



Australian Government

Department of Education, Employment and Workplace Relations

SISFFIT419A Apply exercise science principles to planning exercise

Release: 2

SISFFIT419A Apply exercise science principles to planning exercise

Modification History

Not Applicable

Unit Descriptor

This unit describes the performance outcomes, knowledge and skills required to utilise a broad knowledge of exercise science principles in fitness training.

Application of the Unit

This unit applies to exercise trainers who work in facilities that provide a range of exercise programs to general populations including older clients who present with no major health conditions. The unit is applicable to those employed in fitness environments such as fitness venues and those working autonomously in the fitness industry.

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Nil

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements and Performance Criteria

ELEMENT

PERFORMANCE CRITERIA

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

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|---|---|
| <p>1. Apply a knowledge of musculoskeletal anatomy to exercise planning, programming, and instruction</p> | <p>1.1. Apply knowledge of <i>skeletal anatomy</i> to exercise planning, programming and instruction.</p> <p>1.2. Apply knowledge of the integrated monitoring and control of <i>skeletal muscle contraction</i> by the nervous system to exercise planning, programming and instruction.</p> <p>1.3. Apply knowledge of the <i>structure, range of motion and function of muscles, muscle groups and directional terms</i> to exercise planning, programming and instruction.</p> |
| <p>2. Apply related concepts and principles of mechanics to exercise</p> | <p>2.1. Analyse and apply the <i>forces</i> acting on the body during exercise and <i>basic mechanical concepts</i> to exercise.</p> <p>2.2. Apply concepts and principles of mechanics to exercise.</p> <p>2.3. Use the common terms used to qualify the basic <i>principles of biomechanics</i> when instructing fitness activities.</p> <p>2.4. Identify and explain the basic <i>lever systems</i> in both anatomical and mechanical lever systems to clients.</p> <p>2.5. Use the <i>lever systems</i> in the human body and their role in movement and stability to provide safe and effective exercises for clients.</p> <p>2.6. Take into account the use of levers and cams in <i>resistance</i> equipment to alter the force required by muscles and affect joint stability when developing programs and instructing fitness activities.</p> <p>2.7. Take into account the effect of changes in lever</p> |

ELEMENT**PERFORMANCE CRITERIA**

- length on muscle force output in both anatomical and mechanical lever when instructing fitness activities.
3. Apply related concepts of physiology to exercise
- 3.1. Apply knowledge of the structure and function of the *cardio vascular system* to exercise.
 - 3.2. Apply knowledge of the structure, *processes* and function of body *energy systems* involved in the storage, transport, and utilisation of energy.
 - 3.3. Apply knowledge of the *physiological responses* of the human body to a single bout of physical activity to exercise.
 - 3.4. Apply knowledge of the *physiological adaptations* and *weight bearing* of the human body to regular exercise to exercise planning, programming and instruction.
 - 3.5. Apply knowledge of the *physiological responses* to physical activity in various *environmental conditions* to exercise planning, programming and instruction.

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

- communication skills including use of common terms when providing instructions clients during fitness activities
- literacy skills to
 - source, read, comprehend and apply relevant exercise science principles to exercise plans
- problem-solving skills to determine modifications due to adaptations of the body to exercise

Required knowledge

- basic exercise physiology
- anatomy
- biomechanics and its application to exercise planning
- physiological responses to physical activity
- adaptations of the body to exercise
- environmental conditions and their relationship to exercise planning.

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Evidence of the following is essential:

- monitor the physiological responses of the body to exercise.
- explain the adaptations the body makes to exercise.
- conduct aerobic function assessments.
- monitor the temperature regulation of the body during exercise.
- This unit of competency must be assessed in the context of fitness in Australia. For valid and reliable assessment the fitness activity should closely replicate the work environment. The environment should be safe, with the hazards, circumstances and equipment likely to be encountered in a real workplace.
- This unit of competence should be assessed through the observation of processes and procedures, oral and or written questioning on required knowledge and skills and consideration of required attitudes.

Context of and specific resources for assessment

Where performance is not directly observed and or is required to be demonstrated over a "period of time" and or in a "number of locations", any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- oral or written questioning to assess knowledge of healthy eating guidelines
- portfolio demonstrating evidence of accurate body composition appraisals
- third-party reports from supervisors detailing work performance.

Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Basic mechanical concepts may include:

- types of levers
- mechanical advantage.

Cardiovascular system may include:

- the major physical characteristics of blood and the functions of its major components
- the structure and function of the heart and its major components
- the structural and functional characteristics of the conduction systems of the heart
- the major events of the cardiac cycle
- the structure and function of the various types of blood vessels
- the major arteries and veins of the circulatory system
- the control of blood flow to skeletal muscle.

Concepts and principles of mechanics may include:

- mechanical concepts modelling human movement
- gravity
- centre of mass
- inertia
- force and momentum
- force production by the body
- mechanical concepts related to common exercise equipment
- resistance and or resistance arm
- force and or force arm
- axis of rotation
- variable resistance.

Directional terms may include:

- flexion
- extension
- dorsiflexion
- plantar flexion
- abduction
- adduction
- circumduction
- rotation

- supination
- pronation
- inversion
- eversion
- protraction
- retraction
- elevation
- depression.

Energy systems may include:

- duration and intensity of exercise effect energy contribution from the main energy systems utilised during different forms of exercise
- adenosine triphosphate
- phosphocreatine
- anaerobic glycolysis
- exercise programs that utilise of fatty acid metabolism
- energy system adaptations
- effect of energy intake affects the breakdown of energy substrates
- body systems involved in production of energy.

Environmental conditions may include:

- adaptations of the body to hot and cold environmental conditions
- physiological and biomechanical differences of exercising in the heat compared to normal adaptive conditions
- physiological and biomechanical differences of exercising in the cold compared to normal adaptive conditions
- acute and chronic effects of exercising in water
- the mechanism whereby the body regulates internal temperature in responses to environmental changes and exercise
- dehydration and the importance of water intake and or re-hydration during exercise
- physiological demands placed on the body from smoking
- need for a comprehensive preparation phase to avoid heat or cold stress
- mobility
- general preparation
- pre stretch
- specific preparation.

- Fitness equipment*** may include:
- rowers
 - steppers
 - steps
 - treadmills
 - stationary cycles
 - VO2 max shuttle run test recordings
 - heart rate monitors
 - ratings of perceived exertion
 - 'norm' charts.
- Forces*** may include:
- resistive
 - motive
 - friction
 - centre of gravity
 - centre of force, equipment and muscles.
- Functional appraisals*** may include:
- anthropometry
 - aerobic responses
 - cardiovascular responses
 - strength
 - endurance
 - flexibility.
- Measurement methods*** may include:
- heart rate response
 - pulse response
 - blood pressure response
 - respiration rate response
 - skin colour response
 - perceived exertion
 - exercise form
 - work output.
- Metabolic products*** may include:
- lactate
 - carbon dioxide
 - water.
- Muscle groups*** may include:
- prime mover
 - fixators
 - assistors.
- Physiological responses*** may include:
- the acute responses to the onset of exercise
 - cardiovascular system
 - heart rate response
 - blood volume
 - blood pressure
 - stroke volume
 - cardiac output

- respiratory system
 - respiratory rate
 - immune system
 - nervous system
 - musculoskeletal system
 - endocrine system
 - the regulation of blood flow during exercise
 - the shifts in the distribution of blood to various areas of the body during exercise.
- Physiological adaptations*** may include:
- distinguish between central and peripheral fitness adaptations
 - explain the central and peripheral adaptations of the body to anaerobic training and aerobic training.
- Processes*** may include:
- glycolysis
 - gluconeogenesis
 - lipolysis
 - use of protein as fuel.
- Range of motion*** may include:
- sit and reach
 - goniometers
 - electronic.
- Skeletal anatomy*** may include:
- bones
 - structure and mechanics of bone
 - the biomechanical properties of bone
 - the responses of bone to weight bearing activities
 - bone formation, growth, and remodelling
 - the influence of diet on bone homeostasis
 - the influence of age on bone homeostasis
 - major bones and major landmarks of the skeleton
 - bone markings
 - tuberosity
 - crest
 - trochanter
 - line
 - tubercle
 - epicondyle
 - spine
 - head
 - facet
 - condyle

- ramus
- meatus
- sinus
- fossa
- groove
- fissure
- foramen
- directional terms used to define positions of bones and landmarks
- structural regionalisation of the vertebral column and the implications for movement
- normal and abnormal spinal curvatures and the implications of these conditions for physical activity
- joints
- joints related to exercise
- intervertebral
- sternoclavicular
- sternocostal
- acromioclavicular
- glenohumeral
- elbow
- radioulnar
- radiocarpal
- metacarpophalangeal
- pubic symphysis
- coxal
- tibiofibular
- femoropatellar
- tibiofibular
- ankle
- metatarsophalangeal
- structure and function of joints
- fibrous, cartilaginous and synovial joints
- anatomical structure of joints.

Skeletal muscle contraction may include:

- the main features of nerves and the nervous system related to exercise
- nervous system classification and structure
- central or peripheral
- afferent or efferent
- voluntary or involuntary
- structure of a motor neuron
- generation and conduction a motor impulse

- reflex arcs
- the neural innervation of muscles for movement and proprioception
- the types of muscle contraction, and the relationship between muscle force and external load for each
- the factors influencing muscle contraction
- length tension relationship
- motor unit recruitment
- muscle fibre types
- mechanical advantage of joint position
- force velocity relationships
- size principle
- reciprocal inhibition,
 - agonist or antagonist relationship.

Structure and function of muscles may include:

- the transfer of metabolites between blood and muscles
- the general relationship between nerves and skeletal muscle
- the major postural muscles
- pectoralis minor
- serratus anterior
- intercostals
- brachialis
- pronator teres
- brachioradialis
- flexor carpi radialis
- palmaris longus
- extensor carpi radialis longus
- flexor carpi ulnaris
- extensor carpi ulnaris
- extensor digitorum
- external oblique
- rhomboid major
- rhomboid minor
- levator scapulae
- teres minor
- supraspinatus
- infraspinatus
- internal oblique
- gluteus maximum
- gluteus medius

- gluteus minimus
- transverse abdominis
- iliotibial tract
- adductor magnus
- biceps femoris
- semitendinosus
- semimembranosus
- iliopsoas
- tensor fasciae latae
- sartorius
- adductor longus
- gracilis
- the purpose of connective tissues
- ligaments
- elbow
- radial collateral ligament
- ulnar collateral ligament
- knee
- fibular, ie, lateral, collateral ligament
- patella ligament
- anterior cruciate ligament
- tibial, ie, medial, collateral ligament
- posterior cruciate ligament
- shoulder
- acromio clavicular ligament
- ankle
- tendon
- achilles tendon
- patella tendon
- pelvic floor muscles
- own body weight
- added resistance
- pin loaded
- hydraulic
- free weight
- air braked
- water environment.

Weight bearing may include:

Unit Sector(s)

Fitness

Competency Field

Fitness