National Association for Sport and Physical Education
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GUIDANCE DOCUMENT

Guidelines for Undergraduate Exercise Physiology in a Physical Education Teacher Education Program

A course in Exercise Physiology is a common requirement among undergraduate students preparing for a career in physical education, adult fitness, or athletic training. Often, such courses are taught to an assortment of students from a variety of disciplines (Van Donselaar & Leslie, 1990) with an emphasis on physiological principles applied to adults. This creates a substantial challenge to the instructor in devising course materials and experiences that will meet the needs of each student, particularly for teacher education students who will be working primarily with children. The intent of this document is to specifically address and raise the awareness of the needs of students in a teacher preparation track, defining suggested minimum competencies for those students pursuing a career in physical education.

One of the primary goals of physical education is to foster the development and maintenance of a physically active lifestyle (NASPE, 2004a). Knowledge of exercise physiology, particularly as it applies to exercise programming and physical fitness, is essential for students preparing for a career in physical education. Specifically, a course in exercise physiology should provide teacher education candidates with: a) an understanding of the relationship between physical activity and indices of health and health-related fitness, b) a basic knowledge of acute and chronic responses to various forms of physical activity, exercise and sports, c) the skills for assessment and analysis of physical fitness, and d) the ability to design safe activities and/or exercise programs to enhance health, fitness, or performance. When possible, these concepts should be presented from a developmental or pediatric model, as most teacher candidates will be working with either children or adolescents (Bulger, Mohr, Carson, Robert, & Wiegand, 2000; Karper, 1997). Guidelines for exercise programming as they relate to adults are also included, specifically for those planning to teach at the high school level in preparing their students to continue an active lifestyle into adulthood.

A final consideration is preparing students to apply theoretical concepts of exercise physiology to the physical education setting. The existence of a gap between theory and practice has long been recognized in the area of exercise physiology (Barnett & Merriman, 1994; Bulger et al., 2000; Van Donselaar & Leslie, 1990). Increased attention to teaching applications and activities that require students to be more actively engaged

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in the learning of exercise-related concepts may help to bridge this gap. Examples of such activities might include, but are not limited to, case studies, laboratory exercises, fitness assessments, exercise program design, and problem-based activities. When possible, students should be given the opportunity to work directly with children in applying these concepts (Bulger et al., 2000).

Prerequisite

The prerequisite knowledge recommended for an undergraduate course in exercise physiology would include an understanding of the structure and function of the skeletal, muscular, nervous, cardiovascular, respiratory, and endocrine systems. This type of information is generally found in an Anatomy and Physiology course.

Guidelines (Minimum Exit Outcomes)

These outcomes are stated to be consistent with the phrase "The students will be expected to…".

A. Basic Concepts in Exercise Physiology

1. Understand the distinction among the terms physical activity, exercise and physical fitness.

2. Identify and describe the health related components of physical fitness (cardiorespiratory endurance, muscular strength and endurance, flexibility, body composition).

3. Demonstrate knowledge regarding the relationships between factors involved in growth/maturation and physical activity (effects of growth on fitness, effects of regular physical activity on growth).

4. Understand the gender-related differences in fitness that occur at the onset of adolescence.

5. Describe the relationship between regular physical activity and various indices of health in children, adolescents and adults. Demonstrate a basic understanding of coronary artery disease and how long term physical activity moderates selected risk factors for heart disease (blood pressure, cholesterol, diabetes, obesity).

6. Explain current recommendations for physical activity in adults (Surgeon General's Report on Physical Activity, 1996), as well as recommendations for age appropriate activities for children (NASPE, 2004b).

7. Apply basic training principles (specificity, overload, progression, periodization, individual differences, warm-up, cool-down) in the design of safe exercise programs for developing health, physical fitness or athletic performance.

8. Demonstrate proficiency in leading group exercise with a variety of formats (traditional, step, muscle conditioning, flexibility).

9. Utilize strategies to facilitate behavior change and promote exercise adherence (goal setting, intrinsic and extrinsic motivation, journals/logs, social support, environmental determinants of physical activity).

B. Metabolic Concepts

1. Understand the energy continuum (ATP, creatine phosphate, anaerobic glycolysis, oxidative pathways) and how each metabolic pathway relates to various forms of exercise.

2. Describe the role of carbohydrates, fats, and proteins as fuels for aerobic and anaerobic metabolism. Understand the importance of maintaining proper hydration before, during and after exercise.

3. Describe the metabolic characteristics of children and how differences in the energy continuum (compared to adults) relate to patterns of childhood activity.

4. Evaluate and interpret anaerobic or short-burst fitness in children and adolescents (sprints, vertical jump test, Wingate bike test).

5. Administer field estimates of physical activity / energy expenditure (activity recall, pedometers, accelerometers).

6. Identify and explain factors that are associated with maximal exercise performance (VO_2 max, lactate threshold, economy of effort, gender, age) and fatigue (depletion of fuel, accumulation of lactic acid / H^+, neuromuscular failure).

7. Describe metabolic adaptations that take place in response to regular exercise training.

8. Utilize assessment data and apply basic training principles to enhance bioenergetics.

C. Cardiorespiratory Concepts

1. Describe cardiovascular and respiratory responses to acute exercise in children and adults.

2. Recognize developmental changes that take place in the cardiovascular and respiratory systems during childhood and adolescence.

3. Assess cardiorespiratory endurance through field testing (1-mile run, 9-min

run, pacer test) and demonstrate competency in evaluating and applying that information in the development or modification of a conditioning program.

4. Compare cardiovascular/respiratory adaptations to regular exercise in children and adults.

5. Apply the FITT (frequency, intensity, time, type) principle and compute target heart rate zone in the design of exercise programs to enhance cardiorespiratory fitness.

6. Monitor intensity during the warm-up, primary activity, and cool-down components of an aerobic exercise session (heart rate, rating of perceived exertion - RPE).

7. Understand thermoregulatory responses to hot and cold environments in children/adolescents and apply safety principles accordingly.

D. Neuromuscular/Skeletal Concepts

1. Describe the mechanics of muscular contraction from depolarization of the motor neuron through the sliding filament theory.

2. Understand the influence of growth and development on neuromuscular function (muscular strength/endurance, flexibility).

3. Assess and evaluate muscular strength and muscular endurance in children and adolescents (10RM, abdominal curl-ups, push-ups].

4. Identify neuromuscular adaptations to resistance training in children and adults.

5. Apply the basic training principles with consideration to safety and proper supervision to enhance muscular fitness in children and adults. Understand how different combinations of training load, repetitions, sets, and rest intervals yield enhanced muscular performance relative to muscular strength, muscular endurance and muscular power. Display competency in utilizing a variety of resistance equipment (weights, resistance bands, stability balls, body weight) to strengthen the major muscle groups.

6. Recognize the effects and risks of ergogenic aids (anabolic steroids, creatine, caffeine) on health and performance.

7. Demonstrate knowledge regarding the effects of exercise training on bone density from childhood to early adulthood and prescribe exercise that would optimize the development of peak bone density.

8. Understand the reflex actions related to activation of the muscle spindle and golgi tendon organ.

9. Evaluate flexibility of children and adolescents with an understanding of safety and validity issues concerning selected assessments (sit and reach).

10. Utilize appropriate/safe stretching exercises and employ proper stretching technique (type, intensity, duration, repetitions, frequency) to improve or maintain flexibility.

E. Concepts in Body Composition

1. Recognize the physical, psychological, social and health implications of obesity in childhood and the long-term health consequences of obesity tracking into adulthood.

2. Demonstrate knowledge concerning the prevalence of obesity in youth and understand the multiple factors contributing to obesity in children and adolescents.

3. Understand the components of body composition (lean body mass, body fat) and assess markers of obesity and body composition in children and adolescents (body mass index and CDC BMI percentiles for children and adolescents, waist to hip ratio, skinfolds).

4. Exhibit a thorough understanding of weight management concepts (proper nutrition, physical activity, behavior modification).

5. Tailor exercise programming to meet the individual needs of overweight and obese students.

6. Explain the concept of optimal weight for athletic performance and acknowledge the dangers of excessive weight loss and excessive training.

7. Identify symptoms of eating disorders (anorexia, binge eating disorder, bulimia, muscle dysmorphia) and appropriate individuals/agencies for referral.

Note: The list of minimum outcomes for teacher preparation students related to exercise physiology is extensive. Faculty may find it difficult to include all of these competencies in a single course of undergraduate exercise physiology, particularly if the course is taught to a variety of students from different areas of specialization (adult fitness, athletic training, teacher preparation). Many of the suggested outcomes could be infused into other courses within the teacher preparation curriculum, and would not necessarily be included in exercise physiology.

Faculty

Teachers of undergraduate courses in exercise physiology should have a doctoral degree and a specialization in exercise physiology or closely related field. Collaboration with faculty in teacher education is strongly encouraged to promote integration of exercise physiology content with instructional strategies.

Facilities and Equipment

To facilitate attainment of the minimum suggested competencies a structured laboratory component should be incorporated into the course. The instructor and students should have access to an exercise physiology laboratory with an array of equipment to evaluate fitness and physiological responses to exercise. Additional facilities, such as a gymnasium, weight room, and outdoor track, would provide an appropriate setting for many of the field tests often used in physical education. Minimum and desirable equipment to facilitate learning is listed below.

A. Minimal Equipment for Laboratory Experiences

1. Anatomical charts and models
2. Medical balance scale (body weight and height)
3. Tape measures, skinfold calipers
4. Stop watches
5. Laboratory clock with second hand
6. Monark cycle ergometers
7. Metronome
8. Blood pressure cuffs, sphygmomanometers, stethoscopes
9. Goniometers, sit and reach box, rulers
10. Resistance exercise equipment: dumbbells, therabands, stability balls
11. Pedometers

B. Desirable Equipment for Laboratory Experiences

1. Treadmill
2. Bioelectrical impedance machine
3. EMG equipment
4. Polar HR monitors
5. Accelerometers
6. Metabolic cart

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Suggested Citation:
National Association for Sport and Physical Education. (2006). *Guidelines for undergraduate exercise physiology in a physical education teacher education program.* [Guidance document]. Reston, VA: Author.