EXERCISE PRESCRIPTION
Apply knowledge of functional anatomy and biomechanics

level: 5
credit: 5
planned review date: December 2002
sub-field: Fitness

purpose: People credited with this unit standard are able to: apply knowledge of human anatomy relevant to exercise and fitness; apply knowledge of basic concepts and principles of biomechanics; apply biomechanical principles to the description and analysis of posture, movement, and fitness development; analyse biomechanical implications of normal processes, musculoskeletal injury, and common conditions and disabilities; apply field-based biomechanical observation and measurement techniques to movement analysis and programme development; and apply available anatomical and biomechanical norms and ranges to programme development for people with special needs. This unit standard is designed for people who will, with little supervision, be prescribing exercise for clients in and associated with fitness facilities, recreation programmes, and sports.

entry information: Open.

accreditation option: Evaluation of documentation and visit by NZQA and industry.

moderation option: A centrally established and directed national moderation system has been set up by the Sport, Fitness and Recreation Industry Training Organisation - Fitness Advisory Group.
special notes:

1. This unit standard requires the use of *Standard Exercise Schedule A* (Schedule A) which is intended to reflect a desirable entry-level exercise vocabulary for work in the New Zealand fitness industry. The Schedule contains sections on resistance training exercises using bodyweight, resistance training exercises using free weights, resistance training exercises using exercise machines, free standing exercises, and stretches.

The latest edition of Schedule A is available from the Sport, Fitness and Recreation Industry Training Organisation (Sfrito), PO Box 2183, Wellington; Phone 04 385 9047, Fax 04 385 7024, (Revised 2001).

2. For assessment of performance criterion 1.3 it is intended that trainees be able to demonstrate knowledge of all of the muscle groups referred to in Section Four of Schedule A. Assessment tasks will involve a sample of at least five of the muscle groups in Section Four selected by the assessor. Trainees, given a specified muscle group, are be able to describe or demonstrate all of the elements in the other ranges of performance criterion 1.3 in terms of a standard resistance or freestanding exercise from Schedule A.
Elements and Performance Criteria

element 1

Apply knowledge of human anatomy relevant to exercise and fitness.

Range: breadth of knowledge includes - skeletal structure and function, joint structure and function, role of tendons and ligaments, muscle structure, architecture and function of skeletal muscles, location of major motor and sensory nerve pathways, gross structure and function of internal organ systems (digestive, endocrine, excretory).

performance criteria

1.1 Description of human skeleton relates elements of skeletal structure to function, in support, and in movement.

Range: breadth of knowledge includes - parts of the skeleton, bone, cartilage and joint types, bone structure, bone development, bone growth and repair, loss of bone mass, structure of limbs (bones and joint structure), structure of spine, relationship between structure and movement round major joints, body dimensions; movement types include - flexion, extension, adduction, abduction, medial and lateral rotation, plantar- and dorsiflexion, pronation, supination, circumduction.
1.2 Description of structure and distribution of musculoskeletal connective tissue is used to explain its function in support and in movement.

Range: breadth of knowledge includes - types of connective tissue (ligament, tendon, muscle fascia), location of connective tissue, ligament structure around major joints, detail structure of connective tissue, mechanisms of development, growth, injury and repair, role of connective tissue in the musculoskeletal system.

1.3 Description of voluntary muscle anatomy is related to the execution of specific movement categories and specific exercises.

Range: Schedule A, Sections One, Two and Four; muscle action types - concentric, eccentric, isometric, isokinetic; aspects - type (structure, postural or phasic), origin, insertion, action.

1.4 Description of the gross anatomy of the nervous system is related to the function of nervous system elements in physical activity.

Range: breadth of knowledge includes - organisation of parts of the brain involved with movement, gross architecture of motor and sensory nerves involved in movement, relationship of peripheral nervous system and spinal cord, sensory organs involved in proprioception, innervation of muscles (principles), innervation of major muscle groups.
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1.5 Description of the gross anatomy of internal organ systems explains their role in and effect on physical activity.

Range: cardiovascular system, digestive system, hepatic system, renal system.

element 2
Apply knowledge of basic concepts and principles of biomechanics.

Range: mechanical concepts, mechanical models of human movement, kinetics and kinematics.

performance criteria
2.1 Explanation of basic mechanical concepts demonstrates their relevance to description and analysis of human movement.

Range: breadth of knowledge includes - mass, inertia, gravity, force, torque, distance and displacement, speed, velocity, acceleration, momentum, types of lever, wheel and axle, pulley, mechanical advantage, friction, equilibrium and stability, linear and rotational motion.
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2.2 Movement description and qualitative analysis depicts the action of forces produced by and acting on the body in physical activity.

Range: type of force and torque - internally generated (muscular), from external sources, resistive, motive; breadth of knowledge includes - types of motion, force, torque and motion relationships, planes of motion, Newton's laws of motion (and angular equivalents), centre of gravity (location, movement and significance), the link system, kinetic links and chains, force and torque diagrams.

**element 3**
Apply biomechanical principles to the description and analysis of posture, movement and fitness development.

Range: posture - standing, sitting; movements include - gait (walking, running), propulsion (leaping, jumping), operation of the spine (including skull and pelvic girdle) in movement, operation of the shoulder girdle and shoulder joint complex; fitness development - strength, speed, flexibility.

**performance criteria**

3.1 Analysis of posture applies principles of biomechanics to promoting good posture and to correcting common postural faults.

Range: principles - description of posture, force production, loading of skeletal, muscular and connective tissue; postural faults - kyphosis, scoliosis, lordosis.
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3.2 Normal gait, propulsion, spinal and shoulder movement patterns are analysed in terms of biomechanical movement description and measurement.

Range: principles - description of gross movement and movement around and within joints, force production, loading of skeletal, muscular and connective tissue.

3.3 Analysis of one exercise designed to develop each fitness component applies biomechanical analysis to fitness development.

Range: fitness component - strength, speed, flexibility, stamina.

element 4

Analyse biomechanical implications of normal processes, musculoskeletal injury, and common conditions and disabilities.

Range: implications for - posture, movement, strength, speed, flexibility; normal processes - development, aging, pregnancy; conditions and disabilities include - arthritis, diabetes, hypertension, cardiac insufficiency and injury, visual impairment, hearing impairment, common motor disabilities including epilepsy and head injuries, and people undergoing functional rehabilitation.

performance criteria

4.1 Analysis of developmental and aging processes establishes biomechanical implications for exercise prescription.

Range: changing body dimensions (including New Zealand norms and ranges where available), absolute and relative strength of structural elements, ability to produce and withstand forces.
4.2 Analysis of musculoskeletal injury and recovery from injury shows mechanical aspects of injury and recovery processes.

Range: injury type - trauma, overuse; injury to - muscle, tendon, ligament, bone.

4.3 Analysis of biomechanical aspects of pregnancy identifies implications for exercise prescription for ante- and post-natal women.

Range: body dimensions, absolute and relative strength of structural elements, ability to produce and withstand forces, biomechanical analysis of special exercises to assist pregnancy and recovery following childbirth.

4.4 Analysis of common conditions and disabilities in biomechanical terms demonstrates implications for exercise prescription.

Range: dimensions of analysis - body dimensions, strength of structural elements, strength of musculoskeletal systems, limits of adaptation.
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**element 5**

Apply field based biomechanical observation and measurement techniques to movement analysis and programme development.

Range: exercise selected from Schedule A Sections One and Two; method - observation, using reference points, lines and scales, measurement (time, distance), recording outcomes, use of video.

**performance criteria**

5.1 Mechanical analysis of a whole body exercise applies the process of biomechanical analysis and model development.

Range: process - identify nature of exercise, identify mechanical purpose of the movement, identify joints involved, key muscle groups and types of action, identify mechanical factors influencing effectiveness in the movement, identify significant mechanical variables in the movement, identify constraints on performance.

5.2 Analysis of a whole body exercise applies field-based biomechanical observation and measurement techniques.

5.3 Application of biomechanical analysis and field-based observation and measurement technique to a purposeful movement generates a programme of conditioning exercises for performance improvement.

Range: sport skill, locomotor skill, routine living movement under disability conditions (including advanced age).
element 6

Apply available anatomical and biomechanical norms and ranges to programme development for people with special needs.

Range: special needs groups include
life cycle stages - children and adolescents, older people and seniors, ante- and post-natal women;
people with activity limitations imposed by - asthma, arthritis, diabetes, hypertension, cardiac insufficiency and injury, visual impairment, hearing impairment, common motor disabilities including epilepsy and head injuries, and undergoing functional rehabilitation.

performance criteria

6.1 Description of biomechanical literature demonstrates knowledge of sources relevant to exercise prescription.

Range: textbooks, periodicals, libraries, interloan systems, databases, computer network forums.

6.2 Research of a variety of sources obtains biomechanical programme development information for two distinct special needs groups.

Range: specialist literature, academic sources, health professionals, government departments, support groups.
6.3 Biomechanical information for two distinct special needs groups is presented in the form of exercise programme guidelines.

Range: programme guidelines - fitness component emphasis, exercise content, equipment and facility requirements, assistance requirements, safety constraints, relevant outcomes.

6.4 Consultation with special needs groups allows group members to evaluate programme guidelines and provide input.

Comments to:

Sport, Fitness and Recreation Industry Training Organisation
- Fitness Advisory Group
Unit Standard Revision
PO Box 160
WELLINGTON

by December 2002.

Please Note: Providers must be accredited by the Qualifications Authority before they can offer programmes of education and training assessed against unit standards.

Accredited providers assessing against unit standards must engage with the moderation system that applies to those unit standards. [Please refer to relevant Plan ref: 0069]