Section 2:
Principles of Fitness Development

SECTION 2: PRINCIPLES OF FITNESS DEVELOPMENT

Definition of Physical Fitness

There is no universally agreed upon definition of *physical fitness* and of its components. Definitions for physical fitness include the following:

> A set of attributes that people have or achieve that relate to their ability to perform physical activity (Howley & Franks, 2003).
>
> A set of attributes, primarily respiratory and cardiovascular, relating to the ability to perform tasks requiring expenditure of energy (*Stedman's Concise Medical Dictionary for the Health Professions,* 2001).
>
> The ability to perform moderate to vigorous levels of physical activity without undue fatigue and the capability of maintaining such ability throughout life (American College of Sports Medicine, 1998).

Instructors are encouraged to use definitions from their own sources.

Definition of Health-Related Physical Fitness

More contemporary terminology has defined physical fitness as contributing to either health-related fitness or skill/performance-related fitness. Manitoba's combined PE/HE curriculum emphasizes the health-related components of fitness—that is, the physical and physiological components of fitness that have a more direct impact on health status. *Health-related fitness* may be defined as follows:

> The state of physical and physiological characteristics that define the risk levels for the premature development of diseases or morbid conditions presenting a relationship with a sedentary mode of life (Bouchard & Shephard, 1994).

The health-related fitness components include

- muscular strength, endurance, and flexibility
- body composition
- cardiovascular endurance

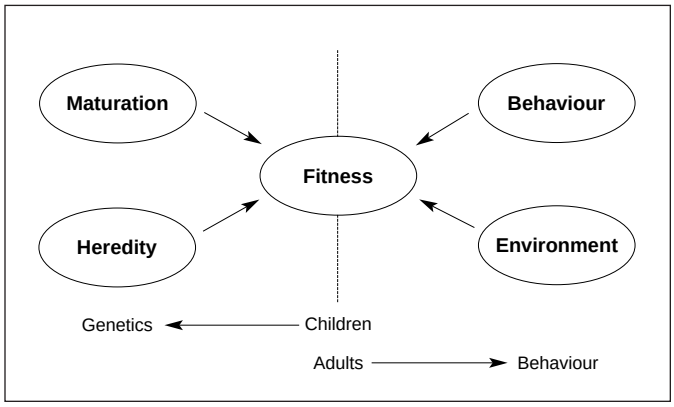
In contrast, skill/performance-related fitness relates to those attributes that are important for performance outcomes in specific sports, movements, or occupations. The skill/performance-related fitness components include agility, balance, coordination, power, reaction time, and speed.

Determinants of Physical Fitness

Factors that determine the level of an individual's physical fitness are multi-dimensional and hierarchical. In general, the determinants of physical fitness may be classified as

- genetically determined (influenced by maturation and heredity)
- behaviourally determined (influenced by physical activity, diet, and other habits)
- environmentally determined

While all these factors are influential determinants of fitness in children/adolescents, some are more influential than others (Figure 2). For example, while a positive, strong relationship between the amount of physical activity and aerobic fitness exists in the adult population (U.S. Department of Health and Human Services, 1996), this relationship is not as clear for children and adolescents (Armstrong, Williams, Balding, Gentle, & Kirby, 1991; Boreham, Twisk, Savage, Cran, & Strain, 1997; Katzmarzyk, Malina, Song, & Bouchard, 1998; Ekelund, Poortvliet, Nilsson, Yngve, Holmberg, & Sjostrom, 2001). In children and adolescents, factors such as rate of maturation and heredity demonstrate a greater influence on most fitness scores than behaviour and/or environmental factors (Jones, Hitchen, & Stratton, 2000; Pate, Dowda, & Ross, 1990; Malina, 1990). Moreover, because of the strong association between maturation and fitness scores, it has been difficult for researchers to determine the contribution of other factors, such as behaviour (e.g., physical activity and diet) on fitness score development. In fact, it remains somewhat controversial whether children are adaptable to physical training (Rowland, 1992; Payne & Morrow, 1993; Shephard, 1997). Although the cause of the growing incidence in childhood obesity (i.e., body composition) remains largely unknown, behavioural factors such as physical inactivity and diet are likely to play the greatest role (Tremblay & Willms, 2000; Ogden et al., 2002).



Standard fitness scores for children/adolescents are influenced more by maturation and heredity than by behaviour or environmental factors (Pangrazi & Corbin, 2001).

Figure 2. Factors That Influence Physical Fitness.

Principles of Fitness Development

Physical fitness development is a vital component of Manitoba's combined PE/HE curriculum. It is, therefore, important for educators to understand the fundamental principles that govern adaptation to physical activity and ultimately lead to the development of physical fitness. Although these principles are well accepted for the adult population, keep in mind that it is currently unknown how well they conform to the training response of children and youth. Nevertheless, a review of these principles helps educators understand how children may respond to physical activity.

Adaptation to physical activity is governed by a number of general principles that include, but are not limited to, the principles of

- overload
- individuality
- diminishing returns
- specificity
- reversibility

A discussion of each of these principles of fitness development follows.

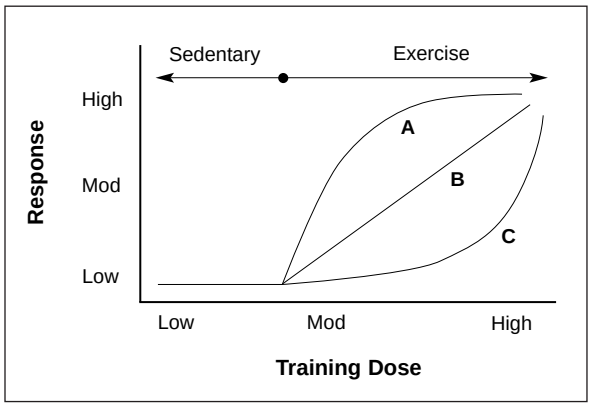
The Principle of Overload

The principle of overload suggests that in order to see an improvement in fitness (i.e., response), the dose of physical activity must exceed that to which the individual is already accustomed. The dose of physical activity is controlled by the manipulation of frequency, intensity, time, and type of exercise, otherwise known as the FITT principle. This principle suggests that there is a dose-response relationship between physical activity and physical fitness. Furthermore, in order for a response to occur, a specific dose threshold must be surpassed.

This principle raises two important questions:

- What is the nature of the relationship between dose and response (i.e., linear, curvilinear, exponential)?
- What is the dose threshold that must be exceeded for a response to occur?

With regard to children and adolescents, the answers are unknown. In other words, we do not know how much physical activity is enough, or how exactly a child/adolescent will adapt to a specific dose of physical activity (Corbin, Pangrazi, & Welk, 1994; Twisk, 2001). We do know, however, that the dose-response relationship can be generally described by three separate curves (Bouchard, 2001; Kesaniemi, Danforth, Jensen, Kopelman, Lefebvre, & Reeder, 2001), as shown in Figure 3. Curve A suggests that most of the benefits are attained at low to moderate levels of activity. Curve B suggests that more activity leads to greater adaptation, while curve C suggests that the greatest benefits are obtained only when the level of physical activity is rather high.

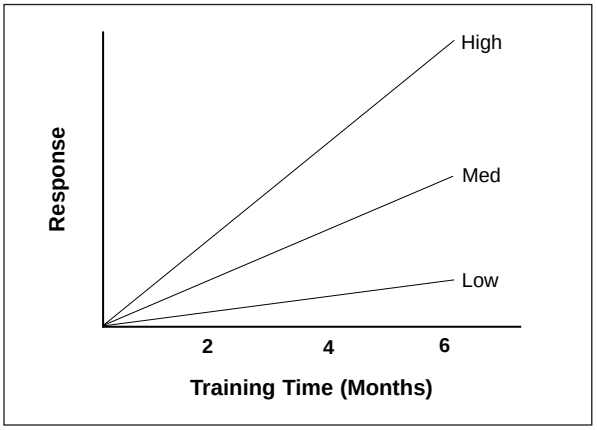


The nature of the relationships between regular physical activity (dose) and most health outcomes (response) generally conform to curve A, B, or C (Bouchard, 2001).

Figure 3. Dose-Response Relationship.

The Principle of Individuality

The principle of individuality suggests that the individual response (i.e., adaptation) to physical activity is highly heterogeneous (Figure 4). No two individuals will respond in exactly the same way to a similar dose of physical activity. Regardless of the physical activity programming being used, some individuals will demonstrate improvement (i.e., responders), while others will not (i.e., non-responders). Therefore, the dose-response relationship is highly individualistic (Bouchard & Rankinen, 2001). It is now recognized that certain individuals are volume-responders (i.e., respond better to a large volume of physical activity), whereas others are intensity-responders. The principle of individuality is strongly influenced by heredity.

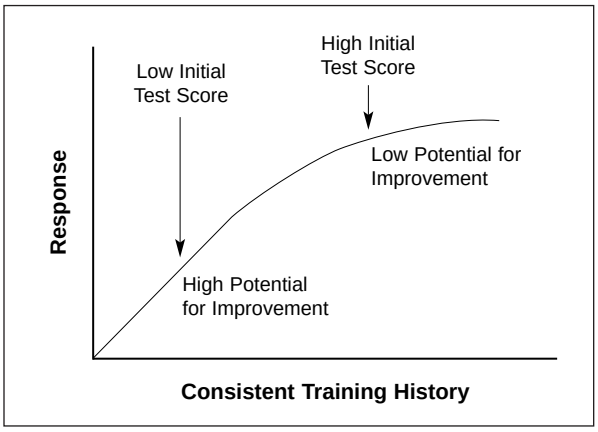


The amount of adaptation in fitness to a standard exercise dose varies widely and is under genetic control (Bouchard & Rankinen, 2001).

Figure 4. Heterogeneous Response to Physical Training.

The Principle of Diminishing Return

The principle of diminishing return suggests that the rate of fitness improvement diminishes over time as fitness approaches its ultimate genetic potential (Figure 5). Simply stated, as fitness improves, "you receive less bang for your buck." Thus, the response to physical activity is not only associated with heredity, but is also highly influenced by an individual's current level of fitness. The fitter individuals are, the less likely they are to improve further.



Recent training history determines an individual's future responsiveness to physical training.

Figure 5. Principle of Diminishing Returns.

The Principle of Specificity

The principle of specificity suggests that improvements in physical fitness are specific to the demands or characteristics (e.g., FITT, speed, angle, acceleration, muscle fibre recruited) imposed by the physical activity. This principle is also known as the SAID principle (specific adaptation to imposed demands).

The Principle of Reversibility

The principle of reversibility suggests that any improvement in physical fitness due to physical activity is entirely reversible. In other words, "use it or lose it." This principle suggests that regularity and consistency of physical activity are important determinants of both fitness maintenance and continued improvement.

Summary of Principles

In summary, the principles of fitness development tend to support the process-oriented approach rather than the outcome-oriented approach to fitness development for the following reasons:

- Fitness scores in children/adolescents are highly influenced by heredity and physical maturity, and to a lesser degree by behaviour (i.e., physical activity). Therefore, an outcome-oriented approach (i.e., focusing on fitness score as the determinant of success) could be extremely frustrating for a portion of the student population and could lead to a negative fitness experience for these individuals.
- The dose-response relationship between physical activity and physical fitness is poorly defined for children/adolescents. Therefore, it is unreasonable to focus solely on fitness scores when the most appropriate exercise prescription (i.e., FITT principle) to reach greater fitness levels is poorly defined for this age group.
- The response to physical activity is highly heterogeneous. That is, not everyone in the classroom will adapt at the same rate or in the same way to a particular activity. Therefore, a focus on outcome would favour those students who happen to be natural "responders."
- The response to physical activity is highly dependent on an individual's prior state of fitness. Consequently, students with the highest fitness level have the least chance for improvement. These students would, therefore, be unduly penalized if the instructor took an outcome-oriented approach.

Promoting the "more is better" or outcome-oriented approach may ultimately result in poor health if the individual takes physical fitness/activity to the extreme.

Physical Activity, Health, and Fitness Relationship

Can one be fit without being healthy? Unfortunately, the answer to this question is yes. For example, many highly fit Olympians have become sick due to the overwhelming physical and psychological demands of high performance training (i.e., overtraining syndrome). This suggests that the motto "more is better" does not hold true when applied to the relationship between physical activity and health. Therefore, this relationship generally conforms to what is described as the "inverted U" relationship (Figure 6). There is a positive relationship between levels of physical activity (i.e., dose) and health up to a particular threshold. Beyond this threshold of activity, health may deteriorate. From a health perspective, this has led to the generality that a little exercise may be useless, a moderate amount is useful, and a large amount may be harmful.

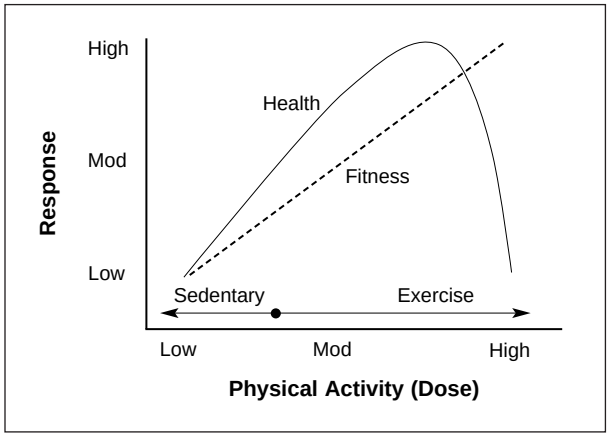


Figure 6. Inverted "U" Relationship of Health vs. Activity.

Strategies for Development of Health-Related Fitness Components

Use a variety of strategies to help students develop and follow a personal fitness plan for lifelong physical activity and well-being. The following guidelines and principles are considered best practices in fitness development (Gannon, Halas, Ng, & Chuchmach, 2002).

Use Effective Teaching Strategies

To promote lifelong participation in physical activity, physical educators must teach students *how* and *why* to be active. Effective teaching strategies provide students with an understanding of the importance of regular exercise to health, and developmentally appropriate ways to meet physical activity goals (Ratliffe, 2002). Quality physical education meets the needs of students, while nurturing positive attitudes towards physical activity (Chad, Humbert, & Jackson, 1999). In addition, physical educators need to consider students' maturity level, physical makeup, prior experiences, and level of motivation. As these factors can affect students' rates of learning, effective planning for the diverse range of developmental levels will help teachers overcome these barriers (Stirling & Belk, 2002).

Focus on Physical Activity

There appears to be increasing support towards the promotion of physical activity rather than physical fitness. Corbin (2002) suggests that fitness benefits will likely follow if physical educators incorporate higher levels of physical activity into their lessons. He argues that physical educators actually have less control over their students' fitness parameters than previously thought, as uncontrollable factors such as heredity and maturation play major roles. Moreover, many children become "turned off" when pushed to "get fit" (Corbin, Dale, & Pangrazi, 1999). Thus, encouraging students to do some physical activity, regardless of intensity, may appeal to a larger majority of students.

Provide Choice, Challenge, Novelty, and Enjoyment

How can physical educators motivate students to become more physically active? Enjoyable and novel activities are most attractive for students and promote physical activity participation. Teachers can refer to various print and electronic sources to obtain ideas for games that are both motivating and challenging in ways that help students develop motor and social skills (Darst, van der Mars, & Cusimano, 1998; Humphries & Ashy, 2000; Humphries, Lovdahl, & Ashy, 2002).

Currently, informal sport and leisure activities, such as mountain biking, rock climbing, and in-line skating, are gaining popularity (Thomson, 2000). Programming that incorporates such activities tends to emphasize small groups and are non-competitive—characteristics that appeal to adolescent girls, a group that has been particularly alienated in traditional physical education programming (Beveridge & Scruggs, 2000; Vail, 1999). In general, simple games that involve few people (e.g., two versus two, three versus three) maximize activity (Humphries et al., 2002).

In addition, choice is believed to be a major influence on students' commitment to physical activity (Condon & Collier, 2002). Involving students in the decision-making process can significantly increase their motivation to participate.

Teach the Purpose and Relevance of Physical Activity and Fitness Concepts

An instructional behaviour to avoid is asking students to participate in activities without first explaining their purpose or relevance. Meaningless activities are not motivating, and many students have little understanding of why they should exercise (Hopple & Graham, 1995). In the Early Years, fitness concepts can be broken down into less complex pieces of information (Ratliffe, 2002). For example, teachers can ask students to use stethoscopes to listen to their own heart while performing various activities. For the Senior Years, a concepts-based fitness approach is effective. Students take part in classroom instruction and lab experiences, complete homework and assessment tasks, participate in a variety of fitness activities, and learn how to design a personalized training plan that they can take with them when they leave the program (Strand, Scantling, & Johnson, 1998). Some evidence suggests that compared to traditional physical education programming, conceptual physical education may decrease sedentary behaviours later in life (Dale & Corbin, 2000).

The Teacher's Role in Fitness Promotion

Teachers play a vital role in promoting physical activity. It is believed that teachers with greater habitual physical activity promote fitness more than inactive teachers do (Cardinal, 2001); so it is important for teachers to be active with the class. Also, teachers need to adopt a broader view and understanding of physical activity promotion and their role within it. For example, teachers are encouraged to involve parents in promoting fitness and physical activity (National Center for Chronic Disease Prevention and Health Promotion, 1997).