BM PERFORMANCE SYSTEM

Applied Biomechanics for Gymnastics Coaches

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1. Center of mass and base of support

Balance depends on the projection of the center of mass relative to the support base. In a beam walk, small controlled adjustments of the trunk and arms help keep the projection within the narrow base. A low-beam progression is safer than increasing height before balance is consistent.

Coach activity: Observe three static balance positions and note which joint strategies keep the athlete stable.

2. Torque and moment arms

Torque is the turning effect of a force around a joint or axis: torque = force x perpendicular moment arm. Extending the legs in a lever shape can increase the external moment arm and the strength demand. Compare tuck and straight-body support shapes before progressing.

Coach activity: Sketch a tucked and extended body shape and label the likely changes in moment arms.

3. Angular momentum

Angular momentum describes rotational motion and depends on moment of inertia and angular velocity. Pulling the body closer to its rotational axis can change rotation speed when external torque is small. This principle does not justify introducing flight skills without qualified supervision.

Coach activity: Compare the rotational shape of a tuck with an extended shape using a diagram.

4. Impulse and landing

Impulse is force integrated over time and changes momentum. Safe landing instruction emphasizes appropriate joint flexion, controlled alignment, and sufficient landing area to manage deceleration. Do not teach athletes to land with locked knees or collapse inward.

Coach activity: Use a checklist to observe knee tracking, trunk control, and a stable final landing position.

5. Swing mechanics

A swing exchanges potential and kinetic energy while grip, shoulder control, body shape and timing influence the movement. Bar and ring progressions must match apparatus setup and the coach's spotting qualification.

Coach activity: Record three observations: grip security, shoulder engagement and body-shape consistency.

6. Load management

Repeated impact, hanging and supporting loads accumulate across a week. Training plans should consider age, growth, sleep, previous exposure, pain and individual response rather than a fixed volume for every athlete.

Coach activity: Compare two weekly plans and identify where recovery or exercise regression may be needed.

7. Practical movement analysis

A useful observation sheet records the intended movement, start position, main joint actions, direction of force, timing, common technical errors, and an objective correction cue. One clear cue is usually more useful than many simultaneous instructions.

Coach activity: Analyze a low-beam walk or supported hang and write two observable coaching cues.

Use and limitations

This is an original BM Performance introductory primer, not a substitute for official FIG/USA Gymnastics rules, medical assessment, or accredited coaching instruction. All inverted, flight and high-apparatus skills require appropriately qualified supervision.