The athlete is able to move how they want in a control and efficient manner.
Economical	There is no wastage of energy by the athlete.

1.1.2 Discuss the difference between skill and ability

It's a simple question, but one that immediately distinguishes the difference between '**knowledge**' and '**skills and abilities**'. These words are often used interchangeably, but what are the differences between them?

Most people *know* how to cut hair. The average person that you stop in the street could tell you that you should cut hair with a pair of scissors. Most people could go into more advanced detail, perhaps telling you to work on a section at a time or describing how to add layers.

Just because someone knows how to cut hair, should they be trusted to do it?

What is Knowledge?
Knowledge is an understanding. It's mental or theoretical, rather than practical. Knowledge can be gleaned from a book, and you can gain knowledge by researching online or visiting your local library.

Having knowledge of how to do something does not necessarily mean that you can do it, even if you understand the steps and what should happen.

What about Skills and Abilities?
The difference between a 'skill' and an 'ability' is much less obvious than the **difference** between 'knowledge' and the other two. In very basic terms, abilities are natural or inbuilt whilst skills are learned behaviours.

When cutting hair you might have an ability to keep your hand steady or cut a straight line, but the skill is what you learned on your hairdressing course.

Skills can be developed and improved over time, by combining our abilities and our knowledge, but the underlying abilities are needed in order for the skills to be developed.

Abilities, likewise, can be improved and honed to some extent – running fast is a skill, but the ability to run fast comes in part from having strong leg muscles, which can be developed through regular exercise.

Ability and knowledge combine to create skills that can be used.

What are some examples of the differences between knowledge, skills and abilities?

Fred is a professional swimmer. He has a knowledge of the various swimming strokes, how best to train and what to eat. Fred's ability to swim might be attributed to his streamlined body shape, his strong arm and leg muscles and his ability to hold his breath for a good length of time. Swimming itself is the skill – a combination of his knowledge of how to swim and his ability to swim.

Laura is a professional baker. She has a knowledge of ingredients and recipes, and her abilities include the careful measuring of ingredients. Her skills are baking and cake decorating – a combination, again, of her knowledge of techniques and her abilities to use those techniques.

Ability

Ability is to have natural means and awareness to do something.

Ability is innate, which means that it is inherited, people are born with different abilities to each other.

Ability is the make up of a person which we inherit from our parents. Abilities contribute to skills. Abilities can be perceptual, motor or a combination of both. Most abilities to do with action are a combination and are referred to as psychomotor abilities.

If you are of average height, strong, good coordination and have a lot of fast twitch fibres in your legs then you have the natural ability to be a sprinter.

Skill

Skill is to have refined and improved those means, to do the same thing better

Skill is a learned response in relation to an object or situation involving perceptual, cognitive or motor mechanisms. We do however inherit certain characteristics of skills from our parents.

List of skills:

- Flexibility
- Muscular Power
- Muscular endurance

- Co-ordination
- Balance

3 Types of skills

1. Motor - involves movement, smooth execution of a physical act

2. Perceptual - involves interpretation of information and making sense of environment

3. Cognitive - skills using mind, problem solving, involves thought processes

In the context of football these skills would be;

Motor - sprinting down the wing during a game

Perceptual - sprinting to intercept the ball being passed down the wing

Cognitive - realising that sprinting down the wing will give width in attack

Skills vs Ability

Ability is to have natural ability (means) and awareness to do something.	**Skill is to have refined and improved those means, to do something better.**
Coordination	Golf drive
reaction time	spring start
problem solving	marathon running
spatial awareness	drop shot
Balance	3-point shot
	Penalty in football

Skills can be classified on the following continuums:

The skill continua situates skills and a linear scale according to their features. Skilled continua help describe the nature of skills. Developing a better understanding of the nature of skills can help coaches develop better practice sessions and strategies for skill improvements.

1. Simple/Complex continuum

Characteristics of simple skills

- Single tall
- no requirement for limbs synchronicity
- easy to replicate
- generic movements

Examples:

- A Squat
- running

Characteristics of complex skills:

- Multiple factors to consider at once
- movement timing and coordination is essential
- high degree of accuracy is required

Examples:

- A pirouette and figure skating
- a golf drive

2. Gross/Fine Continuum

Fine movements are small and accurate with very small muscular contractions pulling trigger of clay pigeon rifle).

Gross movements are large muscular contractions, typically using the whole body (Sprinting)

A tennis serve is along the Continuum between the above.

Examples of an gross skill:

- Running
- walking

Examples of an fine skill:

- a dart throw
- putting in golf Bird injured bad so we have hi 20

3. Open/closed continuum

Open skills occur in a constantly changing environment. The skill has often no clear start or end and happens in response to other factors, e.g. running into open space and receiving a pass in football.

Examples of an open skill:

- Basketball rebound
- judo

Examples of an closed skill:

- Olympic weightlifting
- hammer throw

4. Internally (self) paced/ Externally paced continuum

Movements that are self-paced are controlled by the performer. They will decide the rate at which the skill is performed, e.g. a long jumper or pole-vaulter jumping when they are ready to do so.

Externally paced skills are controlled by other players or factors, for example, being pressed by the opposition and making a pass that you did not want to make.

Examples of internally/self-paced skills

- The triple jump
- jogging

Examples of externally-paced skills

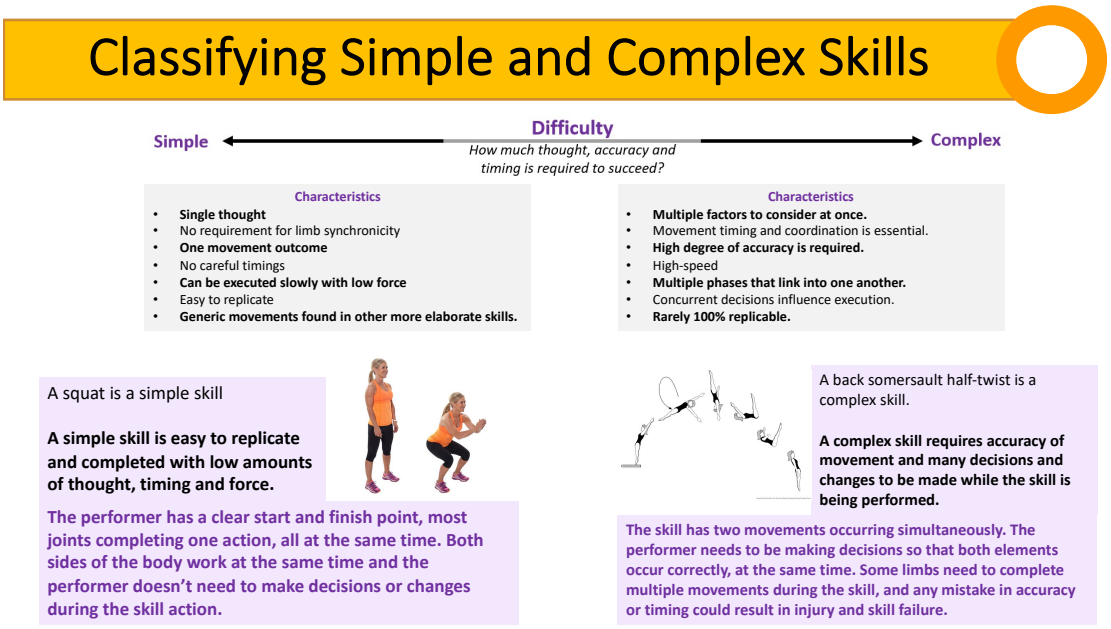
- Hockey penalty shuffle
- badminton return

Justifying skill classification
There are 3 parts to this:

1. State the skill and its class
2. identify a characteristic of the class
3. highlight where that characteristic exists in the skill.

For example:

1. A squat is a gross skill.
2. Growth skills involve large muscle groups, create big movements and require little thought.
3. When squatting, many of the limbs are required to extend, forcing most of the muscle groups in the body to contract. The majority of joints are extending simultaneously therefore the performer does not need to think about the timings and coordination of the smaller muscle groups required to produce this movement.



Classifying Open and Closed Skills

Environment

How reliant is the skill on what's going on around it.

Open ⟷ Closed

Characteristics

- **Influenced by environment stimuli.**
- Solve specific in-the-moment problems.
- **Are often modified to suit situations.**
- Rely on decision making skills.
- **Timings are governed by other events.**
- Unpredictable.
- **Reliant on spatial awareness .**

Characteristics

- **Predictable.**
- Planned.
- **Self-governed.**
- Replicable.
- **Very little variation.**
- Controllable
- **No reliance on environmental stimuli.**

Handball defence is an open skill.

An open skill is a response to the environment, and the performer makes a decision on how best to adapt to the unpredictable and changing situation.

The defender does not know where, when or how to jump and position for a block. They have to constantly watch the attacker closely for clues that suggest what they might do next. Although they can practice, every time they go to make a block it is probably unique in the conditions and the decisions they made

A discus throw is a closed skill.

A closed skill is a predictable movement that can be controlled and repeated regardless of environmental factors.

The performer can train in the right size circle and develop a sequence of movements such as a spin and release that they can train their muscles to do every time. The only influence from the environment could be a wet or dry floor surface depending on the weather.

Classifying Gross and Fine Skills

Muscular Involvement

How many and how much are muscles used?

Fine ⟷ Gross

Characteristics

- Precise
- **Highly coordinated**
- Rely on correct timings
- **Small muscle involvement**
- Little movement

Characteristics

- **Large muscle groups**
- High force output
- **Low degree of accuracy**
- Simple timings and patterns
- **Performed with little thought**

A dart throw is a fine skill.

Fine skills involve small muscle groups that create precise and accurate movements.

When throwing a dart, the muscle controlling the fingers, wrist and forearm must work together to propel an object at the right height, speed and trajectory to hit an area 2-3cm wide. Hand-eye coordination is essential, and the arm and wrist must move in the correct way otherwise the dart will miss.

A deadlift is a gross skill.

Gross skills involve large muscle groups, create big movements and require little thought.

When deadlifting, many of the limbs are required to extend, forcing most muscle groups in the body to contract. The majority of joints are extending simultaneously therefore the performer does not need to think much about the timings or coordination of smaller muscle groups to produce the movement.

Justifying Skill Self/externally paced Classification

Pacing

Who or what decides when the skill starts and how long it takes to complete?

Self-Paced ⟷ Externally-Paced

Characteristics

- **Performer is in control.**
- No specified start time.
- **Speed and duration of skill is controlled by the performer.**
- Typically closed and unaffected by external factors.

Characteristics

- **Requires decision making.**
- External factors determine start point, speed of completion and the type of movement produced.
- **Performers react to their environment.**

Triple jump is self-paced.

Self-paced means the performer is in control of when the skill action starts, ends, and how quickly it's completed.

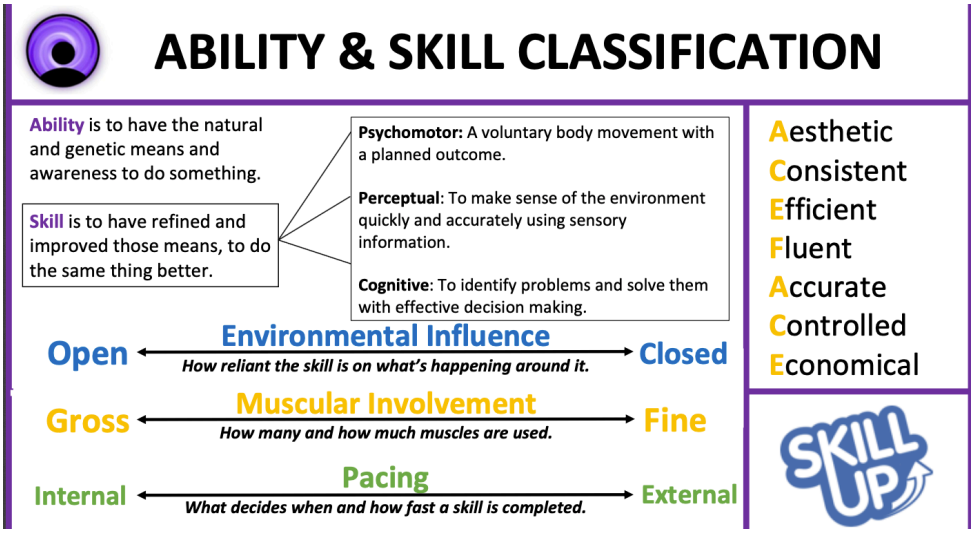
When it's their turn to jump, the performer can prepare themselves and begin their run up when they are ready. They choose the speed they run at and how quickly to transition between each jump phase.

Netball defending is externally-paced.

This skill class means the environment and external factors determine the start, completion and end time of the skill.

Movements when defending are dictated by what your opponents and team mates are doing. The defender can't choose when to start the skill, instead, they must listen and watch, to then respond at the right time and speed.

Review


ABILITY & SKILL CLASSIFICATION
Ability is to have the natural and genetic means and awareness to do something.
Skill is to have refined and improved those means, to do the same thing better.
Psychomotor: A voluntary body movement with a planned outcome.
Perceptual: To make sense of the environment quickly and accurately using sensory information.
Cognitive: To identify problems and solve them with effective decision making.
Aesthetic
Consistent
Efficient
Fluent
Accurate
Controlled
Economical
Open
Environmental Influence
How reliant the skill is on what's happening around it.
Closed
Gross
Muscular Involvement
How many and how much muscles are used.
Fine
Internal
Pacing
What decides when and how fast a skill is completed.
External
SKILL UP

1.2 Analysing skill and technique

https://www.bbc.co.uk/bitesize/guides/zxkr82p/test

Analyse selected skills and techniques from the following perspectives:

Analysing skills in different sports

Football

Skill or technique	Specific Skills	Grading Skills
Passing	Short, long, ground, true ball, chip, over the top,	
heading	the fans of, attacking, jump, contested, pass, set piece	Accuracy, speed, consistency, variation, creativity, success, timing, impact (for all)
shooting	short, long, Valley, half volley, band, sad piece, one touch, under pressure	
tackling	Short, long, ground, true ball, chip, over the top,	
dribbling	Sprint, slow, direction, both feet, under pressure, skill	

Identifying strategies and tactics

A successful strategy is when a collection of decisions are made that all support each other and lead to a greater chance of success.

Strategies can change according to external factors or internal goals.

Strategies can mostly be divided into broad categories such as offensive, defensive, conservative and aggressive.

Example 1 Zone Defence

A defensive strategy to prevent opponents from scoring.

Defender is engaged when attacker enters their designated area.

The defenders made the decision to only pick up opponents in their area.

They must make good decisions when communicating with their teammates on the movements of their opponents.

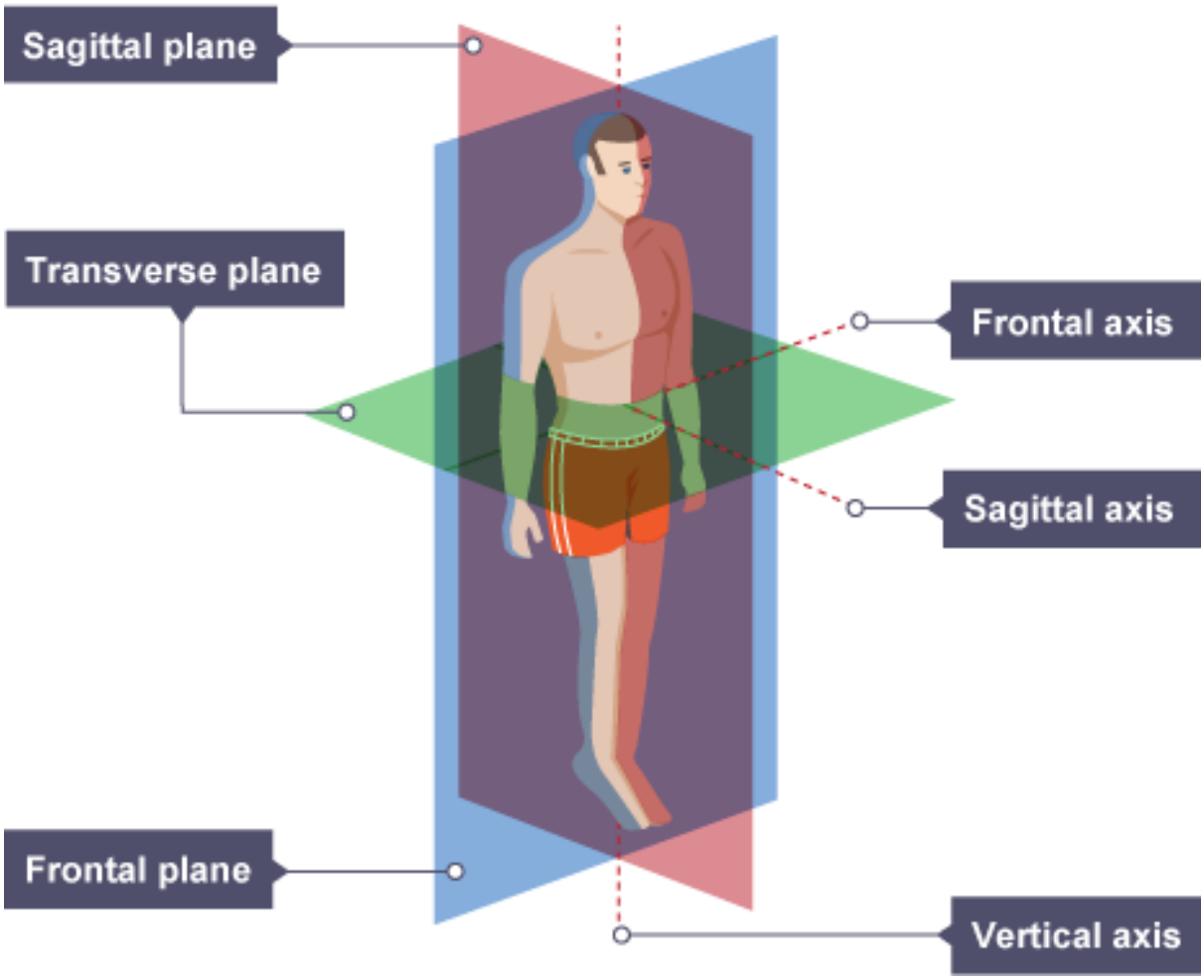
Example 2 High line in football

A highlight of football is when the defenders push up towards the halfway line to reduce the room for the opposing team to play in. This highline is used in conjunction with a high press. The high press means that attacking players pressurize the defender in the hopes that they can gain possession.

Communication is important between the defenders when holding a highline. If one player drops back and the other is hold the line an attacker can get in behind with a well-judged pass.

Students must be able to analyse skills and techniques from the below perspective (give examples of these)

- biomechanical; planes and axes, levers
- movement; vectors and scalars, Newton's laws of motion
- quality/effectiveness; economy of movement, creative application of skill



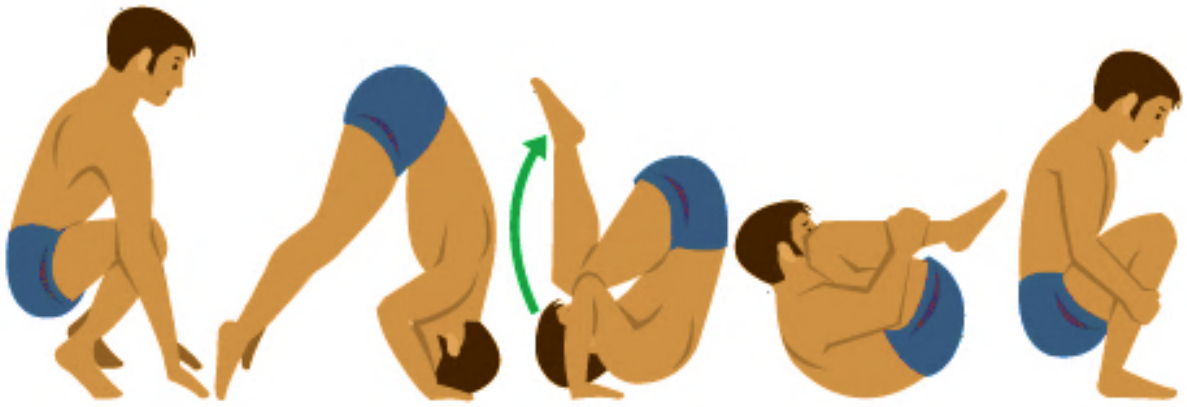
Movement takes place in 1 of 3 planes of motion (sagittal, frontal, or transverse) and around 1 of 3 axes (sagittal, frontal, or vertical).

- All body movements occur in different planes and around different axes.
- A plane is an imaginary flat surface running through the body.

- An axis is an imaginary line at right angles (perpendicular) to the plane about which the body rotates or spins.
- Movement along a plane follows the direction of the plane (frontal plane movement is a lateral raise left to right along that plane)

Question

What plane of movement and axis of rotation does a forward roll take place in?



Plane – sagittal, as there is flexion and extension of the knees, elbows, neck and spine.

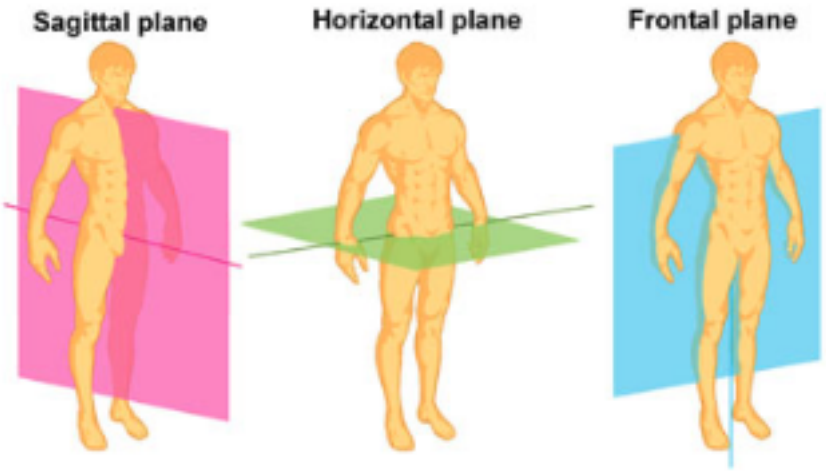
Axis – frontal, as there is rotation around a line running from left to right through the centre of the body.

Planes of movement

There are three planes of movement:

1. **Sagittal plane** - a vertical plane that divides the body into left and right sides. Flexion and extension types of movement occur in this plane, eg kicking a football, chest pass in netball, walking, jumping, squatting.
2. **Frontal plane** - passes from side to side and divides the body into the **front** and back (easiest to remember). This plane allows for lateral movement. Abduction and adduction movements occur in this plane, eg jumping jack exercises, raising and lowering arms and legs sideways, cartwheel.
3. **Transverse plane** - passes through the middle of the body and divides the body horizontally in an upper and lower half. Rotation types of movement occur in this plane, e.g. hip rotation in a golf swing, twisting in a discus throw, pivoting in netball, spinning in skating.

N.B Movements are parallel to the plane in which they take place (follow the line of movement).



Axes of movement

An axes is the point at which movement occurs about. There are three axes of movement around which the body or body parts rotate:

1. **Frontal axis** - this line runs from left to right through the centre of the body. Think about the players on a foosball table (tip frontal for foosball). For example, when a person performs a somersault they rotate around this axis.
2. **Sagittal (also known as the antero-posterior) axis** - this line runs from front to back through the centre of the body. Think of a rod going through your bellybutton. For example, when a person performs a cartwheel they are rotating about the sagittal axis.
3. **Vertical axis** - this line runs from top to bottom through the centre of the body. For example, when a skater performs a spin they are rotating around the vertical axis.

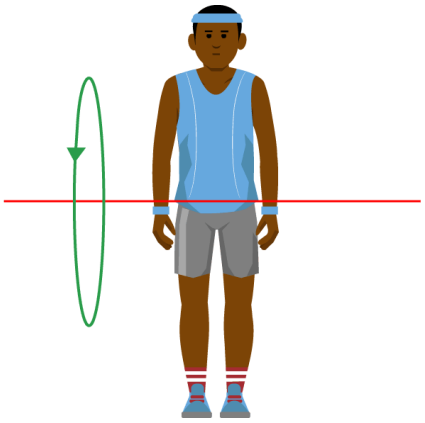


Fig 1 Frontal Axis

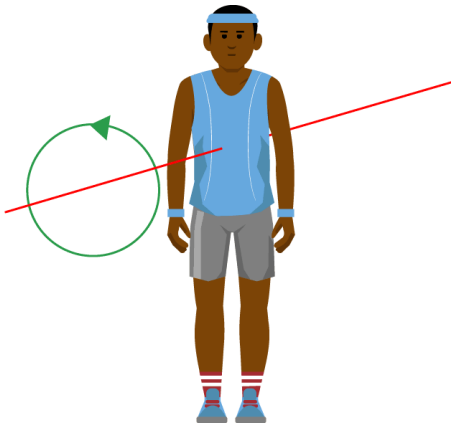


Fig 2 Sagittal Axis

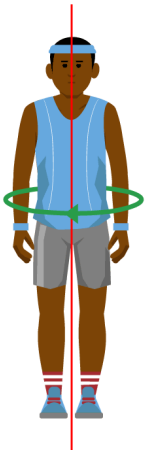
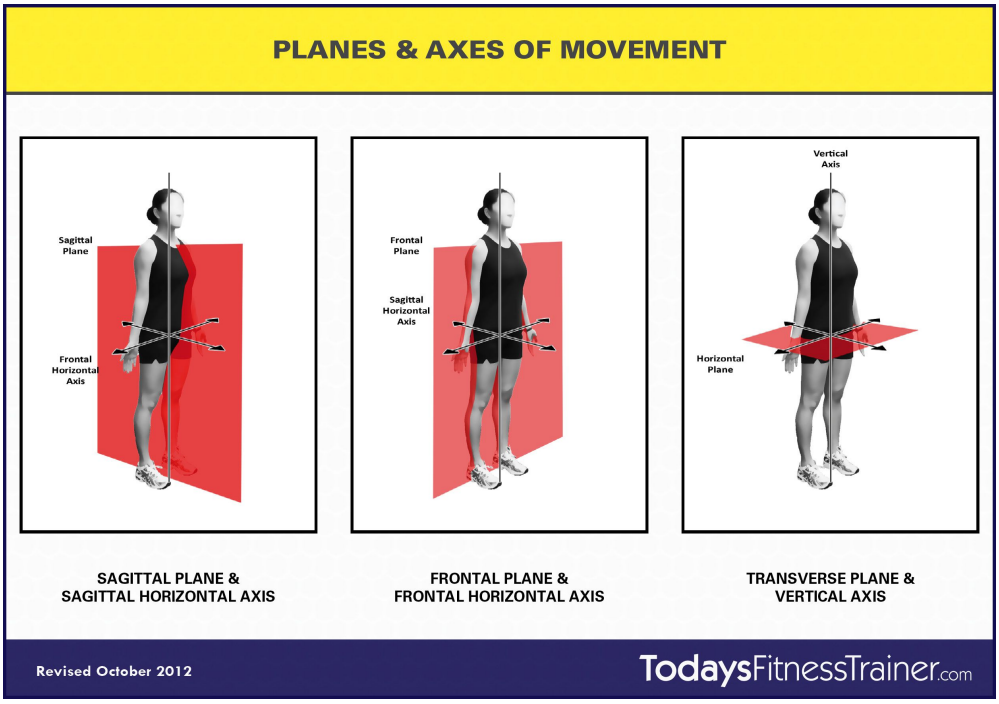


Fig 3 Vertical Axis

Examples of dominant planes, motions and axis in gross movements

Plane	Motion	Axis	Example
Sagittal	Flexion/extension	Frontal	Walking, Squatting, Overhead press
Frontal	Abduction/abduction Side flexion Inversion/eversion	Sagittal	Star jump Lateral arm raise Side bending
Transverse	Int rotation/external rotation Horizontal flexion/extension Supination/pronation	Vertical	Throwing, Baseball swing, Golf swing



Relationship between planes and axes

Each of the above axes run perpendicular to a plane of movement. Movement in each of the three planes is around of the three axes:

- FP rotates around the sagittal axis
- SP rotates around the frontal axis
- TP rotates around the vertical axis

Movement

Vectors and scalar quantities

A magnitude is a general term that refers to the amount or size of something.

A velocity is a specific thing that may have a magnitude.

In physics, “velocity” is a *technical term* that refers to the speed and direction of an object in one handy package called a “vector”.

The amount of velocity you have would be the *speed* part of the vector.

Thus: speed is the magnitude of the velocity.

If you were driving at 55mph due north, then your speed is 55mph and your velocity is “55mph due north”.

However, language gets used in all sorts of ways, and the word “velocity” is often sloppily used to refer to speed as well. You have to use context to sort it out.

Vectors:

A vector is a quantity that has both magnitude and direction.

Examples of vectors:

- Displacement: distance in a given direction (e.g. 50m east).
- Acceleration:
- Velocity
- Force

Sporting example: A QB in American football throws the ball to a receiver. The QB must control the speed of the ball as well as the direction.

Scalars:

A scalar has magnitude only; direction is not important. A scalar is a quantity that is fully described by a magnitude only. It is described by just a single number.

Examples of scalar quantities include:7.1x

- Speed
- volume,
- mass,
- Temperature,
- Power
- Energy
- time.

Sporting example: Usain Bolt running 9.58 for the 100m world record.

What is the difference between a scalar and vector? https://www.ducksters.com/science/physics/scalars_and_vectors.php

A vector quantity has a direction and a magnitude, while a scalar has only a magnitude. You can tell if a quantity is a vector by whether or not it has a direction associated with it.

Example questions: Is it a scalar or a vector?

1) The football player was running 10 miles an hour towards the end zone.

This is a vector because it represents a magnitude (10 mph) and a direction (towards the end zone). This vector represents the velocity of the football player.

2) The volume of that box at the west side of the building is 14 cubic feet.

This is a scalar. It might be a bit tricky as it gives the location of the box at the west side of the building, but this has nothing to do with the direction of the volume which has a magnitude of 14 cubic feet.

3) The temperature of the room was 15 degrees Celsius.

This is a scalar, there is no direction.

4) The car accelerated north at a rate of 4 meters per second squared.

This is a vector as it has both direction and magnitude. We also know that acceleration is a vector quantity.

Levers

Biomechanics can be defined as the science that studies the movement of the body. Sports biomechanics refers to the analysis of the interactions between muscles, bones, tendons and ligaments, and how they relate to movement in sport. Force is an important element of biomechanics as the body creates force to move but also has forces acting on it.

- Students need to be able to draw and give sporting examples of levers.

First, second and third class levers in the body

https://www.bbc.co.uk/bitesize/guides/zxkr82p/revision/1

https://www.ocr.org.uk/Images/252173-biomechanics-psychology-and-physical-training-lesson-element-instructions.pdf

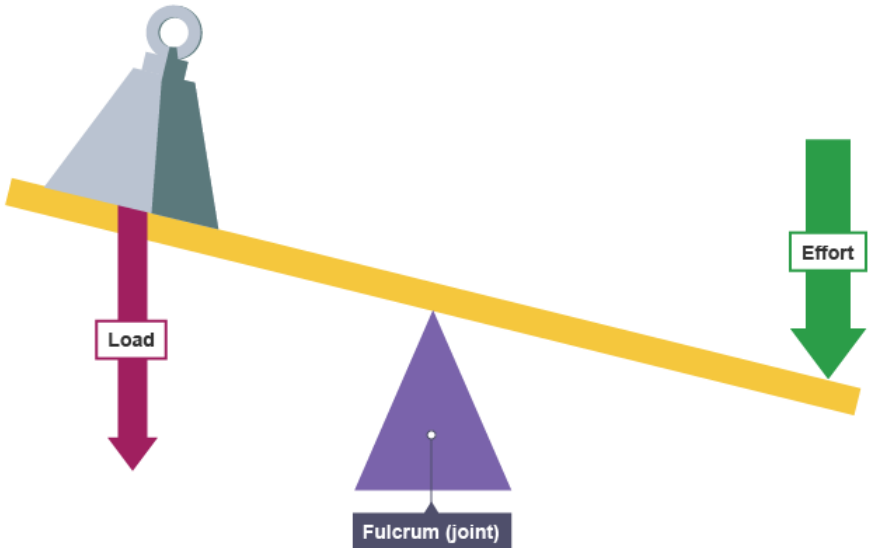
this link is very useful for levers

Levers in our body are formed from bones, joints and muscles.

A lever consists of:

- a rigid structure (bone)
- a force acting upon it (muscle) to produce a turning movement (angular motion)
- a fulcrum which is a fixed point (joint)
- a load or resistance that is placed on the rigid structure (weight of body part being moved and anything that it is carrying)

A typical lever



There are three types of lever.

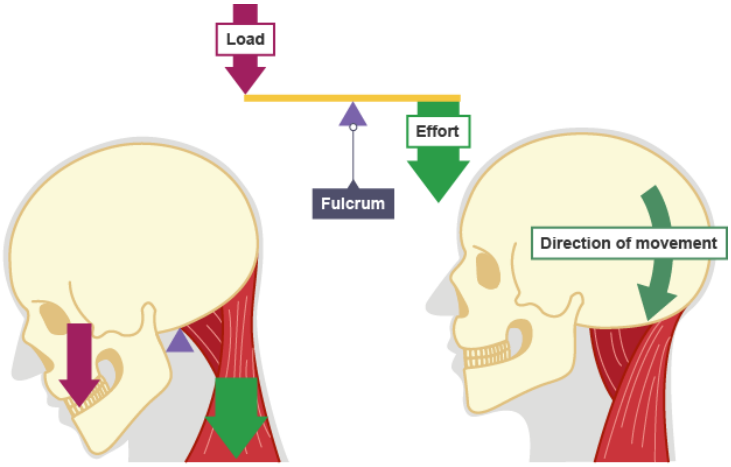
1. First class lever – the fulcrum is in the middle of the effort and the load.

First class lever

This type of lever is found in the neck when raising your head to head a football. The neck muscles provide the effort, the neck is the fulcrum, and the weight of the head is the load.

contraction of the gastrocnemius muscle. This second class lever is used when taking off for a jump or pushing against the blocks in a sprint start.

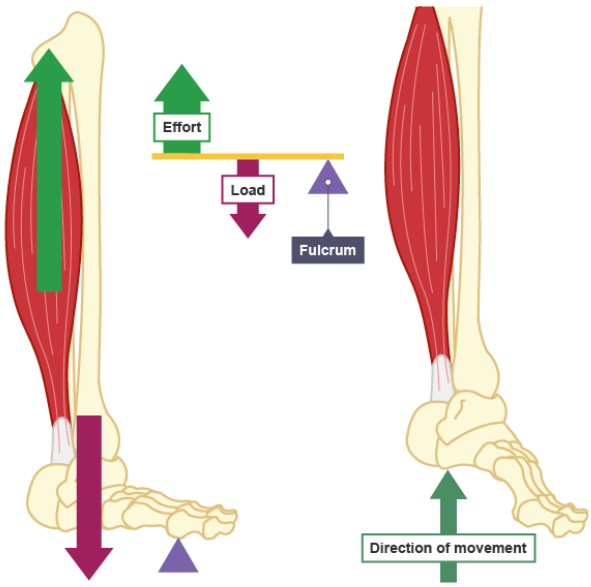
Example in sport: A basketball player taking a free throw or a player heading a football.



2. Second class lever – the load is in the middle between the fulcrum and the effort.

Second class lever
This type of lever is found in the ankle area. When standing on tiptoe, the ball of the foot acts as the fulcrum, the weight of the body acts as the load and the effort comes from the contraction of the gastrocnemius muscle. This second class lever is used when taking off for a jump or pushing against the blocks in a sprint start.

Example in sport: A long jumper taking off from the board.

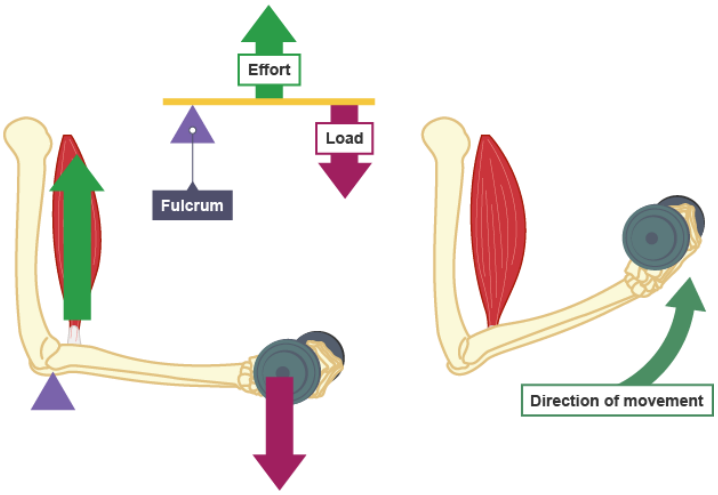


3. Third class lever – the effort is in the middle between the fulcrum and the load.

Third class lever

During a biceps curl, the fulcrum is the elbow joint, the effort comes from the biceps contracting and the resistance is the weight of the forearm and any weight that it may be holding.

Example in sport: A rower pulling.



Differences in Lever class

Effort arm: How far away the effort is applied to the lever away from the fulcrum.

Resistance arm: How far away the resistance is applied to lever away from the fulcrum

Mechanical advantage

This describes a lever which can move a larger load then the size of effort applied.

This occurs when the effort arm is bigger than the resistance arm

Mechanical disadvantage

When the load arm is longer than the effort arm. Mechanical disadvantage helps to move a load further and faster. This is where a large force needs to be applied to overcome the load In order to move it. Third class levers work with mechanical disadvantage. They can increase the speed of the lever arm by making small movements bear the fulcrum that result in larger movements by the load. The forehand in tennis is an example. The long load arm allows for greater generation of speed in the tennis racket face, allowing the player to strike the ball harder.

Calculating mechanical advantage

Effort Arm/Resistance arm = Mechanical advantage

A score greater than one makes them leave her system mechanical advantage more resistance can be overcome than the effort required.

A Small muscle can move large mass. Second class lever - hopping

N.B To recall the order of the levers use the term '**FLE**' - this will help you to remember which part of the lever is in the **middle**.

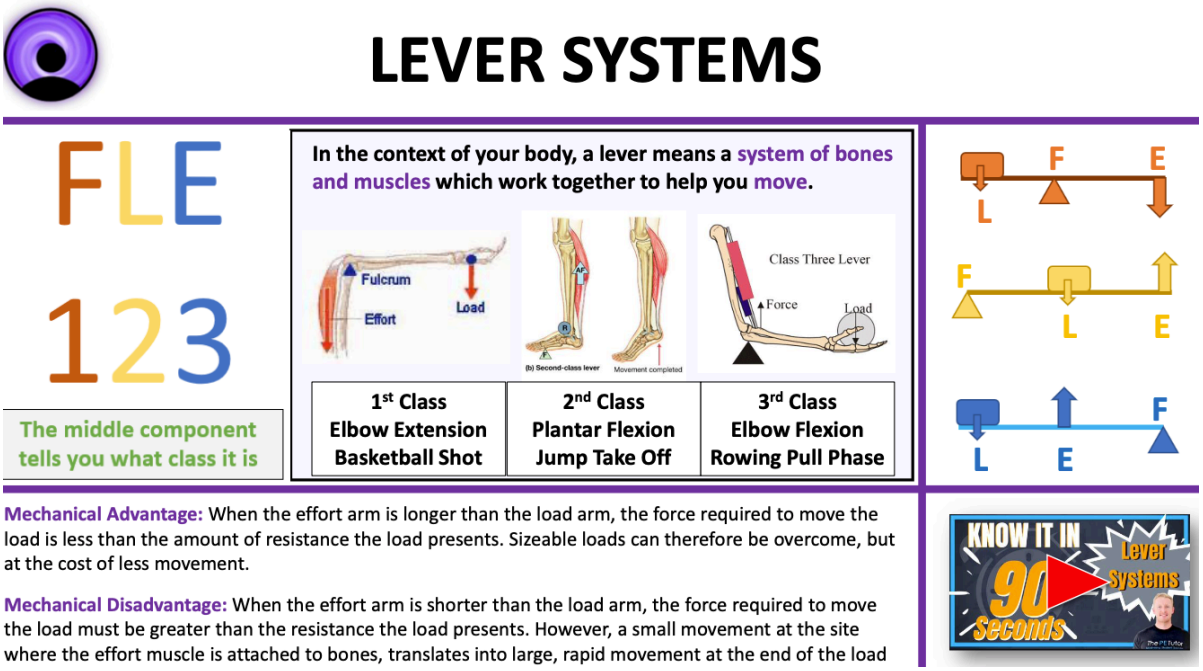
First class lever - **F**ulcrum is in the middle (EFL).

Second class lever - **L**oad is in the middle (ELF).

Third class lever - **E**ffort is in the middle (FEL).

When drawing a diagram Fulcrum is always below the line, load is always pushing downwards, and effort must counterbalance load.

Review



NEWTON'S LAWS OF LINEAR MOTION

Biomechanics

In order to assess my performance, we can analyze how their limbs move, the forces they exert and the shapes they create with their bodies.

These observations and measurements can be compared to tried, tested and proven moving patterns in order to identify technical strengths and weaknesses.

Biomechanics is the term given for this form of movement analysis.

Using biomechanics to improve performance

- Optimum directional force application.
- Best body shape for desired rotation.
- The crack joined angles for takeoff in the long jump
- Correct body posture for maximum force output

These laws completely determine the motion of a point, such as the centre of mass of a sports performer, and are named after the great British scientist of the sixteenth century, Sir Isaac Newton. They have to be modified to deal with the rotational motion of the body as a whole or a single body segment, as below. They have limited use when analysing complex motions of systems of rigid bodies, but these are beyond the scope of this book.

Resource for newtons laws
https://www.youtube.com/watch?time_continue=123&v=sPZ2bjW53c8&feature=emb_logo

First law (law of inertia)

An object/body will continue in a state of rest or of uniform motion in a straight line (constant velocity) unless acted upon by external forces that are not in equilibrium; straight line skating is a close approximation to this state; a skater can glide across the ice at almost constant velocity as the coefficient of friction is so small. To change velocity, the blades of the skates need to be turned away from the direction of motion to increase the force acting on them. In the flight phase of a long jump the horizontal velocity of the jumper remains almost constant, as air resistance is small. However, the vertical velocity of the jumper changes continuously because of the jumper's weight – an external force caused by the gravitational pull of the Earth.

When a golfer places a ball on the tee, the ball will remain on the tee unless an external force moves it. This external force could be the wind or the golf club swung by the golfer.

Second law (law of momentum)

The rate of change of momentum of an object is proportional to the force causing it and takes place in the direction in which the force acts. For an object of constant mass such as the human performer, this law simplifies to: the mass multiplied by the acceleration of that

mass is equal to the force acting (F=ma). When a ball is kicked, in soccer for example, the acceleration of the ball will be proportional to the force applied to the ball by the kicker's foot and inversely proportional to the mass of the ball.

If the person increases their leg strength through resistance training, they will have an increased capacity to generate more force when kicking the ball.

Third law (law of interaction)

For every action, or force, exerted by one object on a second, there is an equal and opposite force, or reaction, exerted by the second object on the first. The ground reaction force experienced by the runner of Figure 5.3 is equal and opposite to the force exerted by the runner on the ground (*F*); this latter force would be shown on a free body diagram of the ground.

A sprinter when sprinting will generate force into the ground. The ground will produce a counterforce, sending the athlete into the air. (Use diagram

Sources of resistance in sport

Inertia	The resistance of a body to a change in motion.
Gravity	A constant downward vertical acceleration on the performers body.
Friction	A gripping force beneficial to athletic movements. Think of the difference of running on a mondo track surface compared to running on a cinder track.
Fluid forces	Hydrodynamic (resistance of movement through water) and aerodynamic (resistance of movement through air) forces can cause resistance to an athlete, who may feel **a drag** (a force that slows down an athlete or an object).

Reducing drag in sport to increase performance

Drag is a force that slows down an athlete or an object. Reducing drag is one of key elements to improving performances in swimming.
The introduction of the Speedo LZR racing suit in 2008 caused ripples around the swimming community. The LZR was a full body suit made of low-friction elastane-nylon and polyurethane. The suits compressed the body and trapped air for buoyancy, this allowed swimmers to glide more freely through the water. This reduced drag felt by swimmers, leading to 20 World records being set at the 2009 World championships. The suit improved swimmers' times so dramatically that the rules had to be changed to ban the suit.
However, almost all swimmers shave their body as excess hair can lead to more drag in the pool.

Review:

Vector, Scalar & Newton's 3 Laws

1ST – Law of Inertia: A body/object will remain at rest or in a constant state of motion unless acted upon by an external force such as gravity, air resistance or another body/object.

2nd – Law of Acceleration: When acted upon by an external force, the rate of change in the body/object's motion is proportionate to the magnitude of the external force that acted upon it.

3rd – Law of Reaction: For every action force, there is an equal an opposite reaction counterforce. In sport, many actions involve a performer applying force in 1 direction so as to move in the opposite way. A sprinter pushes back and downwards through the blocks. The blocks exert a counterforce forwards and upwards propelling the runner into their race.

VECTOR	**Magnitude and direction** **Combine one or more units of measure, in a given direction.**	**Weight** **Acceleration** **Displacement**	**Making a successful hand pass to a teammate with sufficient, force, angle and direction.**
SCALAR	**Only magnitude** **They are measuring one unit**	**Speed** **Distance** **Time**	**A coach measuring a sprinters 100m attempt on a stopwatch**

Law of Inertia

The ball will remain resting still on the floor unless kicked

Law of Acceleration

When kicked, the force of the kick will determine the balls acceleration and speed

Law of Reaction

When the ball hits the post, the equal and opposite reaction forces moves the ball back the way it came from.

Analysing Performance

Performance analysis (PA) provides both coaches and athletes with objective data to help them understand and improve performance. This process requires systematic observation, which provides valid, reliable and detailed information relation to the athletes performance.

PA can help improve coaching by providing video analysis and statistical data. The benefits of objective data is that is provides enhanced feedback between coaches and athletes. Training and lifestyle interventions can be a result of this to help improve performance.

PA is driven by a sports needs to interpret and improve technique, movements and tactics, which can be achieved through delivery of real time feedback.

It is of vital importance to interpret the data, so that the coach and athlete can understand what is happening, rather than think they know what is happening. Understanding the objective data and implementing changes in training programmes is of vital importance to improvements in performance.

British Cycling

British cycling championed by Sir Dave Brailsford is an excellent example of a team that used objective data to improve every aspect of their performance.

Stages of high-performance cycling analysis include:

- Modelling and measuring the actual demands of what it takes to win.
- Supporting the training environment through targeted video and data monitoring.
- Delivering pre-competition intelligence through objective profiles of our athletes and the opposition strengths and weaknesses and through supporting the selection process with objective data.
- Capture, code analyse and feedback are the focus of the competition phase.
- Perform detailed post event analysis to support learning, and tell the store of what happened through objective data.

Benefits for athletes:

- Improved confidence
- Improved decision making
- Improved tactical and technical knowledge
- Improved recovery

Benefits for coaches

- Assists in the understanding of athletes strength and weaknesses
- Enhanced their coaches development
- Enables in-depth review of a performance

Relevance to PE

Observation and the ability to analyse performance are two skills that must be learned and practiced. An approach such as the following is recommended when seeking to develop observation and analyse skills.

1. Focus on a single technique (Forward roll)
2. Observe and analyse the technique being performed
3. Observe and analyse a competitive performance of an individual.
4. Observe a competitive team performance.

Economy of Movement

Simple definition: How efficient or energy sparing an athlete is when they are moving. (Think Economy = efficiency)

Economy of movement (EM) is defined as the quantity of oxygen (ml.k.min-1) required to move at a given speed or generate a specific amount of power. It has been shown to be an vital predictor of endurance performance in a number of sports such as running, swimming and cross country skiing etc.) and can help differentiate differences between individual athletes performance.

Economy of motion is influenced by several factors such as neuro-muscular co-ordination, elastic energy,, joint stability and flexibility, and percentage of type 1 muscle fibres etc.

Energy expenditure: the less energy an athlete uses when executing a skill, the more efficient their movement is. If an athlete is more efficient with their movement, their body will use less oxygen and fatigue less performing a movement.

Example: Marathon runners must have well trained aerobic systems; this will allow them to distribute their energy over the whole race. The more efficient an athlete is, the less energy they use and fatigue to the body.

Technique execution: if an athlete can regularly execute skills with minimal energy wastage, they can sustain efforts for a longer period of time without fatiguing. Athletes seek to become more technically efficient so they can apply the forces they create in the most economically way possible.

Example: The 400m sprint is the most gruelling event on the track, the athletes must have the speed of a sprinter and the endurance of an 800m runner. The race is deemed a sprint but the ability to correctly pace the race is essential. Run too fast to 200m and an athlete will struggle to finish, run too slowly and an athlete won't be able to make up ground.

Hundreds of a second in pacing separates a great race from a poor one. During the last 100m of the race lactic acid builds up and causes the body to fatigue, keeping your body moving in a straight line rather than zig zagging from side to side is essential to a good performance. Every ounce of energy expended in an inefficient way, is energy wasted. Coaches and athletes spend a large portion of their time focusing on developing efficient technique, to minimize energy wastage.
The Skill is sprinting, the technique is sprinting technique and racing execution.

Factors that influence exercise economy:

1. **Neuro-muscular co-ordination**
   Every muscular contraction requires a co-ordinated contraction of muscles and muscle fibres. The great the co-ordination the lower the energy cost, and the more efficient motion will be.

2. **Elastic energy**
   Enhanced elastic energy storage and return improves exercise economy. Plyometric exercises such as jumping can help improves the storage of elastic energy.

3. **Percentage of type 1 muscle fibres etc.**
   The percent type of type 1 muscle fibres affects economy; type 1 muscle fibres have a greater level of efficiency than type 2. Type 2 are required for high intensity exercise like sprinting

4. **Joint stability and adequate flexibility**
   Both of the above enhance economy in walking and running. joint flexibility needs to be Adequate but increased joint stiffness particularly in the hip and calf regions is associated with improved running economy.

Genetics

There seems to be a strong genetic influence with regard to exercise economy with up to 20-30% variation in running economy perceived amongst trained runners of similar ability.

Creative application of skill:

Think of the following sporting movements:

- A step over in football
- A dummy pass in rugby
- A rabona in football
- A Panenka penalty
- A no-look pass in basketball

All these skills above have something in common. They are moving patterns executed in different sports and are all examples of the creative application over skill.

They are high risk, high reward and extremely aesthetically pleasing.

One of the many reasons that sport draws such a huge audience, is that spectators enjoy watching and lead out leads perform highly skilled movement patterns with creativity. Often many athletes trademark a particular skill (Ronaldo and the step-over) which makes them stand out.

Many elite sports people can execute skills at a high level, but it is the athletes who add a creative touch to a particular skill that make the athlete so popular. These athletes are described as having the "X Factor" and everyone wants to watch them play.

Sporting example:

- A good example of the creative application of a skill can be seen in the use of the "Panenka" technique for a penalty kick in football.
- The technique was dubbed the "Panenka" after Antonin Panenka who scored the winning penalty in the 1976 European Championships final.
- The Panenka is when a player feigns to kick the ball into the corner, instead he delicately chips it down the middle. When it comes off it is a sensational occurrence. However, when a player as unsuccessful it makes them look silly.

1.3 Skill acquisition

Outline the stages of learning a new skill

A motor programme consists of 3 parts:

1. The **recipe** is the list of instructions you remember in your brain.
2. The **ingredients** are all the different muscles, limbs and forces you have the potential to use.
3. The **finished meal** is the movement you produce after combining the right muscles, forces and timings together

Fitts and Posner (1967) – stages of skill-learning

Table 6.2 Summary of Fitts and Posner's (1967) Three Stages of Motor Learning

Stage	Process	Characteristics	Other name
Cognitive	Gathering information	Large gains, inconsistent performance	Verbal-motor stage
Associative	Putting actions together	Small gains, disjointed performance, conscious effort	Motor stage
Autonomous	Much time and practice	Performance seems unconscious, automatic, and smooth	Automatic stage

Three Stages of Motor Learning (remember ACEFACE for the characteristic of a skilled performance)

Stage of learning	**Factors that help progress through each stage**	**Example**	**Characteristics of performance quality (think of ACEFACE)**
Cognitive stage	Positive extrinsic feedback Self-discovery Trial and error	Learners think a lot about how to perform as the whole experience is new to them	Poor quality 1. Inaccurate 2. Inefficient 3. Inconsistent 4. Lack of control
Associative stage	Positive/negative Intrinsic/extrinsic Demonstration	Learners can link some prior success with repeat problems they face and have a starting point to form their responses from	Improved quality 1. More consistent 2. More Efficient 3. Better control 4. More Fluent 5. Improved kinaesthetic awareness
Autonomous Stage	Intrinsic feedback Negative Video analysis	Learners can recognise problems and an effective solution for them quickly and produce them accurately and consistently.	Elite level High level of quality in the each characteristic of a skill (ACEFACE)

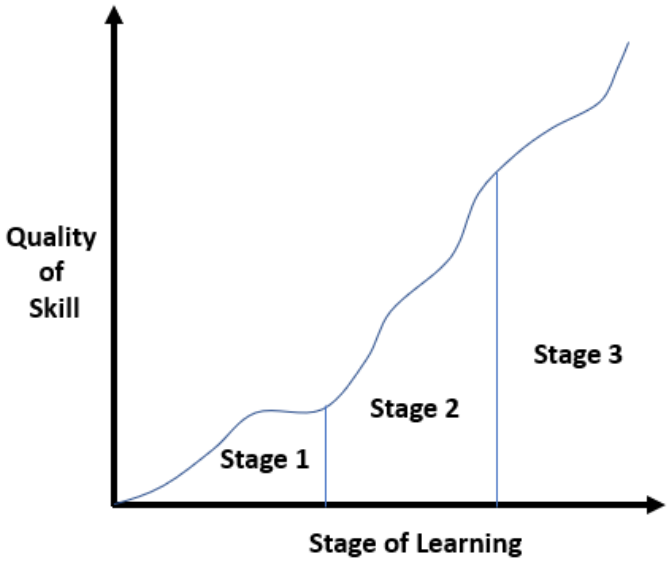
Have you ever wondered why a skill might break down in competition? Well it could well be that the skill was not actually well learned in the first place. The player may only have completed the first two stages of development in the skill and when pressure was applied (in the form of anxiety and nerves) it was not engrained sufficiently well to hold up under pressure.
Time, practice, and above all, patience is required if the skill is to arrive at the automatic or mature stage. Researchers tell us thousands of hours are needed for all skills of a game to be ingrained at the automatic stage. In practical terms this means hours of practice – however for the coach, knowing what stage the player is at is also very important if the journey is to be successful.

The Three Stages of Motor Learning:

- **The Cognitive Stage (Preparation) stage:** When an athlete is first introduced to a skill he or she will be required to understand how to perform the skill correctly. A great deal of thinking and concentration will be required by the athlete at this stage if he or she is to understand the skill. It is important therefore not to over-coach the athlete at this stage. Coaches must not overload the athlete with several tasks at the one time.
    - Coaches must however, above all, be positive and supportive. The coach should also understand mistakes can be useful in the learning process. They can be positive experiences in recognising what is not an efficient movement. In this way athletes can actually learn from their mistakes.
    - **Sporting example:** A volleyball player learning to serve for the first time. This is a tough skill to master, good hand eye coordination and kinaesthetic awareness is required.
- **The Associative (Practice) stage:** The emphasis during this stage is on quality practice. There will still be a high degree of concentration required during this stage but this will shift from an emphasis on learning the proper sequencing of the movements involved in the skill to precision of timing and coordination. Mistakes will now start to reduce. This is how the coach and athlete will know more learning is now taking place. Feedback that progress is being made is very important. However, when progress is not being made, or seemingly is not being made, the role of the coach may change. This is where the coach needs to understand the many factors that impact on the development of the athlete and so there may be times when the learning process takes a secondary importance.
    - **Sporting example:** A rugby player who takes the teams kicks will spend hours trying to perfect their technique. A player in the associative stage will develop their capacity to effectively strike the ball. The player is becoming more comfortable with a routine which will them to approach the ball with purpose, strike the ball at the right angle and have a consistent follow through.
- **The Autonomous (Automatic) stage:** The skill now seems to be easier to perform under different conditions. Less time is needed on thinking or concentrating with only small changes in the skill's technique now required. The skill is becoming more

consistent and reliable. If an error is made the athlete tends to know what to do to correct it. Under pressure the skill is holding up better.

- For the coach and athlete it is now important not to over-analyse or over-complicate the skill. Yes refining it is now perhaps a goal and this can be done in a variety of ways. Again the guide here is it should not be a major reconstruction job rather a fine-tuning. The phrase coined by a popular sports clothing and footwear company is appropriate here, “Just do it!’’ This is the stage when mental rehearsal is very effective so as to ensure the brain’s “picture” of the technique is ingrained. Indeed such mental imagery techniques have been shown to add to the performance.
- **Sporting example:** Most elite level performers are at the autonomous stage A high diver completes a series of complex movements in sequence in the blink of an eye. Divers display a sense of calm and composure when engaging in their routine. They demonstrate high levels of kinesthetic awareness as they move their body through the air before applying an effective entry strategy to the water.

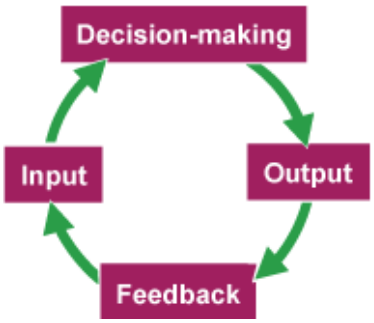


As an individual goes through each stage the quality of the skill increases.

1.3.2 Describe how skills are learned effectively

Information processing model

When sportspeople perform or learn and develop new skills, they have to process information. The information processing model is one method that can be used to consider how learning takes place. The model contains four parts that are linked together in a 'learning loop'.



Input is the information that is received from the senses. At the cognitive (early) stages, this will overload the decision-making process. As the learner becomes more skilled they **selectively attend** the correct cues and information.

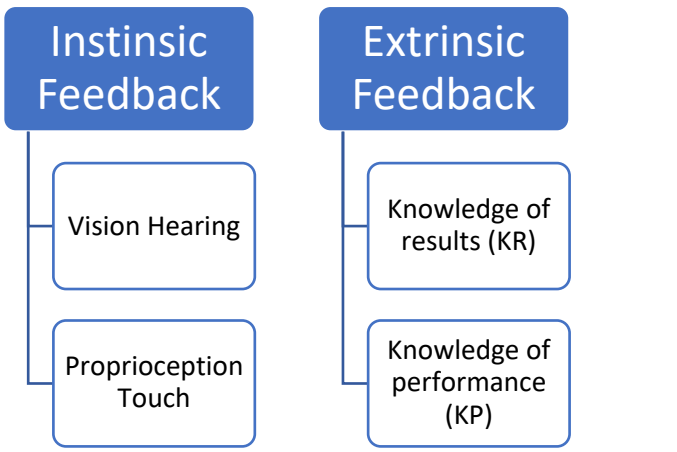
Decision-making interprets the input using its short and long-term memory and decides *what*, *when*, *where* and *how* the learner responds.

Output is the action or actions that respond to the situation.

Feedback will indicate whether or not the response was correct and successful.

Feedback: information or statements of opinion about something, such as a new product, that can tell you if it is successful or liked.

Feedback



There are two types of feedback:

- intrinsic
- extrinsic

Intrinsic feedback (IF) is the physical feel of the movement as it is being performed. It is what is felt by the performer as they execute a skill or performance. Athletes can receive IF through their **kinaesthetic feel** for the movement, for example how their body felt when completed a high dive. They can use that real-time information to adjust their movement to ensure they are in the right position when landing and prevent over rotation.
Athletes also receive IF through **hearing** and **sight**. They could see if the ball went into the back of the net or hear athletes breathing down their neck on the last lap of a 1500-meter race.
IF can be useful as it allows athletes to adjust to improve their performance, but they must also learn to filter out crowd noises, so it doesn't impact their concentration and negatively impact their performance.

Extrinsic feedback is provided by external sources, during or after a performance. It can come from teachers, coaches, team-mates and also includes things that the performer can hear or see. For example, a wheelchair basketball player can hear verbal feedback from a coach, comments from teammates, the response of the spectators and the referee's decisions. The player can see where the ball goes and what the score is.
Augmented feedback is also known as extrinsic feedback because it involves information that is not received from the movement itself. It builds on intrinsic feedback which is the information the athlete receives from their muscles and joints while performing the movement in the sport (Sports Coach, 2009).
There are two types of augmented feedback, **knowledge of performance (KP) and knowledge of results (KR).**

1. **KP** entails feedback about form and technique. Feedback can come from the coach or from video. An example would be identifying an error in technical performance of a skill (tennis serve) and offering a solution or alternative way to improve that skill.
2. **KR** is feedback about results. This can include scores, times, and distances (Mononen et al., 2003). An example in basketball would be an athlete looking at the scoreboard towards the end of the game and seeing they are losing by 3-points. This can lead to anxiety as the clock is ticking down which may lead to errors. This is when the coach should remind the players they have plenty of time and it is only a one score game.

Positive feedback: is when praise is directed towards a performer following the completion of a movement or performance. The coach will highlight was done well during the movement/performance. Performers in the cognitive stage will tend to benefit most from this feedback. For example, a player scores a goal in football, the coach highlights that and praises the skill execution and end result.
Negative feedback: this type of feedback tends to focus on the mistakes made by the performer. This form of feedback must be accompanied by advice on how to improve and what the athlete has done well to provide the motivation to the performer to improve. This type of feedback is beneficial to elite performers as it can help highlight the minor inaccuracies in technique that must be improved to reach the highest level. This feedback is not appropriate for cognitive stage learners. For

example, a coach highlights the errors made by a golfer when putting. The coach now suggest a different grip to improve the golfers putting

Feedback can also be experienced at different times:

- concurrent
- terminal

Continuous (Concurrent) feedback is experienced by the performer whilst completing the action. For example, a gymnast will experience feelings of being in a balanced positioned whilst they successfully complete a handstand.
It is often the case that that concurrent feedback is also intrinsic feedback.
Terminal feedback is experienced by the performer once the movement has been completed. For example, a cricketer receives terminal feedback about the quality of their shot once the ball reaches the boundary.
It is often the case that terminal feedback is also extrinsic feedback.

Advantages of intrinsic and extrinsic feedback
A coach will need to judge what type of feedback – intrinsic or extrinsic – is most effective in helping the performer to acquire and improve their skills. This will vary depending on the performer's experience, ability and learning style. The following factors will help make a judgement.

Advantages of intrinsic and extrinsic feedback

Advantages of intrinsic	Advantages of extrinsic
Helps performers to focus on the feel of a skill	Provides new or additional guidance
Helps performers to solve problems themselves	Helps performers to identify problems
Helps performers to develop skills independently	Offers solutions to problems
Gives performers more time to practise	Prevents performers from reaching a dead end

Most performers benefit from a mix of intrinsic and extrinsic feedback.
Generally, novices and experienced performers will seek different types of feedback at different times.
Novice
A novice can be thought of as a beginner. When a performer is new to a sport, they may need more **extrinsic** feedback to start with. This helps them to acquire the basic skills. However, novices should also have time to practise on their own so they can begin to get a feel for and grasp those skills.
Experienced
An experienced performer, who is familiar with the sport, will have acquired the basic skills and may have developed into an elite performer. They may need more **intrinsic** feedback to refine and master those skills. However, experienced performers will also need extrinsic feedback to overcome persistent problems and to develop more complex skills.
Research suggests that performers benefit from feedback most when they ask for it.

Using feedback effectively

In selecting type of feedback to use, coach needs ensure that the athlete is capable of processing and dealing with that type of feedback.
The type of feedback given to a cognitive stage performer may not be suitable for autonomous stage performer. Negative feedback may be a useful tool to improve an autonomous performer, but some athletes in the associative stage may not be ready for that type of feedback.
The specific type of feedback should be tailored to each individual and should provide them with the motivation to continue to improve and not reduce their confidence in the sport.

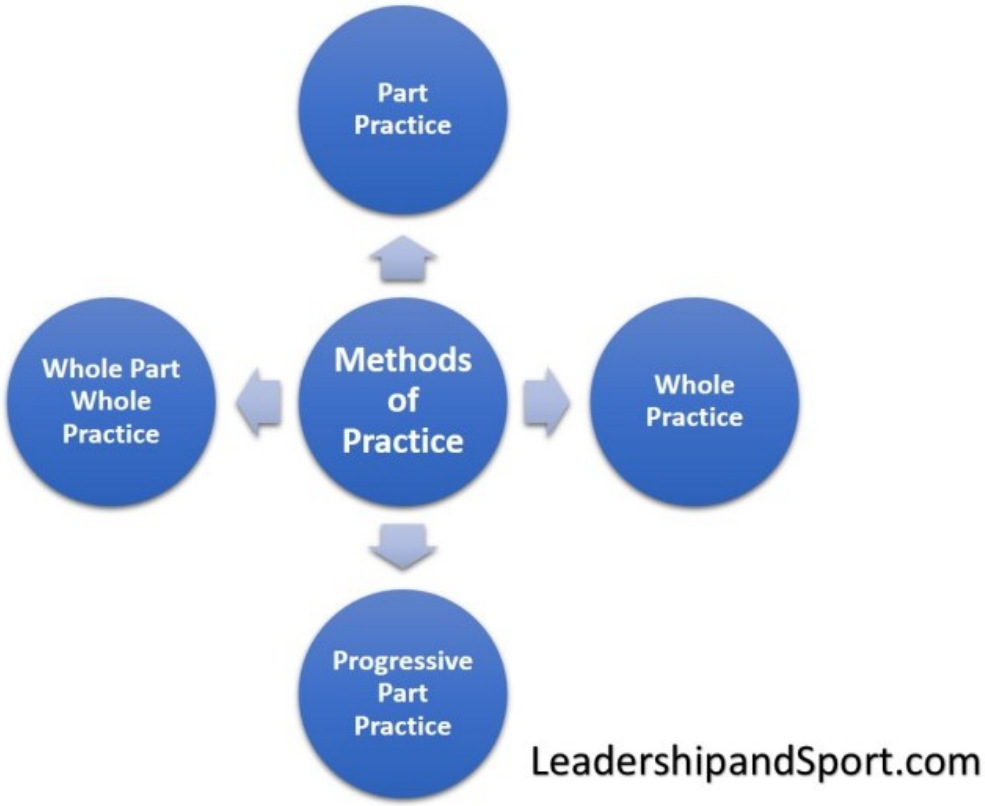
Types of practice:

When designing a training session, a coach must decide what level the athlete is at. The coach can then chose the type of practice which will best suit the specific needs of the athlete.

1. **Fixed**: these can be known as drills and requires repetition of a whole skill in order to improve motor programming. For example, a football player practicing his penalty technique, or a golfer practicing putting.
2. **Massed**: this is a continuous form of practice without rest and is best for simple skills. A tennis rally is an example, where the learner must practice a volley continuously. This leads to fatigue and stimulates real game conditions.
3. **Variable:** This is best for open skills and involves repeating a skill in varying situations. For example, shooting practice in basketball, where a coach may alter the drills shooting position and include defenders. During a **variable practice**, a skill is practised in different settings with unpredictable and changeable conditions.
4. **Distributed:** A skill is broken into intervals, to allow sufficient rest and mental rehearsal. This is best used in difficult, dangerous or fatiguing skills and with young or lowly motivated learners.
5. **Mental practice:** an athlete prepares mentally by rehearsing and visualising their performance or individual parts of their performance in their mind. This can assist the athlete in executing the technique/skill required to perform optimally. Visualisation can improve confidence, which can play a role in successful skill execution. Mental practice is important in developing complex skills. For example, a high diver (10m board) will visualising their routine before they attempt it.

Methods of practice

Several approaches can be taken when practising skills. These approaches are called methods of practice, and each method has its own benefits. A coach must decide the most suitable method for the athlete and for the skill being practised.



Whole

Whole practice is when a sports coach teaches a skill together without breaking this apart. Whole practice is sometimes used by a sports coach because some skills are very difficult to break down (Sprinting, cycling, rowing).
This method is useful because it allows learners to experience the feel for a skill and can be quicker to learn than part practice. However, whole practice could potentially lower the quality of the performance as part practice enables coaches to break down the skill to provide more detailed feedback.
Example: a basketball player practicing free throws

Part
Part practice is when a sports coach breaks down a skill and coaches/teaches a separate part of this skill before bringing the whole skill back together again.

An example of this would be a tennis coach teaching a tennis serve. The tennis serve can be broken down into a number of different sections to coach, such as grip, stance, toss, back swing, impact, follow through plus additional areas such as spin and speed. A sports coach can then teach different areas of a tennis serve to gradually improve their performance. Part practice is good for helping athletes who are new to a skill and are not yet autonomous learners (see our stages of learning article for more information). We have found this method useful to boost motivation when somebody is struggling to complete the skill. Using the part practice method allows athletes to focus on one part of the skill before moving onto the next part. Another advantage is that part practice is useful for dangerous skills.
Example: Developing the skills for the phases of long jump by breaking each phase down: run up and the jump. (or triple jump: hop, skip and jump).

Whole-part-whole
A method of learning a skill in which the learner tries to perform the whole skill from time to time after practising parts of the skill, particularly those parts which are difficult.

The whole part whole practice method is when a coach observes the whole skill before identifying areas to improve. The sports coach would then develop and improve an area within their performance before bringing the whole skill back together.

An example of this would be a football coach observing a small sided passing game and noticed their athletes were making errors when receiving the ball. The coach would then provide some support on how to receive a pass through different practice/drills and then bring it all back again into the same small sided passing game.
The whole part whole method is useful for athletes new to a sport as they can get a feel for the skill if they have never performed it before. It can also be quicker than the part practice method.
Over our years in sports coaching, we have used the whole part whole practice method and have found this to be very effective due to it speed and ability to be used within context of a game.
Example: Skills or techniques which allow PARTS of the performance to be separated easily from the WHOLE performance work best, for example when practicing a tennis serve, you may execute an overhead serve and identify your ball toss as being a weakness. You would then practice making an accurate toss and when ready return performing the full serve again.

Progressive part
The progressive part practice method is when a sports coach would coach/teach different parts of a skill and then bring these all together to create a complete skill.
The example of a progressive part practice method would be when coaching/teaching the triple jump technique. A coach would begin with the run up, then take off, then flight and followed by the landing. Each skill would link to one another.

1.3.3 Design practice schedules incorporating the principles of effective practices and a variety of practice methods

Principles of effective practice

These principles are used to assist coaches and athletes in creating effective training sessions that are at the suitable level of the developing athlete. When a coach is designing a training session, these principles should be a starting point of how they want their sessions to look and advance over time.

VPS MARTER (mnemonic) to remember the principles of effective practice.

1. Varied
2. Progressive
3. Specific
4. Measurable
5. Realistic
6. Timely
7. Exciting
8. Recorded

- **Varied** - no session should be identical to the previous one and a range of approaches should be used to help boost motivation and improve a skill(s) in numerous different ways.
    a. **Example**: Different methods of practice should be incorporated, to ensure training doesn't become boring, which can decrease motivation levels.
- **Progressive** - the demands in each session should be gradually increased. This ensures that skill development does not hit a plateau.
    a. **Example**: add in additional conditions (3v2 attack v defence, this makes it harder for the defence) to make the session harder
- **Specific** - the approach selected should be tailored to fit the skill and experience levels of the performer. It should match their stage of learning and not be too hard or too easy.
    a. **Example**: an elite athlete may require negative feedback to finetune their fine skill execution
- **Measurable** - the long-term goal for the development plan and the short-term goals used in each session should all be measurable. They should have figures included that makes it easy to see whether goals has been reached or not.
    a. **Example**: Recording data e.g. distance covered using GPS or number of turnovers in a rugby based session. This data should be tracked over time to see improvements in performance.

- **Achievable** - the approaches used in each session should provide skilled challenges that are attainable. This can help ensure performers work their hardest during sessions as they know progress is within their reach.
    a. **Example**: A coach giving an 800m athlete target times for a session that are difficult but achievable. If the times set are too difficult the athlete will fail and this can decrease learning and motivation.
- **Realistic** - approaches used should mirror the demands of competition. This will ensure any skilled developments can be easily transferred back into games.
    a. **Example**: The training sessions should be aligned with the demands of the sport. Would a 100m sprinter focus on marathon training?
- **Timely** - sessions should be set for the appropriate amount of time. Approaches should be carried out for a long enough period to enable the performer to groove the skill and access necessary feedback. However, it should not be too long as tiredness may arise and skill levels may drop along with confidence.
    a. **Example: 400m weekly training schedule:**
        i. **3 x running sessions (120 mins each)**
        ii. **2 x gym session (90 mins each)**
        iii. **1 x Recovery session (90 mins)**
        iv. **1 x mixed power session (120 mins)**
- **Exciting** - sessions should be exciting and fun in order to maintain motivation levels. Adding in competition to approaches can help whet the appetite of performers and make them want to attend training.
    a. **Example**: penalty kick/cross bar challenge in different teams, with a reward at the end.
- **Recorded** - create a training diary to help keep track of your progress. Doing this will let you express your feelings after sessions and help chart your skill development by tracking your goals at the end of sessions.
    a. **Example**: a training diary is essential to track performance and documenting progress. What worked and what didn't can be highlighted.

The Free throw

<u>Individual drills</u>

Drills are an integral component of any sport. They break down the key skills into smaller more manageable tasks, and can be made as easy or difficult as one requires based on skill level.

A game that can be played is ‘plus 1, minus 2’. This means that a player starts on 2 and must aim to reach 10. If they score they get a point, if they miss 2 pints are taken away from their score.

Swish

- Break players into twos and threes at each basket.
- The shooting player starts on 5 and must reach 10.
- Rules are:
    - For every swish, they player gets 1 point
    - For every basket made, without a swish they get 0
    - Every miss they get -1

Plus/minus

- Similar to Swish, without the swish
- Get 1 pint for every shot made
- Every miss they get -1

<u>Team Drills</u>

Laps

- 3 player at each basket
- 5 minutes on each clock
- Player 1 shoots two free-throws
- IF he completes both he desont have to run
- If he misses
    - Once, he sprints up and back the court
    - Twice, sprints a lap of the court

In-a-row

- Split into groups of 3
- Goal is to make a certain number of shots in a row before the timer goes off
- Add a consequence if they miss – suicides etc.

Baseline-free-throws

- Whole team starts on the baseline
- Every person must go to the a free throw line individually and complete a shot
- If anyone misses the team must complete a sprint of the court