MA99 EDUCATION

Training for Improved Performance: Topic Notes

02

NSW HEALTH AND MOVEMENT SCIENCE 11-12 SYLLABUS 2023 FOR HSC 2027 AND LATER

In this subtopic: biomechanical principles applied to technique · advanced skill refinement · technology in performance analysis.

1. Biomechanical principles applied to technique

Year 12 requires biomechanical principles to be applied to a specific technique, analysing how a change would affect performance, rather than defined in isolation as in Year 11.

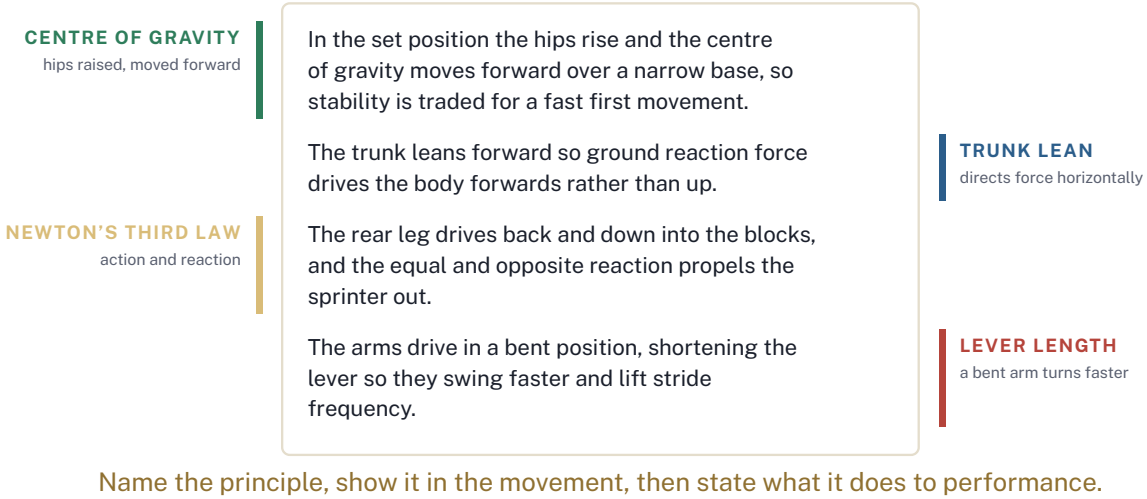


Figure 1 · A summary of biomechanical principles in the sprint start.

2. Applying the principles

PRINCIPLE	APPLICATION TO PERFORMANCE
Centre of gravity and base of support	A lower centre of gravity over a wider base increases stability, useful in a defensive stance; a narrower base allows faster acceleration, useful in a sprint start.
Levers	A bent limb shortens the lever, so it needs less force and rotates faster, but its end moves more slowly and reaches less far. A straight limb lengthens the lever, giving greater end point speed and reach but needing more force to move.
Newton's laws	Newton's third law explains that force applied into the ground produces an equal and opposite reaction propelling the body, which underlies coaching cues about foot strike direction.
Projectile motion	The angle and speed of release determine a projectile's flight path, relevant to a javelin throw, a basketball shot or a kicked ball.

Key idea: judging a technique change

A strong response does not just name a principle; it explains the specific performance consequence of applying it, and any trade-off involved.

A lower centre of gravity that increases stability may also reduce reach or speed, so evaluate both sides of a change.

3. Advanced skill refinement

Building on the stages of learning studied in Year 11, Year 12 focuses on refining a skill once it is already at the associative or autonomous stage. At this level, small technical adjustments, rather than large corrections, produce further improvement, and feedback becomes more specific, often focused on timing, sequencing or a single technical detail rather than the whole movement.

Closed skills, performed in a stable, predictable environment such as a free throw, can be refined through highly repeatable practice. Open skills, performed in a changing environment such as passing under defensive pressure, require practice under increasingly game-realistic and variable conditions to transfer to competition.

4. Technology in performance analysis

Video analysis, wearable sensors and motion capture technology allow a coach to measure aspects of technique that are difficult to judge by eye alone, such as joint angles at a specific instant, ground contact time, or the exact sequencing of a movement. This turns qualitative observation into quantifiable data that can be tracked over time and compared against a benchmark.

Evidence note: technology in sport

Wearable GPS and heart rate technology is now used across many elite and community sports to monitor training load and reduce injury risk (Australian Institute of Sport).

Worked example: judging a technique change

In a hypothetical (MA99) example, a netballer makes 12 of 20 shots from the same spot, which is 60 per cent. After a coach adds a full follow through and a steady pre-shot routine, she makes 15 of 20, which is 75 per cent, a gain of 15 percentage points. Video analysis then confirms that her release angle is now consistent, so the coach can link the change to the technique and not to luck.

Remember

Technology supports, rather than replaces, biomechanical and coaching judgement; data still needs to be interpreted against the athlete's specific technique goals.

Where a question asks about ethics or technology, weigh a benefit, such as objective data, against a limitation, such as cost or access.

Exam focus: biomechanics and skill for performance

Apply a named biomechanical principle to a named technique, and state the specific performance consequence.

Distinguish closed skills, practised in a stable environment, from open skills, which need variable, game-realistic practice.

For technology questions, weigh a benefit against a limitation such as cost, access or the need for expert interpretation.

Check your understanding

1. Explain how centre of gravity could be manipulated differently in a defensive stance and a sprint start.
2. Explain the trade-off involved in shortening a lever during a movement.
3. Distinguish between closed and open skills, with an example of each.
4. Explain how video analysis could be used to refine an athlete's technique.
5. Evaluate the effectiveness of technology in improving performance in a chosen sport.

Check your answers

1. In a defensive stance the centre of gravity is lowered and the base of support widened for stability; in a sprint start the hips are raised and the centre of gravity moved forward toward the edge of the base, trading stability for fast acceleration.
2. A shorter lever swings faster and needs less force, but the end of the lever moves more slowly and reaches less far, so the athlete trades speed at the end point for ease of movement.
3. A closed skill is performed in a stable, predictable environment, such as a free throw; an open skill is performed in a changing environment, such as passing under defensive pressure.
4. Slow motion, frame by frame video can measure joint angles at release or foot strike, compare them with a benchmark, show the athlete the fault, and be repeated after the change to check it.
5. State a judgement, for example that technology is highly effective for objective, trackable data, and weigh it against cost, access and the need for expert interpretation.

About this resource

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Scope

NSW Health and Movement Science, Year 12. Written to the NSW Health and Movement Science 11-12 Syllabus 2023, Training for Improved Performance, for students sitting the HSC in 2027 and later years. Worked examples use invented athletes and training programs, and any real source cited is named; every number was recomputed from its inputs before printing.

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