

The Human Movement System

Kinetic chain—interrelation of nervous, muscular, and skeletal systems to create movement

The Nervous System

Central nervous system (CNS)—brain and spinal cord; coordinates activity of body parts

Peripheral nervous system (PNS)—all nerves branching off spinal cord, extending out to the body

Mechanoreceptors—sense distortion in body tissues

Golgi tendon organs (GTO)—sense changes in tension

Muscle spindles—sense changes in length

Proprioception—cumulative sensory input to the CNS from all mechanoreceptors

The Muscular System

Stabilization and Movement Muscles of the Core

Stabilization	Movement
<ul style="list-style-type: none"> • Transverse abdominis • Multifidus • Internal obliques • Diaphragm • Pelvic floor muscles • Rotator cuff • External obliques • Quadratus lumborum • Psoas major • Rectus abdominis • Gluteus medius • Adductor complex 	<ul style="list-style-type: none"> • Latissimus dorsi • Hip flexors • Hamstring complex • Quadriceps • Pectoralis major • Deltoids • Gluteus maximus • Triceps • Biceps • Erector spinae

Tendons—connect muscle to bone; anchor to produce force; limited blood flow, slow to repair

Sarcomeres—individual contractile units; actin and myosin filaments

Type I (slow twitch) muscle tissue—more aerobic; slower to reach maximal contraction; resistant to fatigue

Type II (fast twitch) muscle tissue—more anaerobic; produce more speed and strength; faster to fatigue

Behavioral properties of muscle—extensibility, elasticity, irritability, ability to develop tension

Isolated Function of Major Muscles

Major Muscle(s)	Isolated Function (concentric action)	Common Exercise
Quadriceps (rectus femoris; vastus lateralis, medialis, and intermedius)	Knee extension	Squat (upward phase)
Hamstrings (semitendinosus, semimembranosus, biceps femoris)	Knee flexion	Hamstrings curl
Gastrocnemius	Plantar flexion	Calf raise
Gluteus maximus	Hip extension and external rotation	Lunge (upward phase)

Continued...

Major Muscle(s)	Isolated Function (concentric action)	Common Exercise
Rectus abdominis	Spinal flexion, lateral flexion, and rotation	Ball crunch
Pectoralis major	Shoulder flexion and horizontal adduction	Push-up
Latissimus dorsi	Shoulder extension, adduction, and internal rotation	Band row
Biceps	Elbow flexion	Biceps curl
Triceps	Elbow extension	Triceps extension

The Skeletal System

Ligaments—connect bone to bone; limited blood flow, slow to repair

Axial skeleton—skull, rib cage, and vertebral column

Appendicular skeleton—bones of upper and lower extremities

Skeletal system functions—movement, support, protection, blood production, mineral storage

Types of Joints

Joint	Characteristic	Example
Non-synovial	No joint cavity or connective tissue; little to no movement	Sutures of the skull
Synovial:	Produces synovial fluid; has joint cavity and connective tissue	
• Gliding	No axis of rotation; slides side-to-side, back and forth	Carpals of the hand
• Condyloid	Condyles of one bone fit elliptical cavities of another; one plane of motion	Knee
• Hinge	Uniaxial; one plane of motion	Elbow
• Saddle	One bone fits like a saddle on another; two planes of motion (sagittal, frontal)	Thumb (only ones in body)
• Pivot	One axis; transverse plane movement	Radioulnar
• Ball-and-socket	Most mobile; all three planes of motion	Shoulder

Vertebrae of the Spinal Column

Lumbar	Thoracic	Cervical
L1—L5	T1—T12	C1—C7



Exercise has been shown to reduce bone mass loss and increase bone mineral density.

The Cardiorespiratory System

Structures of the heart:

Atria—superior chambers; receive blood from outside heart

Right atrium—gathers deoxygenated blood from body

Left atrium—gathers oxygenated blood from lungs

Ventricles—inferior chambers; force blood out of heart

Right ventricle—pumps deoxygenated blood to lungs

Left ventricle—pumps oxygenated blood to body

Sinoatrial (SA) node—located in right atrium; receives signal to contract; *“pacemaker for the heart”*

Arteries—transport blood away from heart

Veins—transport blood back to heart

Stroke volume—amount of blood pumped with each contraction

Heart rate—rate at which the heart pumps; average = 70-80 BPM

Functions of blood—transportation, regulation, protection

Respiratory pump—components that move air in and out of the body

Structures of the Respiratory Pump

Bones

- Sternum
- Ribs
- Vertebrae

Muscles: Inspiration

- Diaphragm
- External intercostals
- Scalenes
- Sternocleidomastoid
- Pectoralis minor

Muscles: Expiration

- Internal intercostals
- Abdominals

Biomechanical Terminology

Anatomic Locations

Anterior—front of body

Posterior—back of body

Superior—above point of reference

Inferior—below point of reference

Proximal—nearest to point of reference

Distal—farthest from point of reference

Medial—closer to midline

Lateral—farther from midline

Planes of Motion

Sagittal plane—divides body into left and right halves; forward-backward movement

Flexion—bending of joints; decreases relative angle

Extension—straightening of joints; increases relative angle

Plantarflexion—extension at ankle

Dorsiflexion—flexion at ankle

Example sagittal plane exercises—biceps curl, squat, running

Frontal plane—divides body into front and back halves; side-to-side movement

Abduction—movement away from midline

Adduction—movement toward midline

Inversion—bottom of foot rotates medially

Eversion—bottom of foot rotates laterally

Example frontal plane exercises—lateral arm raise, side step, side lunge, side shuffle

Transverse plane—bisects body into top and bottom halves; rotational movement

Horizontal abduction—lateral-rotational movement away from midline

Horizontal adduction—medial-rotational movement toward midline

Internal rotation—inward rotation of limbs

External rotation—outward rotation of limbs

Pronation—eversion, dorsiflexion, and abduction of feet

Supination—inversion, plantarflexion, and adduction of feet

Example exercises—trunk rotation, bicycle crunches, lunge with rotation

Principles of Human Movement

Length-tension relationship—length at which muscle can create most tension; too short or too long = reduced force production

Force-couple—muscles moving together to produce movement

Reciprocal inhibition—agonist contracts while antagonist relaxes to allow movement

General adaptation syndrome—how the body responds and adapts to stress; *3 phases*:

Alarm—initial response to exercise; 2-3 weeks

Adaptation—body adapts to stimuli; progressive improvement; 4-12 weeks

Exhaustion—body no longer tolerates demands of training; adaptations may halt; overtraining syndrome risk increases

Specific adaptation to imposed demands (SAID) principle (principle of specificity)—type of stimulus placed on body determines expected physiological outcome

Mechanical specificity—weight and movements placed on body

Neuromuscular specificity—specific exercises using different speeds

Metabolic specificity—energy demand placed on body

The overload principle—to create physiological change, exercise stimuli must be greater intensity than body is used to receiving

Muscle Action Spectrum

Concentric—produces tension while shortening to overcome external resistance

Isometric—produces tension while maintaining constant length

Eccentric—produces tension while lengthening

Muscular Functions

Muscles as Movers

Muscle Type	Muscle Function	Exercise	Muscles Used
Agonist	Prime mover	<ul style="list-style-type: none"> Chest press Row Squat 	<ul style="list-style-type: none"> Pectoralis major Latissimus dorsi Gluteus maximus, quadriceps
Synergist	Assist prime mover	<ul style="list-style-type: none"> Chest press Row Squat 	<ul style="list-style-type: none"> Anterior deltoid, triceps Posterior deltoid, biceps Hamstring complex
Antagonist	Oppose prime mover	<ul style="list-style-type: none"> Chest press Row Squat 	<ul style="list-style-type: none"> Posterior deltoid Pectoralis major Psoas

Body Alignment and Posture

Static posture—starting point of movement; standing natural, relaxed

Dynamic posture—positioning of body during movement

Optimal dynamic posture at the five kinetic chain checkpoints:

Feet—hip-to-shoulder width; pointed straight ahead

Knees—soft and extended; in line with second and third toes

LPHC—neutral; abs and glutes engaged

Shoulders—back and down; no thoracic rounding

Head/neck—cervical spine neutral

Neutral spine—cervical, thoracic, and lumbar curves of spine in good alignment

Kyphosis—abnormal rounding of thoracic spine; usually accompanied by rounded shoulders

Lordosis—sway back; excessive lumbar curve

Repetitive movement—regularly repeated movements can alter kinetic chain; elements of occupation and recreation (e.g., carrying overloaded bags, wearing dress shoes, constant in-class jumping)

Repetitive lack of motion—frequent immobility; holds potential for repetitive stress injuries (e.g., sitting at desk all day)

Overactive—muscle is overly tense or tight during movement

Underactive—muscle is weak; not being recruited as it should

Altered reciprocal inhibition—when overactive muscle decreases neural drive to functional antagonist

Postural distortion patterns—common postural malalignments and muscle imbalances individuals develop based on variety of factors (e.g., lifestyle, occupation):

Pronation distortion syndrome—foot pronation (flat feet); adducted, internally rotated knees (knock knees)

Lower crossed syndrome—anterior tilt to pelvis (arched lower back)

Upper crossed syndrome—forward head, rounded shoulders

Common Overactive and Underactive Muscles

Imbalance	Checkpoint	Feet	Knees	LPHC	Shoulders	Head/Neck
Overactive		<ul style="list-style-type: none"> Soleus Lateral gastrocnemius Peroneals 	<ul style="list-style-type: none"> Biceps femoris (short head) Tensor fascia latae (TFL) 	<ul style="list-style-type: none"> Hip flexors (TFL, quadriceps, psoas) Adductors Abdominals (rectus abdominis, external obliques) 	<ul style="list-style-type: none"> Latissimus dorsi Pectoralis major/minor 	<ul style="list-style-type: none"> Upper trapezius Sternocleidomastoid Levator scapulae
Underactive		<ul style="list-style-type: none"> Medial gastrocnemius Anterior tibialis Posterior tibialis 	<ul style="list-style-type: none"> Vastus medialis oblique (VMO) 	<ul style="list-style-type: none"> Gluteus maximus Gluteus medius Hamstrings Intrinsic core stabilizers 	<ul style="list-style-type: none"> Middle and lower trapezius Rhomboids Rotator cuff 	<ul style="list-style-type: none"> Deep cervical flexors

Components of Integrated Fitness

Integrated fitness—comprehensive approach combining multiple types of exercise; helps participant achieve higher levels of function; flexibility, core, balance, plyometric, SAQ, cardiorespiratory, and resistance training

Flexibility Techniques

Self-myofascial release—apply pressure to “knots” (adhesions) to achieve relaxation response; hold 30 seconds

Static stretching—passively take muscle to point of tension; hold 30 seconds

Active stretching—agonist moves limb through full range of motion allowing antagonist to stretch

Dynamic stretching—multiplanar extensibility; optimal neuromuscular control; full range of motion

Core Activation Techniques

- Drawing-in maneuver**—draw navel toward spine without spinal flexion
- Bracing**—co-contraction of superficial core muscles; improves LPHC stiffness

Balance Training Concepts

- Proprioceptively enriched environment**—unstable, yet controllable
- Dynamic balance**—maintain equilibrium through intended path of motion when external forces are present

Plyometric Training Concepts

- Plyometric training**—quick, powerful movements; eccentric contraction followed by explosive concentric contraction
- Rate of force production**—muscles exert maximal force in minimal amount of time

SAQ Training Concepts

- Speed**—straight-ahead velocity
- Agility**—maintaining center of gravity over changing base of support while changing direction at various speeds
- Quickness**—reacting to stimuli with appropriate muscular response without hesitation

Cardiorespiratory Training Concepts

Cardio Training Zones

Zone	Training Heart Rate
One	65-75% HR _{max}
Two	76-85% HR _{max}
Three	86-90% HR _{max}

Interval training—alternates between intense exertion and rest or lighter exertion

Resistance Training Adaptations

- Stabilization**—remain stable and balanced over center of gravity in a changing environment
- Endurance**—muscles fire over prolonged periods of time
- Strength**—neuromuscular system provides internal tension and exerts force against external resistance
- Hypertrophy**—skeletal muscle fiber enlargement
- Power**—ability to produce large amount of force in short amount of time

Acute Variables

Periodization—division of training program into smaller, progressive stages

Training intensity—exercise effort compared to maximal effort; percentage of 1RM

Training volume—total work performed within specified time; repetitions × sets

Rest Period and Percent Recovery

Amount of Rest	Percent Recovery
20-30 seconds	50%
40 seconds	75%
60 seconds	85-90%
3-5 minutes	100%

Endurance Training in Strength-based Classes

Component		Reps	Sets	Tempo	% Intensity	Rest Interval
Movement Prep	Flexibility	1	1-3	30 sec hold	N/A	N/A
	Core	12-20	1-4	Slow	N/A	0-90 sec
	Cardio	12-20 6-10 (SL)	1-3	Slow	N/A	0-90 sec
Resistance		12-20	1-3	Slow	50-70% 1RM	0-90 sec

Overall Strength or Muscular Development in Strength-based Classes

Component		Reps	Sets	Tempo	% Intensity	Rest Interval
Movement Prep	Flexibility	5-10	1-2	1-2 sec hold	N/A	N/A
	Core	8-12	2-3	Medium	N/A	0-60 sec
	Cardio	8-12	2-3	Medium	N/A	0-60 sec
Resistance		6-12	3-5	Medium	75-85% 1RM	0-60 sec

Exercise Technique

Common Group Fitness Exercise Examples by Format

Format	Movement Prep	Body of Workout
Strength and Resistance	<ul style="list-style-type: none"> • Kneeling hip flexor stretch • Lat stretch • Floor planks • Floor bridge • Single-leg squats 	<ul style="list-style-type: none"> • Squat to overhead press • Push-ups • Bent-over rows • Biceps curls • Lunge variations
HIIT and Interval	<ul style="list-style-type: none"> • Static stretch calves and adductors • Abdominal crunches • Push-ups • Walking lunges • Squat jump to stabilization 	<ul style="list-style-type: none"> • Jogging (around perimeter or in place) • Burpees • Shuffles • Repetitive squat jumps

Continued...

Format	Movement Prep	Body of Workout
Boot Camp	<ul style="list-style-type: none"> Abdominal crunches Push-ups Walking lunges Prisoner squats 	HIIT/interval techniques with aggressive team-oriented approach
Yoga	<ul style="list-style-type: none"> Child's pose Cat/cow flow Spinal balance Chair pose 	<ul style="list-style-type: none"> Sun salutation A Warrior 1, 2, and 3 (warrior series) Mountain pose to goddess pose Plank flow
Cycle	Avoid undue fatigue in the legs or prematurely spiking heart rate	<ul style="list-style-type: none"> Seated or standing flats Seated or standing climbs Sprints Attacks Jumps

The Proprioceptive Progression Continuum

Challenge	Base of Support	Lower Body	Upper Arm
Foundational  Advanced	Floor	Two-legs stable	Two-arm
	Sport beam	Staggered-stance stable	Alternating arms
	Half foam roll	Single-leg stable	Single-arm
	Foam pad	Two-leg unstable	Single-arm with trunk rotation
	Balance disc	Staggered-stance unstable	
	Wobble board	Single-leg unstable	
	BOSU ball		

Group Fitness Modalities

SMR—foam rollers, rolling sticks, massage balls

Bodyweight training—leverages bodyweight and position to create exercise challenge

Suspension training—fixed straps, portable straps

Weighted equipment—dumbbells, barbells, kettlebells, medicine balls, weighted bars

Elastic resistance—bands, tubing, figure-8 tubes, looped bands

Balance—stability balls, balance plates, sliding discs

Reactive, SAQ, and power—battle ropes, boxes, ladders, cones, dots

Aquatic—belts, noodles, webbed gloves, paddles, water dumbbells

Mind-body—mats, blocks, straps

Skill mastery—cycle bikes, step benches, mini-trampolines, ballet bars, boxing gloves, kick/punch bags

Monitoring Exercise Intensity

Radial pulse—two fingers below wrist on thumb side of arm; count 10 seconds, multiply by 6

Talk test—self-evaluation of intensity associated with ability to talk while exercising

Dyspnea—troubled breathing; rated on scale from +1 through +4

Rating of perceived exertion (RPE)—expresses how hard participants feel they are working based on physical sensation; *two versions*:

Borg scale—rated 6 (no exertion) to 20 (maximal exertion)

0-10 RPE scale—rated 0 (nothing at all) to 10 (maximal)

Chronic Conditions and Special Populations

Chronic Conditions

Basic Exercise Guidelines for Participants with Hypertension

Mode	Indoor cycling, low-impact cardio, dance, group rowing
Frequency	3-7 days per week
Intensity	50-85% HR _{max}
Duration	30-60 min per day
Special Considerations	<ul style="list-style-type: none"> Avoid heavy lifting, Valsalva maneuver; ensure normal breathing Modify tempo to avoid extended isometric and concentric actions Avoid laying down Stand up slowly to avoid dizziness

Basic Exercise Guidelines for Participants who are Obese

Mode	Indoor cycling, dance, resistance, aquatics
Frequency	At least 5 days per week
Intensity	60-80% HR _{max} ; can adjust to 40-70% HR _{max}
Duration	40-60 min per day; or 20- to 40-min cardio twice per day
Special Considerations	<ul style="list-style-type: none"> Ensure participant comfort Perform seated or standing Participant may have other chronic conditions; obtain medical release from physician

Basic Exercise Guidelines for Participants with Cardiovascular Disease

Mode	Indoor cycling (carefully monitored), low-impact cardio, dance
Frequency	3-5 days per week
Intensity	40-60% of peak work capacity
Duration	Progress to 20-45 min
Special Considerations	<ul style="list-style-type: none"> Upper body exercise increases dyspnea; must be monitored Allow sufficient rest between sets

Basic Exercise Guidelines for Participants Recovering from Stroke

Mode	Large muscle group activities
Frequency	3-7 days per week
Intensity	50-80% HR _{max}
Duration	20-60min per session
Special Considerations	<ul style="list-style-type: none"> • Ensure participant can balance • Standing or seated advised • Progress movement pattern before weight

Basic Exercise Guidelines for Participants with Cancer

Mode	Low-impact cardio, circuit-style classes with plenty of options, balance and core training
Frequency	3-5 days per week
Intensity	50-70% HR _{max}
Duration	15-30 min per session
Special Considerations	<ul style="list-style-type: none"> • Avoid heavy lifting during initial training stages • Allow adequate rest intervals; progress slowly • Only use SMR if tolerated; avoid with those undergoing chemo or radiation therapy • May need to start with only 5 min, then progress based on severity of condition and fatigue

Basic Exercise Guidelines for Participants with Osteoporosis

Mode	Stationary or recumbent cycling, aquatics, low-intensity yoga
Frequency	2-5 days per week moderate; 3 days per week vigorous
Intensity	40-85% of peak VO ₂
Duration	20-60 min per day; or 8- to 10-min bouts
Special Considerations	<ul style="list-style-type: none"> • Progress slowly, monitor participant well • Progress toward free sitting (no support) or standing • Breathe normally; avoid holding breath, Valsalva maneuver • Use slow, rhythmic active or dynamic stretches if static or SMR is not tolerated • Perform twisting motions slowly, if at all

Basic Exercise Guidelines for Participants with Diabetes

Mode	Cycle, low-impact or step aerobics
Frequency	4-7 days per week
Intensity	50-90% HR _{max} Stage I cardio (may adjust to 40-70% HR _{max}); progress to stages II and III with physician approval
Duration	20-60 min
Special Considerations	<ul style="list-style-type: none"> • Check for appropriate footwear; have participant or physician check feet for blisters or abnormal wear • Keep snack available (quick carb source) to avoid sudden hypoglycemia • Avoid excessive plyometrics; high-intensity training not recommended

Basic Exercise Guidelines for Participants with Arthritis

Mode	Cycle, low-impact or step aerobics
Frequency	3-5 days per week
Intensity	60-80% HR _{max} State I cardio, progress to stage II (may reduce to 40-70% HR _{max} if needed)
Duration	30 min
Special Considerations	<ul style="list-style-type: none"> Avoid heavy lifting, high repetitions Stay in pain-free ROM May need to start with only 5 min, then progress based on severity of condition

Special Populations

Basic Exercise Guidelines for Youth Group Fitness Programs

Mode	Circuit style classes, lots of variety, individualization, interaction; most class formats deemed safe
Frequency	5-7 days per week
Intensity	Moderate to vigorous
Duration	60 min per day
Special Considerations	<ul style="list-style-type: none"> Progress based on postural control, not weight Make exercising fun!

Basic Exercise Guidelines for Older Adults

Mode	Aquatics, chair-based resistance, cycle, basic or beginner yoga
Frequency	3-5 days per week moderate; 3 days per week vigorous
Intensity	40-85% peak VO ₂
Duration	30-60 min per day; or 8- to 10-min bouts
Special Considerations	<ul style="list-style-type: none"> Progress slowly; monitor well Progress toward free sitting (no support) or standing Breathe normally; avoid holding breath, Valsalva maneuver Use slow, rhythmic active or dynamic stretches if static or SMR is not tolerated

Basic Exercise Guidelines for Pregnancy

Mode	Cycle, low-impact cardio, light resistance, aquatics; all need physician clearance
Frequency	5-7 days per week
Intensity	Light to moderate; 13-14 on Borg scale
Duration	20-30 min per day
Special Considerations	<ul style="list-style-type: none"> Avoid prone or supine positions after 12 weeks of pregnancy Avoid SMR on varicose veins, areas of swelling Plyometrics not advised in second and third trimesters

Nutritional Concepts

Bioenergetics and Metabolism

Adenosine triphosphate (ATP)—energy storage and transfer unit within cells

Anaerobic—without oxygen

ATP-PC—uses phosphocreatine; up to 10-15 seconds

Glycolysis—uses glucose; up to 2-3 minutes

Aerobic—requires oxygen

Oxidative system—aerobic; uses glucose; activity longer than 2-3 minutes

Macronutrients

Glycogen—complex carbohydrate stored in liver and muscle cells

Essential amino acids—cannot be produced by body, must be acquired by food

Nonessential amino acids—produced by body, no need to consume in diet

Complete protein—provides all essential amino acids, easy to digest and absorb

Saturated fat—chain of carbons bonded to all hydrogens it can hold; no double bonds

Unsaturated fatty acids—not completely saturated with hydrogens; one or more double bonds

Polyunsaturated fatty acids—several spots where hydrogens are missing; omega-3, omega-6

Calories per Gram	
Carbohydrates	4
Protein	4
Fat	9

Macronutrient Intake Recommendations

Macronutrient	Population	Recommended Intake
Carbohydrates	General population	45-65% total daily calories; or 3g/kg body weight
	Those exercising more than 1 hour per day	4-5 g/kg body weight
	Athletes, high-intensity exercisers training more than 4 hours per day	8-12 g/kg body weight
Protein	General population	10-35% total daily calories; or 0.8 g/kg body weight
	Endurance athletes	1.2-1.4 g/kg body weight
	Strength athletes	1.6-1.7 g/kg body weight
Fat	All populations - total consumption	20-35% total daily calories
	All populations - saturated fat	Less than 10% total daily calories

Hydration

Recommended Water Intake	
Sex or Exercise Status	Recommended Intake
Women	2.7 L (91 oz) per day
Men	3.7 L (125 oz) per day
2 hours pre-exercise	14-20 oz
15 minutes pre-exercise	16 oz if tolerated
During exercise	4-8 oz every 15-20 min; or 16-32 oz per hour depending on rate of sweat
Post-exercise	16 oz for every 1 lb body weight lost

Electrolytes—potassium, sodium, calcium, chloride, magnesium, phosphate; have electrical properties; control fluid balance between body systems

Class Design and Planning

Group Fitness Methods

- Pre-choreographed**—created by single person, business, or organization; connecting theme, brand, or experience
- Pre-designed**—template provides overall direction while allowing manipulation of other variables
- Freestyle**—choreography based on instructor's personal preference, skills, and knowledge

Class Planning

- Class vision**—clearly defined intention of class experience; from participant perspective; drives outcome and components of complete class
- Outcome and objective considerations**—participant expectations, movements to support expectations, available equipment, available time, intensity manipulation, arrangement and sequencing
- S.M.A.R.T. goals**—specific, measureable, attainable, realistic, timely
- Flow**—create a seamless experience from start to finish
- Pre-class set-up**—arrive 15 minutes early; evaluate equipment; ensure sound system function; resolve technical difficulties

Group Fitness Class Checklist

Pre-class Planning	<ul style="list-style-type: none"> Design class blueprint
Intro	<ul style="list-style-type: none"> Greet participants Be available before class to orient participants Have background music on or cued up when class starts Provide equipment recommendations Formally introduce self and class format Quickly explain options for modifications
Movement Prep	<ul style="list-style-type: none"> Begin general or specific movement prep Demonstrate movement selection with proper technique Transition movement prep into body of workout
Body of Workout	<ul style="list-style-type: none"> Build movement sequences logically, gradually, and progressively Use all three planes of motion and balance muscle groups Monitor intensity using training zones, talk test, or RPE scales
Transition	<ul style="list-style-type: none"> Create motivating and educational environment Conduct transition with body awareness exercises
Outro	<ul style="list-style-type: none"> Give specific praise to group on effort and progress Invite participants to come back again Request feedback of questions after class

Participant Arrangements

Staggered—instructor teaches from front while viewing all participants

Row—instructor can move through room to coach participants using large equipment

Circuit—instructor can move from station to station, coaching specifically to exercises at each

Circle—allows circular jogging and forward-backward movement toward center of room

Group Fitness Formats

Strength and resistance—increase muscular strength and endurance using an opposing force for resistance

HIIT and interval—alternate higher intensity work periods with moderate-to-low intensity recovery periods

Boot camp—combination of resistance and cardio; total-body workout; military-style presentation

Mind-body—yoga, Pilates, T'ai Chi; slow, controlled movements; combines strength, stability, flexibility, balance, and breathing techniques

Cycle—stationary bicycles designed to simulate outdoor cycling



Proper bike fit:

- Seat should be at hip height
- Handlebar should support proper alignment of the upper body

Specialty formats—dance, aquatics, active aging adult, discipline-specific, equipment-driven, and hybrid formats

On-the-spot Considerations

- Unexpected participants**—talk to unexpected participants one-on-one before class, or after to avoid disruption
- Space limitations**—have participants perform exercises standing in place to reduce risk of contact with another participant; sometimes no option but to turn participants away
- Equipment changes**—always plan backups for equipment (both audio and exercise)
- Timing challenges**—adjust least important or most time-consuming portion of class to accommodate loss of time
- Managing conflict**—deal with it right away; offer suggestions so participants feel valued; ask regular participants to show new ones how class works

Class Instruction and Presentation

Music Considerations

Benefits of music while exercising:

- Dissociation**—diverting mind from feelings of fatigue; lowers perception of effort
- Synchronization**—moving to music improves movement efficiency
- Motor learning**—music replicates forms of human locomotion

Downbeat—first beat of a measure

32-count phrasing—common musical structure used in group fitness; audible emphasis every 32 counts

Foreground music—using tempo, lyrics, or song components to drive movements

Background music—using music to set mood and support atmosphere

Sound level—measured in decibels (dB); permissible exposure is 85 dB over 8 hours

Recommended Music Tempo (BPM) for Common Formats

Class Format	Recommended BPM Range
Resistance Training	125-135
HIIT/Tabata	150-160
Boot Camp	130-140
Step	128-132
Barre, Pilates	124-128
Kickboxing	140-150
Aquatics, Seniors	122-128

Recommended Genres/Style for Common Formats

Class Format	Recommended Genres/Style
Resistance Training	Top 40 pop, alternative, classic rock, deep house, progressive house
HIIT/Tabata	Electronic (house, techno), fast top 40, alternative, indie rock
Boot Camp	Dubstep, alternative, indie rock
Step	Pop, thematic or decade compilations
Barre, Pilates	Tropical house, classical, jazz, soul, soft rock
Kickboxing	Techno, progressive house, dubstep
Aquatics, Seniors	Oldies, Motown, dance, top 40 pop
Yoga	Down-tempo (exotic/ambient), world, indie or alternative

Communication Strategies

Supportive communication—creates climate of trust, caring, and acceptance

Nonverbal communication—other than written or spoken language; creates meaning; body language

One-way communication—instructor sends message with no confirmation of receipt from receiver

Two-way communication—instructor sends message and receiver communicates response back

Coaching and Motivation

Positive-based correction—feedback to elicit corrective change in most encouraging manner possible

Autonomy-supportive cueing—creating environment that emphasizes self-improvement, not competing against others

Extrinsic motivation—performing activity for reward separate from activity itself (e.g., cash prize for winning a race)

Intrinsic motivation—performing activity for reward directly stemming from activity (e.g., feeling energized after a class)

Cognitive influences—“inner dialogue” influence on behavior; confidence, self-talk; performance accomplishments, modeling, verbal persuasion, imagery

Interpersonal influences—individuals or groups one interacts with regularly

Affective influence—resulting from emotions

Sensation influences—physical feelings related to behaviors involved in establishing healthy lifestyle

Behavior influences—created as result of individual’s own behavior

Transtheoretical Model (TTM)—individuals progress through *stages of behavior change*; movement through stages is cyclical; precontemplation ↔ contemplation ↔ preparation ↔ action ↔ maintenance

Teaching and Learning Styles

Participant-centered approach—placing needs of group above desires of instructor

“Show, tell, do” method—combine demonstration and verbal instructions, then have participants perform action in order to best learn it

Styles of teaching:

Cue-based teaching—continuous, reliable, precise verbal cues simultaneous with movement

Visual-based teaching—demonstrate form and technique, provide comprehensive view from start to finish

Mirroring (mirror imaging)—instructor teaches class facing participants

Reflective imaging—instructor faces same direction as participants and uses mirror to teach movements

Timed coaching—verbal coaching; motivational phrasing to push through timed movement sequences

Teaching methods:

Part-to-whole—teach one move before second move, add second move to first, repeat for rest of combination

Repetition-reduction—teach move, repeat until mastered; repeat with each additional move; then, return to starting move and reduce repetitions

Simple-to-complex (layering)—teach combinations at basic level; then, add additional movements, range, or intensity for complexity

Slow-to-fast (half-time)—teach exercise at slower rate; once mastered, speed up to appropriate tempo

The visual-auditory-kinesthetic model:

Visual—learn by seeing or watching; demonstrations; observe body language

Auditory—learn by listening to directions; avoid unnecessary, wordy statements

Kinesthetic—learn through movement or touch

Cueing Techniques

Three-dimensional cueing—incorporates visual, auditory, and kinesthetic learning

Hands-on cueing—instructor redirects participant through touch

Positive-based cueing—words that cue to the solution, not the problem

4-beat cueing—counting down from 8, providing verbal and/or visual cues on counts 4-3-2-1

2-beat cueing—counting down from 8, providing verbal and/or visual cues on counts 2-1

Types of cues:

Personal—short, personal anecdotes; builds community and rapport

Safety—reminds participants of proper technique; corrects improper movement

Motivational/inspirational—positive cues about performance, effort, or ability

Alignment—describes body set-up or execution

Respiration—reminds when and how to breathe

Rhythmical—indicates timing of movements or upcoming timing changes

Informational/educational—explains reason for and potential benefit of a movement

Numerical—communicates numbers for counted portions of movement

Anatomical—explains muscles or body parts involved

Directional—indicates direction of movement (left, right, front, back)

Empowering—how a movement empowers participants beyond the gym

Spatial—one's body in relation to other participants or equipment

Movement—describes movement or pattern to be performed

Environmental and Safety Considerations

Recommended facility temperature—between 68°F and 72°F

Altitude—air at high altitude contains less oxygen than at low altitude

Air quality—exercise should not take place in environments where Air Quality Index (AQI) is higher than 150

Environmental Concerns for Group Fitness

Condition	Concerns and Symptoms
Cold Weather:	Consider wind chill; adequately cover skin; dress in multiple thin layers
<ul style="list-style-type: none"> Hypothermia 	<ul style="list-style-type: none"> Shivering Pale skin Bluing of the lips, hands, and feet
Hot Weather:	Core temperature over 102°F = heat exhaustion; over 104°F = heat stroke
<ul style="list-style-type: none"> Heat Exhaustion 	<ul style="list-style-type: none"> Profuse sweating Pale skin Dizziness Hyperventilation Rapid pulse
<ul style="list-style-type: none"> Heat Stroke 	<ul style="list-style-type: none"> Sudden collapse and unconsciousness Flushed, hot skin Reduced sweating Shallow breathing Further increased heart rate Death can occur if core temperature goes above 107 degrees Fahrenheit

Humidity—if air is humid, water in sweat does not evaporate readily; lowers ability to remove heat from body

Hyponatremia—loss of sodium; results in fluid retention

Hypokalemia—loss of potassium; results in weakness, fatigue, constipation, muscle cramping

In-class Safety Concerns for Group Fitness

Condition	Concerns and Symptoms
Over-exertion	<ul style="list-style-type: none"> Rapid breathing Becoming disoriented, dizzy, or lightheaded Losing color in their face Lack of sweating Abnormally rapid heart rate Fever Nausea and vomiting Confusion
Dehydration	<ul style="list-style-type: none"> Confusion Rapid heart rate Rapid breathing Passing out Lack of sweating Extreme thirst
Fatigue	<ul style="list-style-type: none"> Shortness of breath Chest pain Irregular or rapid heartbeat Dizziness or feeling light headed Severe abdominal, pelvic, or back pain

If weather or temperature makes exercise outdoors dangerous:

- Move class to climate-controlled space
- Minimize time in extreme weather
- Alter exercise sessions if weather-related stress is observed
- Have appropriate emergency equipment (e.g., ice, cold water, cold packs, mobile phone)

Emergency Response

Emergency response activation plan—should be prearranged by facility; familiarize and follow protocols; may have recording and reporting requirements for liability

Emergency response steps:

- 1) **Survey the surrounding area**—circumstances, condition of individuals, hazards to anyone nearby
- 2) **Look for signs of trouble**—position of the individual, skin color, bleeding, level of consciousness, pain or discomfort, distress
- 3) **Call emergency services**—dial 9-1-1
 - a. **Communicate**—with the individual if he/she is conscious
 - b. **Initiate CPR**—only if person is unresponsive; begin after step 2 and have a 3rd party call 9-1-1 if available; if no 3rd party, call 9-1-1 before starting CPR

For participants with asthma—participant should have inhaler; if not, breathing through nose or with pursed lips may reduce or dissipate symptoms

Occupational Hazards

Overtraining syndrome (OTS)—excessive frequency, volume, or intensity of training; results in fatigue, recurring illness, loss of sleep, moodiness, decreased physical performance, overuse injuries

Reduce OTS risk by:

- Diversifying formats taught
- Managing personal intensity
- Coaching instead of demonstrating
- Getting adequate rest and nutrition

A GFI should replace shoes after every—100 hours, 500 miles, or 3-6 months of use

Tactics to preserve vocal health:

- Project from diaphragm
- Avoid shouting and screaming
- Rest voice

Professionalism



Group Fitness Instructors are required to review, understand, agree to, and follow the AFAA Code of Professional Conduct.

Continuing Education

Credible resources—supported by evidence-based, peer-reviewed research from respected organizations, groups, and individuals

Sources of continuing education—workshops, trainings, readings and quizzes, online courses from approved providers

Liability Insurance

General liability insurance—protects insured from ordinary negligence

Professional liability insurance—covers professional negligence when participant sustains loss

Social Media and Marketing Considerations

Fitness community—evolving, growing, dedicated group of people who follow, trust, and regularly communicate with instructor

Fitness message—benefit statement or philosophy related to fitness

Fitness mission—informative statement about what instructor does (or wants to do)

Fitness vision statement—inspirational statement about what instructor wants to be in the future

Social media etiquette—target demographics using appropriate platform; keep positive and meaningful; follow social media campaign standards