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ABSTRACT

The physical fitness status of children ages 6-12 is the topic of discussion in this monograph. The publication is organized into 4 major sections and 17 chapters. The first section, "An Introduction to Childhood Fitness," includes 3 chapters: (1) Status of Physical Fitness in U.S. Children; (2) The Public Health Perspective: Implications for the Elementary Physical Education Curriculum; and (3) Understanding Children's Physical Activity Participation and Physical Fitness: The Motivation Factor. Section Two, "Fitness Education and Programming," presents the following chapters: (4) Trainability of Prepubescent Children: Current Theories and Training Considerations; (5) Fitness Activities for Children with Disabilities; (6) Weight Control and Obesity; (7) Fitness Education: A Comprehensive Multidisciplinary Approach; and (8) Family and School Partnerships in Fitness. The third section, "Fitness Assessment," includes 4 chapters: (9) Physical Fitness Assessment; (10) Motor Fitness: A Precursor to Physical Fitness; (11) Fitness Testing for Children with Disabilities; and (12) The Evaluation of Children's Growth and Its Impact upon Health-related Fitness. The final section, "Fitness Applications for the Practitioner," is composed of 5 chapters: (13) Energizing Strategies for Motivating Children toward Fitness; (14) Academic and Physical: A Model for Integration of Fitness Concepts; (15) Teaching Fitness Concepts; (16) Game Boards That Promote Participation in Fitness Activities and the Learning of Basic Fitness Concepts; and (17) A Practitioiner's Guide for Marketing Children's Fitness Programs. The document concludes with figures, tables, and an extensive bibliography. (LL)

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New Perspectives on Childhood Fitness

Marjorie L. Leppo
Editor

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HEALTHY FROM THE START:

New Perspectives on Childhood Fitness

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Introduction

Marjorie L. Leppo

For years there have been many questions and concerns pertaining to the activity level of elementary-age children and their physical fitness status. Physical educators have been particularly concerned about the short- and long-term repercussions resulting from inactive and unhealthy behavior patterns in children.

Recently, the American Heart Association (AHA) added sedentary life-style to its list of major contributors to heart disease (Snider, 1992). The AHA placed lack of exercise in the same category as smoking, high blood pressure, and high blood cholesterol. In addition, the Healthy People 2000 objectives for the nation recommend increasing (a) the number of children who participate in daily, light to moderate activity a minimum of 30 minutes per day and (b) the proportion of children engaging in vigorous physical activities that promote and maintain physical fitness (U.S. Public Health Service, 1990).

How active and physically fit are American children? Collectively and independently, how can change agents reduce cognitive, psychological, sociological, and physiological barriers, as perceived by children, to an active life-style? These questions, as well as other issues, are among the topics addressed by researchers and teachers throughout the United States within this fitness monograph on children ages 6-12.

To discuss these issues and provide the reader with current research findings required a forum that permitted a multidimensional approach. Ultimately the monograph evolved into four major sections on fitness. Part A provides several perspectives on childhood fitness. Part B examines fitness education and programming. Part C discusses fitness assessment, and Part D provides fitness applications for the practitioner.

In chapter I of the monograph, the definition of physical fitness is examined in a historical context. The authors then utilize a health-related perspective to discuss research germane to the physical fitness expectations and status for children, based on gender, secular trends, and cross-cultural comparisons of United States children with other populations. Concluding observations are also made on childhood physical fitness expectations and status based upon criterion-referenced standards. Chapter II examines the differences between health-related physical activity and physical fitness goals, and their implications for the elementary curriculum. The author provides insightful answers to the question can/should these goals coexist in the curriculum? Chapter III concludes this section with an approach to physical fitness and physical activity levels of children from a psychosocial perspective. The authors discuss the relationship of children's self-perceptions with respect to their desire to be physically active and suggest how to structure motivational environments.

Part B of the monograph presents five aspects of fitness education and programming that can occur within and outside the school. Included in this section is a discussion of current theories, guidelines, and suggested training programs for children. Two chapters, V and VI, focus on children with special needs. Chapter V addresses fitness, instructional guidelines, and activity modifications for disabled children. Chapter VI examines childhood obesity, its impact upon self-esteem and activity level, and what implications tracking clusters of risk factors have upon a child's future health status. Chapters VII and VIII answer the question how can professionals involve parents, the school, and the community in programs that support and enhance an active life-style among children? Viable school programs are discussed, which include multidisciplinary curricula involving physical educators, classroom teachers, health educators, and other school personnel, as well as projects that stimulate parent and community participation.

For nearly half a century, researchers and practitioners have reflected a polarity and diversification of opinions regarding the assessment of children. Part C presents the currently available test batteries for assessing the able-bodied and disabled child, and examines the measurement issues from several perspectives. Chapter XII explores how height and weight data might be better utilized to evaluate the physical growth and nutrition of children. Included in this section is a discussion of the possible relationship between children's competency in fundamental motor skills, their physical activity levels, and physical fitness. A new perspective is also suggested for the interpretation and assessment of motor skills.

From the inception of this monograph, the editors decided to include a section that focused on fitness applications for the practitioner. Part D suggests ways to make research applicable to the classroom/gymnasium learning environment. Motivational strategies to encourage activity and fitness levels of children are discussed along with innovative activities designed to facilitate the integration of fitness concepts using a multidisciplinary approach to learning. The final chapter of the monograph suggests ways to market quality physical education and fitness programs to the public sector.

Together the researchers and teachers who have contributed to this monograph, representing different areas of specialization, have created a contemporary and holistic view of childhood fitness in ages 6-12.

An Introduction to Childhood Fitness

I

Status of Physical Fitness in U.S. Children

Harold B. Falls
Russell R. Pate

Historical Perspective and the Definition of Physical Fitness

A national interest in childhood fitness has existed in various degrees for at least 80 years. The National Playground and Recreation Association of America devised a test of athletic ability in 1913. About the same time, several larger cities (e.g., Detroit, Los Angeles, Philadelphia) and at least one state, California, developed their own, similar tests (Clarke & Clarke, 1987). A major federal government interest appeared in the 1950s after Kraus and Hirschland (1954) published their now well-known and widely cited paper in which they concluded that U.S. children and youth were less fit than their counterparts in Europe. This led to the first President's Conference on the Fitness of American Youth in 1956 (American Association for Health, Physical Education and Recreation [AAHPER][1], 1965). AAHPER responded by developing a youth fitness test and establishing national norms in 1957. The manual to accompany the test was published in 1958 (AAHPER, 1965). AAHPER stated, "The results of the first testing in 1957 showed that the young people of this country were not as physically fit and vigorous as they should be" (AAHPER, 1965, p. 5). However, no standards for comparison or other basis on which to make the statement were presented.

Another outgrowth of the 1956 President's Conference was the establishment of the President's Council on Youth Fitness (PCPFS)[2] (AAHPER, 1965). The PCPFS provided government support and promotion for the AAHPER Youth Fitness Test and its various revisions until 1987 when it published its own President's Challenge, a revised version of the original AAHPER Youth Fitness Test (PCPFS, 1987b). A major characteristic of the Youth Fitness Test was that it was always heavily oriented toward the testing of qualities that are generally considered to be determinants of athletic ability (AAHPER, 1965; Hunsicker & Reiff, 1976; Pate, 1983). Concern regarding that emphasis began to surface in the early to mid-1970s. This concern was based on the belief by many professionals that the health needs of children were being overshadowed by the athletic ability emphasis in youth fitness testing (Pate, 1983). In response, several committees and an AAHPERD task force studied the issue (Plowman & Falls, 1978). The work of these groups culminated in publication of the AAHPERD Health-Related Physical Fitness Test (Falls, 1980; AAHPERD, 1980a; Blair, Falls, & Pate, 1983).

Between 1980 and 1987 the AAHPERD Youth Fitness and Health-Related Physical Fitness Tests more-or-less coexisted and competed with each other. These two tests were essentially the "only game in town." However, the pendulum was definitely swinging toward the side of a health-related emphasis in fitness programs for children. A revised, health-oriented FITNESSGRAM was published (Institute for Aerobics Research[3], 1987), the American Health and Fitness Foundation (AHFF, 1986) published a health-related test, and an extensive fitness testing and survey program emphasizing health aspects was undertaken in Canada (Canada Fitness Survey, 1983). AAHPERD finally followed suit and published a test to replace both the Youth Fitness and Health-Related Physical Fitness Tests (AAHPERD, 1988). This test is part of a program called Physical Best and is identical in many respects with the 1987 revision of the FITNESSGRAM. Even the new PCPFS testing program had a health-related aspect to it by including items for flexibility and cardiorespiratory endurance (PCPFS, 1987b). However, any real relationship to health aspects of fitness were lost due to the requirement that children must score at unreasonably high levels on the test items in order to be considered "physically fit" (i. e., in order to win the PCPFS awards). These score requirements are far beyond anything that would be required for health relationships, or for that matter, any sort of normal functional capacity. In addition, the PCPFS's President's Challenge did not include an item for body composition. Of all the fitness testing programs currently in wide use in North America, the President's Challenge is the only one that does not include a body composition item (Pate & Shephard, 1989). The PCPFS's President's Challenge will apparently be short-lived as a separate physical fitness program. A recent announcement indicates it will soon be merged with AAHPERD's Physical Best and cease to exist as a separate entity (Morris & Schwarzenegger, 1992).

The shift in emphasis in children's physical fitness tests from athletic ability to assessment of health-related traits is one of the most significant developments in the history of U.S. physical education. Equally significant, however, in the late 1980s and early 1990s has been the emerging importance of physical fitness testing of children as an issue of appropriate concern in public health (Caspersen, Powell, & Christenson, 1985; Simons-Morton, Parcel, O'Hara, Blair, & Pate, 1988; Simons-Morton, O'Hara, Simons-Morton, & Parcel, 1987; Sallis & McKenzie, 1991). Improved status of children's levels of physical fitness are now among the important public health goals of the nation (U. S. Department of Health & Human Services, 1991; McGinnis, 1992).

Also among the more important current developments in children's physical fitness testing are the apparent merging of the President's Challenge and Physical Best into a single program (Morris & Schwarzenegger, 1992) and recent publication of the revised Prudential FITNESSGRAM (Cooper Institute for Aerobics Research, 1992), which includes revised and updated test items and enhanced criterion-referenced standards—all based on the best currently available empirical data.

This brief historical sketch highlights one of the major problems inherent in reviewing the available research on physical fitness status: establishing a definition for physical fitness that can provide a framework within which to fit the review (Gutin, Manos, & Strong, 1992). Physical fitness has been a very global term (Falls et al., 1965; Clarke, 1975; Clarke & Clarke, 1987; Pate, 1983; Pate & Shephard, 1989). However, during recent years, it appears that fitness experts have slowly reached a consensus that an adequate definition of physical fitness in children should meet certain criteria, which include (a) conveying a concept of physical fitness that is applicable and relevant to the vast majority of children; (b) conveying concepts that are consistent with the current body of knowledge in the exercise sciences; and (c) conveying concepts that are based on the scientifically established relationships among physical activity, functional capacities, and health. Furthermore, the definition should employ language that is clear and specific enough to facilitate operationalization of the definition (Pate & Shephard, 1989). Based on the above criteria, Pate and Shephard (1989) have articulated the following operational definition of physical fitness: (a) an ability to perform daily activities with vigor, and (b) traits and capacities that are associated with low risk of premature development of the diseases of physical inactivity. Pate (1983) has presented a rationale for the definition. This definition has gained broad acceptance over the past decade to the extent that two major criteria are generally applied in selecting components to be included in physical fitness testing and/or developmental programs. These are first, that the component should be related to day-to-day functional capacity, health promotion, and/or disease prevention to the extent that it is documented by convincing scientific evidence; and second, epidemiological and/or experimental studies should demonstrate that status on the component is better in more physically active children or that exercise training improves status on the component (Pate & Shephard, 1989). Broad acceptance and application of these criteria are readily apparent by perusal of components included in current national testing programs (Institute for Aerobics Research, 1987; Cooper Institute, 1992; AAHPERD, 1988; AHFF, 1986; Canada Fitness Survey, 1983) and in opinion statements on childhood fitness issued by professional groups (American Academy of Pediatrics, 1987; American College of Sports Medicine, 1988a). Also, health-related aspects of children's physical fitness have begun to receive emphasis from a public health perspective (Corbin & Pangrazi, 1992; Simons-Morton et al., 1987; Sallis & McKenzie, 1991; Simons-Morton, Parcel, O'Hara, Blair, et al., 1988; McGinnis, 1992). Thus, we have chosen to review the status of physical fitness in children 6-12 years of age utilizing a health-related frame of reference.

Physical Fitness Expectations and Status for Children Ages 6-12

Expectations and Status Based on Gender

Males and females obviously differ anatomically in many respects at all ages. Also, in youth (13-18 years) and adulthood, males achieve greater stature and weight (Hamill, Johnson, Reed, & Roche, 1977; Abraham, Johnson, & Najjar, 1979). However, the picture is different in childhood. Pate and Shephard (1989) have plotted height and weight versus age for boys and girls from data obtained in the two National Children and Youth Fitness Studies (NCYFS) (Ross & Gilbert, 1985; Ross & Pate, 1987).[4] Figures 1a & b show clearly that values for both height and weight are virtually identical for boys and girls within the age range covered by this monograph. Furthermore, comparison with National Health Examination Survey (NHES) and Health and Nutrition Examination Surveys (HANES) data from 1963-1965 and 1971-1974 shows there has been a secular consistency over at least two decades (Hamill et al., 1977). The finding of no gender differences in height and weight in the age range 6-12 years in U.S. children is consistent with similar data obtained from Australian, Canadian, and European populations (Ross, Drinkwater, Whittingham, & Faulkner, 1980; Pyke, 1986; Canada Fitness Survey, 1983). In fact, these similarities among populations led Ross et al. (1980) to propose an anthropometric prototype for use as a reasonable substitute for control samples in situations where adequate comprehensive survey data are not available. These identical values for height and body weight in 6-12-year-old boys and girls thus eliminates the possibility of explaining physical fitness test score differences between genders on variations in stature and weight, even though research has shown that variability in both these parameters may account for many of the differences noted on items of the nature often included within physical fitness test batteries (Astrand & Rodahl, 1986; Bar-Or, 1983). The surveys cited above demonstrate that any gender differences observed in mean scores on physical fitness test items would likely be due to factors other than differences in body weight and stature.

Figure 1a
Mean Height of U.S. Boys and Girls

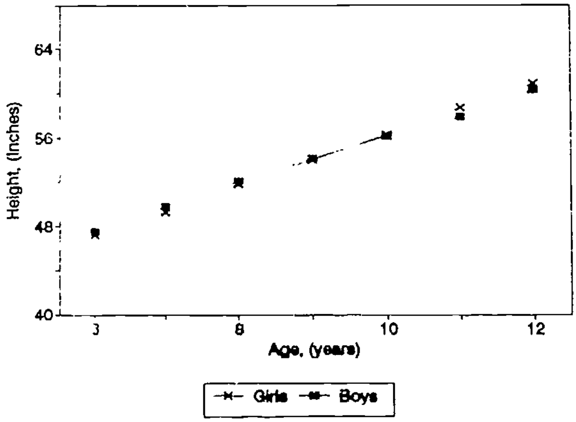
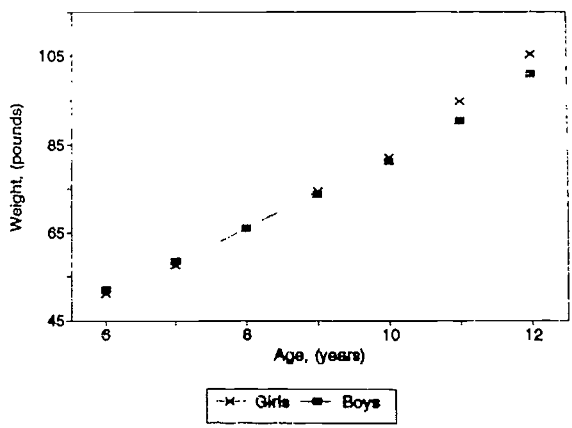


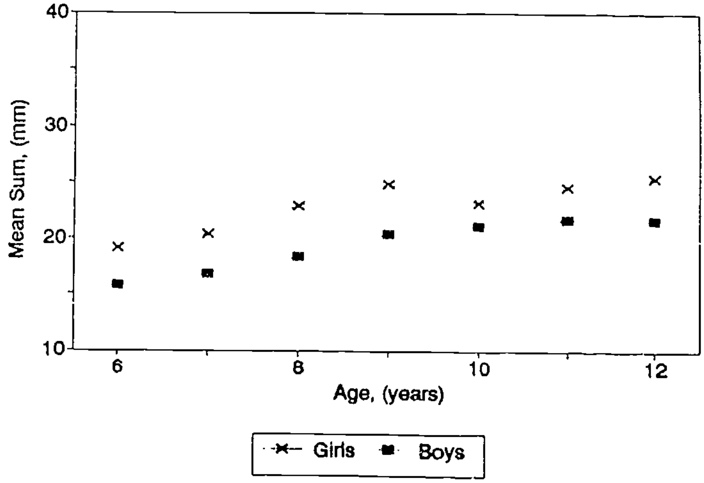
Figure 1b
Mean Weight of U.S. Boys and Girls



Adapted from Pate & Shephard (1989). Data from Ross & Gilbert (1985) and Ross & Pate (1987).

There is evidence that some gender differences do exist in body composition within the age range 6-12. Figure 2, constructed from the NCYFS I and II data, shows an approximately 4mm greater sum of triceps and subscapular skinfolds in girls compared with boys at each age. The skinfold differences shown in Figure 2 contribute to an estimated approximate 2% greater total body fat at age 10 (Forbes, 1987). Since mean total body weights (Pate & Shephard, 1989; Hamill et al., 1977) and weights for height (Hamill et al., 1977) are virtually identical for the two sexes ages 6-12, one may be led to conclude that lean body mass must be less in the girls. Cross-sectional and longitudinal growth studies, however, do not provide conclusive support. Analyses based on the HANES data show nearly identical gender values for arm muscle and bone cross-sectional area, metacarpal bone cross-sectional area, and the lean body mass to height ratio (Forbes, 1987). Similar results have been reviewed by Malina (1986). Forbes (1987) has concluded that there is a sex difference in lean body mass throughout childhood but that it is of small magnitude. Analysis of fat-free body mass (FFBM) based on the HANES data show it to average 1.3 kg higher for boys between ages 6-10 (Fomon, Haschke, Ziegler, & Nelson, 1982). However, the protein content difference was only 0.7%, which is only 4% of the total protein of the FFBM.

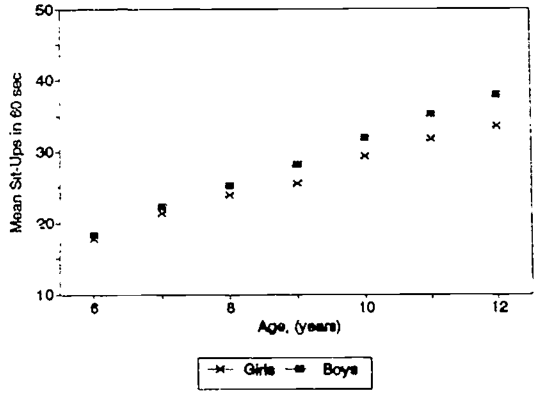
Figure 2
Mean Sum of Triceps and Subscapular Skinfold Thicknesses for U.S. Boys and Girls



Adapted from Pate & Shephard (1989). Data from Ross & Gilbert (1985) and Ross & Pate (1987).

Other studies indicate that if lean body mass differences do indeed exist they are likely confined to the upper extremities rather than being generalizable to all parts of the body (Malina, 1986; Tanner, Hughes, & Whitehouse, 1981). The small gender differences in body composition that have been identified in children ages 6-10 seem unlikely to play a significant role in determining variances in performance on physical fitness test items that are typically administered to that population.

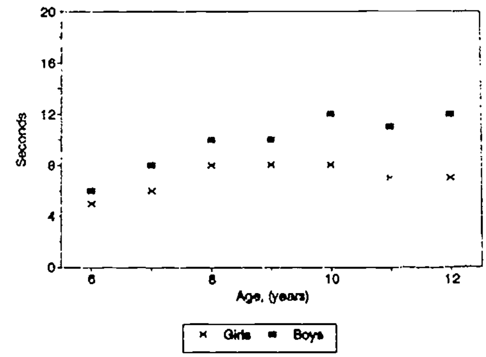
Figure 3
Mean Sit-up Performance of U.S. Boys and Girls



Adapted from Pate & Shephard (1989). Data from Ross & Gilbert (1985) and Ross & Pate (1987).

Performance differences based on gender are, however, noted on items that have a strength or muscular endurance component. Figures 3 (sit-ups) and 4 (flexed-arm-hang) present data in graph form from the NCYFS I & II and National School Population Fitness Survey (NSPFS) (Reiff et al., 1986) respectively. Performances of boys and girls are very similar and not noticeably different until possibly 11-12 years of age. Taking the approach that we should expect no significant gender differences on muscular strength and endurance items for ages 6-10 is well supported by the data in Figures 3 and 4 and by the growth studies cited earlier. Providing a scientific explanation for the apparent differences at ages 11-12 must await further research. It is very plausible that the differences may be entirely due to differences in habitual physical activity. For example, one recent report indicated that, based on national survey data, twice the proportion of females (12%) as males (6%) ages 10-16 years should be considered sedentary enough so as not to attain health benefits from their activity (Freedson & Rowland, 1992). Shephard (1982) has reviewed evidence that when females 6-12 participate in physical activity to the same extent as males most of the differences noted in muscular strength and power performance disappear. Other studies have been interpreted as showing that children are adapted to a lower degree of strength utilization in daily life and are therefore more sensitive to strength training (Bailey, Malina, & Mirwald, 1986). If this is true, it should require only a moderate intensity and duration of training to yield significant gains in strength. It has been further noted that girls appear to be even more adapted to low levels of activity than boys, but that when girls are given the opportunity for participation, gender differences in activity patterns tend to disappear (Gilliam & MacConnie, 1984).

Figure 4
Flexed-Arm-Hang Scores for U.S. Children
(50th Percentile)



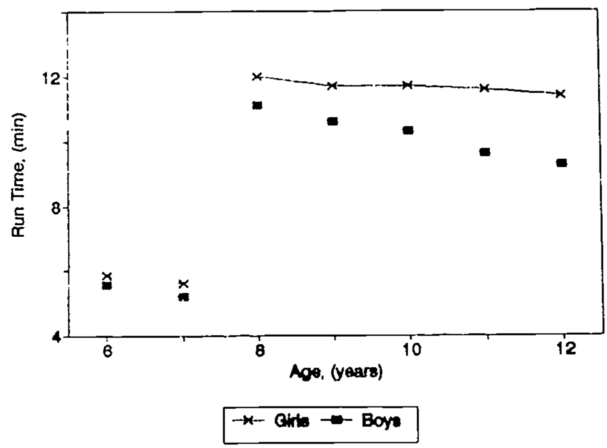
Adapted from Pate & Shephard (1989). Based on data from Reiff et al. (1986).

The point of this part of the discussion is to advise a note of caution regarding interpretations of expectations about gender differences in physical fitness test scores in children ages 6-12. Differences may be expected—at least by ages 10-12. However, those differences may be small and could easily be due to habitual level of physical activity rather than true gender-related factors. A precise analysis of factors that contribute to gender differences in physical fitness test scores must await the availability of research that equates boys and girls according to their levels of habitual physical activity. Also, studies comparing boys and girls in the age range 10-12 years should include a determination of the time of onset of puberty. It has been noted that boys tend to increase their performance on physical fitness tests upon reaching puberty whereas girls tend to level off (Shephard, 1982; Pate & Shephard, 1989; Marshall & Tanner, 1986). The pubertal growth spurt begins at about 10.5 years of age in girls versus 12.5 in boys (Marshall & Tanner, 1986). The gender differences observed at ages 10-12 in muscular strength and endurance could thus be very well explained by the fact that a significantly greater proportion of the female population had reached puberty.

Figure 5 presents age- and gender-related performance on the 1/2 mile and mile run/walk tests (NCYFS I & II). An improvement with age and a definite sex difference in favor of the boys are easily discernible. Similar results were obtained from the National School Population Fitness Survey (Reiff et al., 1986). Even though performance on the distance runs improves with age, Pate and Shephard (1989) have cautioned against interpreting that improvement to coincide with age improvements in weight-relative maximal oxygen uptake, or VO_2 max ($ml \cdot kg^{-1} \cdot min^{-1}$). They have presented evidence that weight-relative VO_2 max is roughly equal across age groups of children and that improvements in running performance with age are probably a function of increased economy of running, other developmental changes, and improved choice of pace. Further, it is likely that most of the observed sex differences are accounted for by differences in body composition, hemoglobin concentration, and habitual physical activity (Pate & Shephard, 1989). When maximal oxygen uptake is plotted against measures of lean body mass, the regression line is practically identical for both sexes (Bar-Or, 1983). This suggests that in order to get a more valid estimate of VO_2 max, run/walk test scores should be corrected for body composition as in the revised Prudential FITNESSGRAM (Cooper Institute, 1992).

In the age range 6-12 years, gender differences similar to those in Figure 5 are to be expected when a run/walk is used to estimate cardiorespiratory endurance. However, differences should be smaller when corrections are made for body composition. Gender differences in run/walk performance that remain after correcting for body composition are in all probability due to differences in habitual physical activity, especially if the activity includes running.

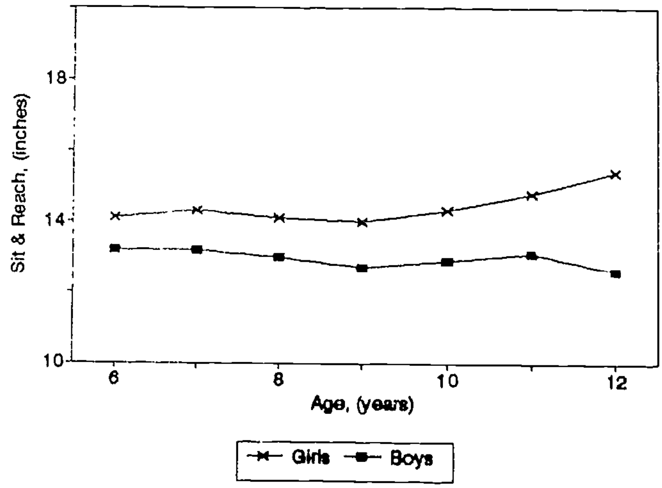
Figure 5
Mean 1/2 Mile and Mile Run Performance for U.S. Children



Adapted from Pate & Shephard (1989). Data from Ross & Gilbert (1985) and Ross & Pate (1987).

Figure 6 presents data on sit & reach test performance from the NCYFS (Pate & Shephard, 1989). The test scores are fairly consistent from age to age in both sexes through age 10. After age 10, there is a gradual improvement in scores for girls, which continues through age 16 (age 13-16 not shown in figure). There is also a gradual improvement in boys; it does not begin until age 14. Because of the ages at which the improvement begins, it is attractive to speculate that the improvements are somehow related to the attainment of sexual maturity. There is apparently no research directed toward the question.

Figure 6
Mean Sit & Reach Performance of U.S. Children



Adapted from Pate & Shephard (1989). Data from Ross & Gilbert (1985) and Ross & Pate (1987).

Figure 6 also shows a sex difference in sit & reach scores. In contrast to the results obtained on other fitness test components, this one favors the girls. These differences are again quite small, averaging about 1 inch in the age range 6-12 years, and there is no research available that might provide an explanation for them. Moreover, mean scores for both boys and girls are well beyond the generally accepted criterion-referenced standards for flexibility (Institute for Aerobics Research, 1987; Cooper Instititue, 1992; AAHPERD, 1988).

Results very similar to those shown in Figure 6 were obtained by Reiff et al., (1986) in the National School Population Fitness Survey using a somewhat different form of sit & reach test.

Expectations and Status Based on Secular Trends

The status of physical fitness in children has received a great deal of national attention for a period of at least 35 years. In particular, it has been implied, and explicitly stated, that there has been a serious decline in the physical fitness of children. For example, a spokesperson for the President's Council on Physical Fitness and Sports was recently quoted as stating that based on a variety of tests, fitness levels of young people have been on a steady decline over the past 20 years (Kim, 1991). Similar pronouncements have been made by others (Reiff et al., 1986; Hayes, 1984; Alliance launches, 1988). Such statements are, at best, misleading and apparently based only on opinion fraught with emotionalism because research data to support them are unavailable (Baranowski et al., 1992). First of all, in the age range 6-9 years, national normative data on any physical fitness component was unavailable until the AAHPERD Health-Related Physical Fitness Test (AAHPERD, 1980a), the National School Population Fitness Survey (Reiff et al., 1986), and the National Children and Youth Fitness Study II (Ross & Pate, 1987) were published in the 1980s. Therefore, conclusions regarding secular changes in the physical fitness status of children 6-9 years of age cannot be made utilizing any adequate data base prior to 1980 for the comparisons. Furthermore, even though there is data available to study secular trends in athletics-related physical fitness for ages 10-12 years, much of the national normative data on health-related physical fitness components in this age range have only become available in the 1980s (Baranowski et al., 1992). One aspect of the National School Population Fitness Survey (Reiff et al., 1986) was a comparison of data obtained in 1985 with that from previous surveys (1957, 1965, 1975). This was only possible with children 10 years of age or older since younger children were not included in the earlier surveys. Further, only five test items—shuttle run, standing long jump, 50-yard dash, pull-ups (boys only), and flexed-arm-hang (girls only)—were common across the surveys.

The data summaries show significant improvements in test scores between 1957 and 1965 for both boys and girls and no significant general changes indicated in the 1975 data—the results being almost identical with the 1965 data. The only significant differences obtained between 1985 and 1975 data were somewhat slower 50-yard dash times for the girls ages 10-11. Fifty-yard dash times for the 12-year-old girls, 1985 versus 1975, were identical (Reiff et al., 1986).

Similar interpretations of the four survey results were made by Pate and Shephard (1989) and Corbin and Pangrazi (1992). In addition, they concluded that the improvements in fitness test scores between 1957 and 1965 could be due, at least in part, to greater familiarity of children with the test battery. In any event, test score comparisons among the 1965, 1975, and 1985 surveys, sponsored by the PCPFS, do not support the pronouncements from that organization and other groups and individuals that there has been a trend of decreasing physical fitness in children over the time period covered by the surveys. In fact, it can be easily argued based on data from the 1957, 1965, 1975, and 1985 youth fitness surveys that children's physical fitness has improved in the approximately 30 years covered (Corbin & Pangrazi, 1992).

As noted above, data on most health-related physical fitness test items collected from national probability samples did not become available until the mid-1980s (Pate & Ross, 1987; Ross & Gilbert, 1985; Baranowski et al., 1992). However, skinfold data were available from NHES (1963-1970) and the HANES (1971-1974 and 1976-1980) respectively. Gortmaker, Dietz, Sobol, and Wehler (1987) compared skinfold data collected from the 1960s with that from the 1970s in NHES and HANES. They defined obesity as being above the 85th percentile for triceps skinfold determined in the earlier survey. They estimated that obesity had increased from 17.6% of the 6-11-year-old population in 1963-1965 to 27.1% in 1976-1980. Gortmaker et al. (1987) were careful, however, to point out that although the changes in estimated obesity are substantial, it still only affects a minority of the population. Except for females age 12, 20% or less of children ages 6-12 would be classified as obese using current scientifically based criteria. That obesity only affects a minority of children is substantiated by the results presented in Table 1 from Lohman (1992).

Lohman and colleagues (Lohman, 1992) compared the NHES skinfold data from the 1960s with the NCYFS skinfold data from the mid-1980s. Using a criterion for obesity of 25% fat in males and 32% fat in females, they reported the increase in prevalence of obesity shown in Table 1. It is easily noted from Table 1 that the problem is apparently more serious in the female population. Whereas, the proportion of increase in estimated obesity from the 1960s to the 1980s is roughly the same in the two sexes, a greater percentage of the female population is classified as obese. One encouraging aspect of Lohman's analysis is that the increase in obesity within the age range 13-16 years is apparently much less than that shown here for ages 6-12. Further, the data comparisons show no increase at all for either sex at age 16, the oldest age included in the analysis (Lohman, 1992).

Table 1
Prevalence of Childhood Obesity (Estimated % of Population) Over 2 Decades Based on 25% Fat for Males and 32% Fat for Females

Age	Males		Females	
	NHES	NCYFS	NHES	NCYFS
6	2	6	5	9
8	5	12	10	20
10	10	16	17	20
12	13	19	20	25

Adapted from Lohman (1992).

Both Gortmaker et al. (1987) and Pate and Ross (1987) have presented evidence that the apparent increase in skinfold thickness measures in the 6-12-year-old population may be related to a decrease in habitual physical activity and that there may be a causal relationship with an increase in television viewing. Pate and Shephard (1989) have indicated that if reduced physical activity is an underlying cause of the reported increase in fatness in children, it's possible that today's children may be lower in other aspects of physical fitness than their predecessors. However, data that would allow a direct examination of this possibility are not currently available.

Expectations and Status Based on Cross-cultural Comparisons of U.S. Children with Other Populations

One approach to defining the physical fitness status of U.S. children is to compare their results on physical fitness test items with those of age-matched counterparts from other countries. Shephard (1982) has described this as resulting in a more realistic appraisal of national fitness than what has been presented following the youth fitness surveys of 1957, 1965, 1975, and 1985. The usual approach has been to make pronouncements about a current sorry state and the decline of physical fitness in children when, in fact, data to support the statements have been lacking. The most representative and carefully collected population survey data currently available on U.S. children appears to be that presented by Ross and Gilbert (1985) and Ross and Pate (1987). The data presented by Reiff et al. (1986) is also representative but probably exhibits more variability in methodology.

Recently, similar population survey data have become available from other countries. Even with its availability, direct, meaningful comparisons are difficult. There is no consistency from one survey to another in test items used. And even where the same items are used, there are often differences in methodology, e. g., flexed-arm-hang may be done with a forward hand grip in one study and a reverse grip in another. Nonetheless, the data available do allow a focusing of at least part of the picture in regard to physical fitness status of U.S. children in comparison with children from other countries. Figures 7-11 present comparisons from several surveys for U.S. children (Ross & Gilbert, 1985; Ross & Pate, 1987; Reiff et al., 1986; Updyke & Willett, 1989); for Flemish girls (Simons et al., 1990); for British children (Tanner & Whitehouse, 1975); for Canadian children (Canada Fitness Survey, 1983; Manitoba Department of Education, 1978); and for Australian children (Pyke, 1986). Close observation of the figures reveals that the position of the U.S. children compared with those in other countries is variable—in some cases, the U.S. children do better, and in others they do worse. *There is no consistent pattern wherein U.S. children do worse than most children in other developed countries.*

Figure 7a
Distance Run Comparisons: Distance Run vs. Age—Boys

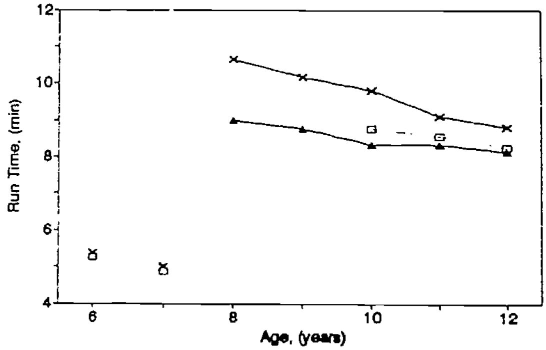
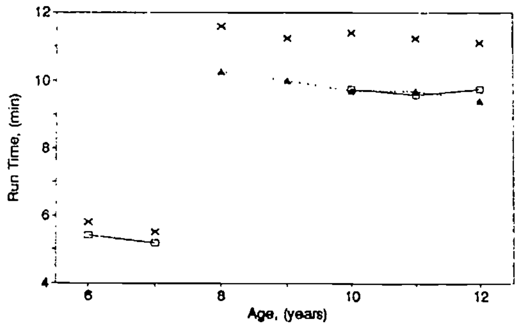


Figure 7b
Distance Run Comparisons: Distance Run vs. Age—Girls



Adapted from data in Ross & Gilbert (1985), Ross & Pate (1987), Manitoba Department of Education (1978), Pyke (1986). Scores for ages 6-7 are 800 meters; for ages 9-12 are 1600 meters. 50th percentile. It should be noted in boys that the major differences appear to be at ages 8-10. At the younger and older ages, differences are much less.

The most noticeable differences favoring children from other countries are in the distance run scores (Figures 7a & b). We know of no adequate explanation for the superior performances of the Australian and Canadian children on the 1600-meter run. They are quite possibly due to differences in state of training, level of motivation, and familiarity with the test procedure. Sixteen-hundred-meter run performance is an indirect measure of maximal oxygen uptake. Shephard (1978) has reviewed the world literature on maximal oxygen uptake in children and has stated the dominant impression in the more developed countries is one of uniformity of data. A similar conclusion was reached by Krahenbuhl, Skinner, and Kohrt (1985). Therefore, one would not expect the differences noted here on an indirect measure of VO_2max.

Figure 8a
Sit & Reach Comparisons: Sit & Reach vs. Age—Boys

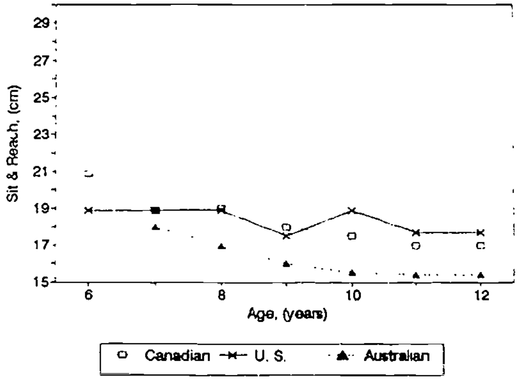
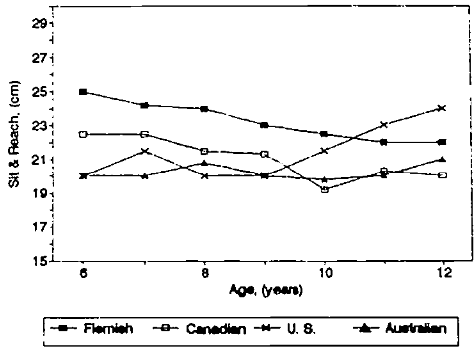


Figure 8b
Sit & Reach Comparisons: Sit & Reach vs. Age—Girls



Adapted from data in Ross & Gilbert (1985), Ross & Pate (1987), Pyke (1986), Manitoba Department of Education (1978), Canada Fitness Survey (1983), Simons et al. (1990). All scores adjusted to 15 cm as level with the soles of the feet. 50th percentile.

For s.. & reach performance (Figures 8a & b), the U.S. children appear to do at least as well or better than children in other countries. Flemish girls appear to do better at the younger ages. However, the U.S. girls have caught up and surpassed the Flemish performance by age 11. For triceps skinfold (Figures 9a & b), British and Flemish children exhibit slightly less thickness.

These differences are small (1-2 mm) and probably within sampling variability. However, they are consistent across most ages and possibly do represent a greater relative fatness in North American children.

Figure 9a
Triceps Skinfold Comparisons: Triceps Skinfold vs. Age—Boys

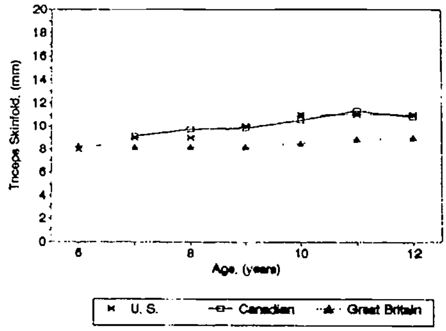
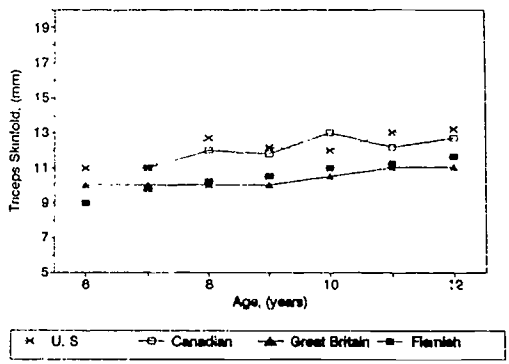


Figure 9b
Triceps Skinfold Comparisons: Triceps Skinfold vs. Age—Girls



Adapted from data in Ross & Gilbert (1985), Ross & Pate (1987), Simons et al. (1990), Tanner & Whitehouse (1975), Canada Fitness Survey (1983). 50th percentile.

In the comparisons on sit-ups (Figures 10a & b) data from two U.S. surveys are shown. U.S. 1 is from the NCYFS studies (Ross & Gilbert, 1985; Ross & Pate, 1987) and U.S. 2 is from the NSPFS survey (Reiff et al., 1986). Performance for ages 6-9 is somewhat better for the NSPFS data. However, for all ages, at least one of the two U.S. surveys yielded results quite close to those for the other countries. It should be noted that in the Belgian and Canadian surveys, the hands were held behind the neck during the sit-up—a position that makes the test somewhat less difficult to execute. The apparent differences for the two U.S. surveys highlight the possible misinterpretations that may be made when survey data are compared between countries.

Figure 10a
Sit-up Comparisons: Sit-ups vs. Age—Boys

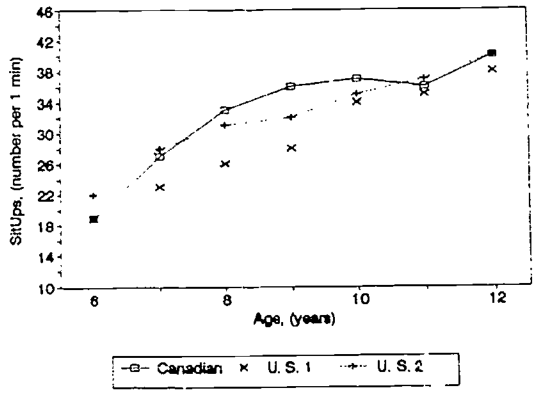
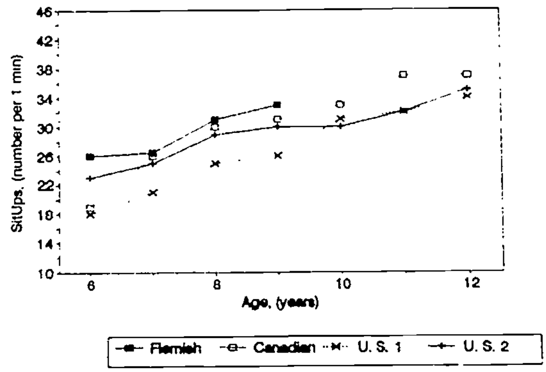


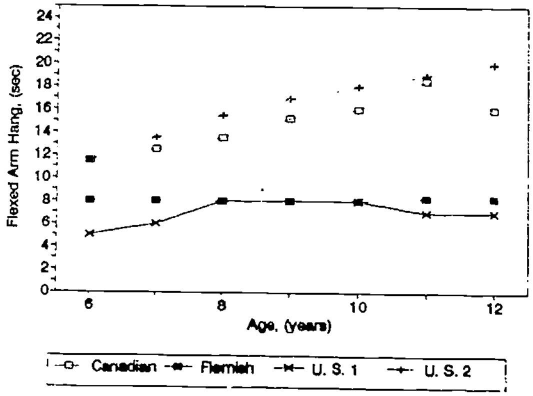
Figure 10b
Sit-up Comparisons: Sit-ups vs. Age—Girls



Adapted from data in Ross & Gilbert (1985), Ross & Pate (1987), Reiff et al. (1986), Simons et al. (1990), Manitoba Department of Education (1978), Canada Fitness Survey (1983). 50th percentile.

In the flexed-arm-hang comparisons (Figure 11), U.S. 1 is from the NSPFS survey (Reiff et al., 1986). Test procedures included a forward hand grip. Simons et al. (1990) also utilized a forward grip for Flemish girls. Therefore, these two curves are more or less directly comparable. The results from the Canadian survey (Manitoba Department of Education, 1978) were obtained utilizing a reverse hand grip (palms facing the body). U.S. 2 data are from the Chrysler Fund—AAU program (Updyke & Willett, 1989) wherein a reverse grip is also utilized. The results shown in Figure 11 indicate that U.S. girls perform as well, or better, on flexed-arm-hang when compared with girls from other countries.

Figure 11
Flexed-Arm-Hang Comparisons



Adapted from data in Reiff et al. (1986), Simons et al. (1990), Updyke and Willett (1989), Manitoba Department of Education (1978). 50th percentile.

Expectations and Status Based on Passing Rates for Criterion-referenced Standards (CRS)

Historically, normative standards such as percentile scores have been used in the interpretation of physical fitness test scores obtained on children. A recent development, however, has been the establishment of CRS for health-related physical fitness (HRPF) tests based on the rationale that the CRS could represent the minimal level of an attribute or function that is consistent with good health (defined as minimizing disease risk) and the ability to carry out daily tasks (Cureton & Warren, 1990). The CRS, in essence, provide an operational answer to the often asked question, "Fit for what?" The first physical fitness test to provide CRS was the South Carolina Physical Fitness Test, developed in 1978. The Health-Related Physical Fitness Test of AAHPERD in 1980 provided screening recommendations similar to CRS, and the new Physical Best program published by AAHPERD in 1988 provided complete CRS. Other recent tests having CRS are the Fit Youth Today Program (AHFF, 1986) and the Prudential FITNESSGRAM (Institute for Aerobics Research, 1987; Cooper Institute, 1992; Cureton & Warren, 1990). The revised Prudential FITNESSGRAM (Cooper Institute, 1992) goes a step further in presenting two levels of CRS based on relative health risk.

At least four studies have compared children's HRPF test results with the available CRS (Cureton & Warren, 1990; Looney & Plowman, 1990; Blair, Clark, Cureton, & Powell, 1989; Corbin & Pangrazi, 1992). Results from these studies indicate that U.S. children are not lacking in physical fitness when it is considered in a context of health and daily functional capacity. Cureton and Warren (1990) determined that, depending on age, 65-75% of boys in the age range 6-12 could meet the FITNESSGRAM CRS on mile run/walk. For girls in the same age range, the percentages meeting the CRS were 60-80. These comparisons were made with percentile scores published in AAHPERD (1980), Ross and Gilbert (1985), Ross and Pate (1987), and Reiff et al. (1986). Additionally, Simons-Morton et al. (1987) reviewed the cardiorespiratory fitness status of U.S. children and youth. They concluded that children are the fittest age segment of our society and that they score well above criteria of desirable cardiorespiratory fitness generally established for adults.

Utilizing the data from NCYFS I & II, Looney and Plowman (1990) conducted a more extensive study of the passing rates on the FITNESSGRAM CRS. The percentage meeting the CRS for each sex and age for each item in the test are shown in Table 2.

Table 2
Percentage of NCYFS I & II Subjects Achieving FITNESSGRAM Standards

Age	Sex	Mile Run	% Fat	BMI[a]	Sit&Reach	Sit-ups	Pull-ups
6	M		96	95	96	42	
	F		95	93	97	43	
7	M		92	93	93	66	
	F		93	90	98	62	
8	M	84	87	88	89	56	
	F	85	89	85	95	51	
9	M	81	82	83	87	68	
	F	80	85	80	95	58	
10	M	76	87	82	92	74	64
	F	62	93	85	95	62	34
11	M	80	84	82	90	75	68
	F	64	89	74	96	63	33
12	M	71	83	83	85	65	73
	F	69	90	79	97	70	32

Adapted from Looney & Plowman (1990).
[a]Body Mass Index

Blair, Clark et al. (1989) reported analyses on the application of the FITNESSGRAM CRS to a population of 23,811 children ages 6-12 who were tested during the 1987-1988 school year. This was an opportunistic sample of students from the U.S. population in schools that elected to participate in FITNESSGRAM and use the Cooper Institute for Aerobics Research service bureau method of producing FITNESSGRAMS (Weber, Kohl, Meredith, & Blair, 1986). Blair, Clark et al. (1989) present evidence that this sample was an adequate representation of the U.S. school population. Table 3 is similar to Table 2 in that it shows the percentage meeting the CRS for each sex and age for each item in FITNESSGRAM. Similar results to those of Cureton and Warren (1990), Looney and Plowman (1990), and Blair, Clark et al. (1989) have recently been presented by Corbin and Pangrazi (1992), based on the National School Population Fitness Survey data base.

Assuming that the CRS have some validity—and there is evidence that they do (Cureton & Warren, 1990; Looney & Plowman, 1990)—the results from Cureton and Warren (1990), Looney and Plowman (1990), Blair, Clark et al. (1989), and Corbin and Pangrazi (1992) suggest that most U.S. children exhibit acceptable levels of physical fitness. The only item where there is even a hint of poor performance is on upper-body strength. However, even though the percentages are lower on upper-body strength, roughly 40-70% of all students meet the standards.

Table 3
Percentage of Students Achieving FITNESSGRAM Standards
FITNESSGRAM Project, 1987-1988

Age	Sex	N	Mile Run	Body Comp[a]	Sit&Reach	Sit-ups	Upper Body[b]
6	M	1,031	76	97	98	64	53
	F	1,088	84	96	93	63	49
7	M	1,394	76	93	98	77	60
	F	1,381	86	92	93	80	57
8	M	1,516	77	90	98	73	54
	F	1,379	76	90	91	72	44
9	M	1,561	77	86	96	82	57
	F	1,517	72	83	88	76	45
10	M	1,997	70	81	98	76	57
	F	2,018	63	83	84	64	46
11	M	2,191	73	75	96	77	56
	F	2,050	68	77	85	67	46
12	M	2,416	70	78	96	67	64
	F	2,272	73	83	90	72	45

Adapted from Blair, Clark et al. (1989).

[a]Either skinfolds or body mass index
[b]Either pull-ups or flexed-arm-hang

Concluding Remarks

We have surveyed available literature on the definition of physical fitness in children and considered physical fitness status and expectations using a health-related perspective. Based on this survey, it can be reasonably concluded that:

- Most gender differences in physical fitness are not present until about 10 years of age. The most apparent are in body composition, upper-body strength, and performance on cardiorespiratory endurance items where girls score lower and on sit & reach where they score higher. Performance on strength and cardiorespiratory items are related to the body composition differences. The physical fitness significance of the gender differences is unknown but probably slight since the only noticeable gender difference in the percentages achieving CRS is on the upper-body strength item (Tables 2 and 3).
- There is very little available data on which to base conclusions regarding secular trends in physical fitness. On physical fitness items where data are available, there have been no significant trends over the past 25-30 years, except for one toward perhaps slightly more subcutaneous fat. Cross-cultural comparisons based on population survey data reveal that U.S. children compare favorably on most items with age-matched groups in Europe, Great Britain, Australia, and Canada.
- A relatively high percentage of U.S. children achieve criterion-referenced standards on health-related physical fitness tests.

Endnotes

[1]The current title of the organization is American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD).

[2]The current title is President's Council on Physical Fitness and Sports (PCPFS).

[3]The Institute for Aerobics Research is associated with the Cooper Clinic in Dallas, Texas. Its name was changed to Cooper Institute for Aerobics Research (CIAR) in November 1991.

[4]NCYFS I (Ross & Gilbert, 1985) was a national survey of physical fitness in children and youth, 10-18 years of age. NCYFS II (Ross & Pate, 1987) was an analogous study covering children ages 6-9.

Author Notes

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II

The Public Health Perspective: Implications for the Elementary Physical Education Curriculum

Linda D. Zwiren

Introduction

The public health community is trying to reduce the risk of chronic disease in adults by increasing the activity level of the population (U.S. Public Health Service, 1990). Deaths from chronic diseases like coronary heart disease (CHD) can be reduced greatly if sedentary people become moderately active (Blair, Clark, Cureton, & Powell, 1989). The public health community is also exerting a major influence on school physical education programs. Because most children attend school, the school system has been targeted as a major change agent. "The large number of children who can be reached through the schools and the importance of the development of early patterns of behavior for diet and exercise make a compelling case for schools as a major focal point for reaching the national objectives for health promotion and disease prevention" (Simons-Morton, Parcel, & O'Hara, 1988, p. 129).

The intent of the Healthy People 2000 physical fitness goals is to increase activity and physical fitness levels of children and, perhaps more importantly, to move children toward becoming active adults. The cry is for physical education programs to adopt health-related physical activity and physical fitness goals (Sallis & McKenzie, 1991).

There is a difference between increasing physical activity, a behavior, and increasing physical fitness, a characteristic. The first section of this chapter will describe the difference between activity and fitness and will briefly examine the research to determine whether one or the other (or both) is related to reduction of disease risk factors in children.

A further question is whether increasing physical activity and/or physical fitness will reduce children's risk for developing heart disease later in life. Perhaps a more important question is what will make children become active adults, i.e., develop a life-style of physical activity. There is relatively little research on whether physically active and/or physically fit children will become physically active adults. Several factors, therefore, will be discussed that may be determinants of future activity behaviors.

Finally, this chapter will examine the implications of public health goals on the elementary physical education curriculum. Several statements have been made calling for an increase in physical activity and cardiovascular activities within the physical education class. "School programs should emphasize the so-called lifetime athletic activities such as cycling, swimming, and tennis. Schools should decrease time spent teaching the skills used in team sports such as football, basketball, and baseball" (American Academy of Pediatrics, 1987, p. 449). Will this health focus result in elementary physical education classes neglecting the development of certain motor and sport skills? Will the elementary physical education curriculum become mainly a physical training program and neglect some of the traditional objectives and goals of the physical education curriculum? Various aspects of physical education programs will be explored to try to place the public health objectives within the more encompassing goals of the physical education curriculum.

Physical Activity Versus Physical Fitness

The United States Public Health Service (PHS) has recently released *Healthy People 2000: National Heath Promotion and Disease Objectives* (U.S. Public Health Service, 1990), which lists objectives to be obtained by the year 2000 designed to reduce preventable death, disease, and disability. Physical fitness, nutrition, alcohol and drugs, and unintentional injuries are among the 22 priority areas in which the objectives are organized (McGinnis, Kanner, & DeGraw, 1991). One of the highest priorities in the objectives specific to health promotion is physical activity and fitness (see Appendix). Since the school system has been targeted as a major change agent, two of the objectives are related to elementary and secondary physical education programs:

- Increase to at least 50% the proportion of children and adolescents in grade 1-12 who participate in daily school physical education.
- Increase to at least 50% the proportion of school physical education class time that students spend being physically active, preferably engaged in lifetime physical activities.

The Healthy People 2000 objectives further refined and placed a slightly different emphasis on the goals the U.S. Department of Health & Human Services (HHS) set up in 1980. In 1980, the Department of HHS identified youth fitness as an area of priority for promoting national health and established specific fitness and activity goals for children and adults (Powell, Spain, Christenson, & Mollenkamp, 1986). With respect to youth fitness, the 1980 goals were: 60% of youths should attend physical education classes daily;

70% should be tested periodically for physical fitness levels; and 90% should participate in physical activities appropriate for maintaining an effective cardiorespiratory system. The Healthy People 2000 objectives set more realistic goals than the 1980 goals, and include specific baseline data and surveillance methods. However, the most important shift in the year 2000 objectives is the greater emphasis placed on reducing inactivity and encouraging sedentary individuals to engage in light to moderate activity than on increasing physical fitness components.

Physical Fitness

There is a difference between physical fitness and physical activity goals. Physical fitness is a set of characteristics that are dependent on heredity and training levels, i.e., physical fitness is a set of attributes that people currently have or are attempting to improve through exercise. The components of health-related fitness are (a) cardiovascular fitness; (b) muscular strength; (c) muscular endurance; (d) flexibility; and (e) body composition (attainment of an appropriate body weight with a healthy proportion of body fat). The characteristic of maximal oxygen uptake (VO_2max) is used as the best measure of cardiorespiratory fitness and is closely related to the performance of long-distance runs. Thus, health-related physical fitness batteries contain distance runs to determine aerobic or cardiorespiratory efficiency. In addition, these test batteries contain tests to measure the other components of health-related physical fitness (see chapter IX). When the emphasis is placed on exercising above a certain minimal intensity (typically 60-90% of maximal heart rate) for a minimal amount of time (typically 15-20 minutes) the objective is to increase VO_2max, i.e., to increase cardiorespiratory fitness.

Physical Activity

Physical activity is defined as the production of energy by skeletal muscles. Therefore, the objectives concerned with increasing physical activity relate to increasing one's daily energy expenditure. Increasing physical activity level depends mainly upon changing an individual's behavior from an inactive to an active life-style. The emphasis for increasing physical activity is to increase energy expenditure through regularly moving large amounts of muscle mass, with little concern for the intensity of the exercise (Zwiren, 1988). Guidelines for the appropriate amount of energy expenditure beyond minimal daily requirements for children and youth to lower coronary heart disease (CHD) risk are not presently known. Based on adults, the recommendation is 11-13 kJ/kg/day (Blair, Clark et al., 1989).

Exercise/Sport Participation

It should be noted that for this section of the monograph exercise and sport will be treated as a subcategory of physical activity. Exercise is defined as any physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness or of sport skill attainment is an objective (Zwiren, 1992). Sport participation will be considered physical activity that is engaged in during organized game situations. The distinctions stated here among physical fitness, physical activity, exercise (training or conditioning), and sports participation, however, are not consistently used in the literature.

The Relationship Between Physical Fitness, Physical Activity, and Coronary Heart Disease Risk Factors

Risk Factors

Many of the Healthy People 2000 objectives are meant to have an impact on decreasing the number of deaths from heart disease by reducing risk factors known to be related to the likelihood of developing the disease. The risk factors identified in adults are listed in Table 1. Since coronary heart disease is not a pediatric disease (i.e., children do not die of heart disease that results from atherosclerotic changes in blood vessels), it is important to establish whether adult risk factors are present in children and if present do they track (persist) into adulthood. A review of the literature (Berenson et al., 1989; Zwiren, 1992) shows that some risk factors are present in children and track into adulthood. Generally the risk factors that are present in childhood and persist into adolescence are most likely to track into adulthood.

Table 1
Coronary Heart Disease Risk Factors for Adults

Nonmodifiable	Modifiable	Treatable
Age	Physical Inactivity	Hyperlipidemia
Gender	Obesity (abdominal)	Type II Diabetes Mellitus
Race	Hypertension	Hypertension
Family History	Cigarette Smoking	Low Levels of HDL-C
	Imprudent Diet	Platelet Aggregation and Fibrinolysis Hyperuricemia

Adapted from Goldberg (1989).

The most important implication for children is that obesity is related to a clustering of risk factors in children and young adults (Zwiren, 1992). In addition, obesity increases the persistence of any risk factor; and changes in the status of obesity is the biggest factor in changing risk factors in children (Becque, Katch, Rocchini, Marks, & Moorehead, 1988).

> Observations in the Bogalusa Heart Study show that body weight, body composition, and fatness (and its distribution) relate not only to blood pressure, but contribute to the early onset of insulin resistance as well.... Trunk or central body fatness, as measured by subscapular skinfold, relates more to cardiovascular risk parameters in children, just as observed in adults. (Berenson et al., 1989)

In a 40-year follow-up study (Mossberg, 1989), pubescent children who were classified as overweight (more than 3 standard deviations above the mean weight for children of their age) had higher than expected morbidity and mortality in adult life. Therefore, the prevention of onset of obesity in early life may be the most important factor in reducing the risk of CHD in later life.

Risk Factors, Fitness, and Activity

Has the research literature established whether physical fitness attributes and/or physical activity behavior are linked to altering risk factors in children? The results of various studies are equivocable. Several studies have shown that cardiovascular fitness (as measured by submaximal or maximal graded exercise tests) is related to cardiovascular risk factors, while other studies have found that physical activity (as measured by recall questionnaires, heart rate monitors, motion sensors, and direct observation) is the more accurate determinant of risk-factor profiles (Rowland, 1991; Zwiren, 1992).

Still other studies have found no relationship between risk factors and physical fitness and/or physical activity. Several studies that have found relationships to exist between fitness and risk factors, however, have found that when physical fitness status was adjusted for some measure of body fatness (body mass index, skinfold thickness) the relationship was minimized or eliminated (Rowland, 1991). Rowland (1991), in an editorial comment, states that the only risk factor that appears to be consistently related to physical fitness and/or physical activity in the pediatric age group is obesity.

The failure to demonstrate a strong link between activity and/or fitness and CHD risk factors, however, should not dissuade efforts to promote physical activity in children. Studies may have failed to establish a consistent link due to the problems in measuring habitual physical activity and maximal oxygen uptake in young children. Most importantly, there is consensus that physically fit and physically active children and adults have more favorable risk profiles and that the objective for children is not necessarily to reduce risk factors but to develop regular activity habits that persist throughout life (Rowland, 1991; Blair, Clark et al., 1989).

The question remains, however, when promoting physical activity in children, should the emphasis be on the improvement of the characteristic of cardiovascular fitness (i.e., improving VO_2max with the specific requirement of exercising 3-5 times a week, for a minimum of 15-20 minutes, in an intensity range of 60-90% of maximum heart rate) or on the activity behavior of increasing daily energy expenditure by increasing the amount of light to moderate large muscular activity without regard to intensity. It has been questioned whether VO_2max (the indicator of cardiovascular fitness) has the same implications for prepubescent children as for adults and whether specific training guidelines for adults will increase VO_2max in children (Zwiren, 1992). It is this author's opinion that for elementary school children to improve positive health status, the emphasis should be on increasing energy expenditure with physical activity of lower intensity than is recommended for increasing maximal oxygen uptake, but of longer duration and greater frequency. Exercise prescription for increasing energy expenditure is especially important for children with one or more of the following factors:

- children with at least one major CHD risk factor;
- obese children, especially those in the highest weight percentile and who have abdominal deposition of fat; and
- children leading a sedentary life-style, including those who have disabilities.

Helping Children to Become Active Adults

A major goal of the Healthy People 2000 objectives is to establish patterns of regular activity in children that will have an impact on their activity level as adults. The research is lacking, however, that examines whether activity, exercise, or sport participation in children will produce activity habits that will continue into adulthood. The few studies that looked at the tracking of children's sport participation have shown a weak link (Fox, 1991). It seems logical, at this point, to present some basic factors that have an impact on activity behavior.

Self-efficacy

It is generally accepted, but not presently proven, that participation patterns, quality of physical activity, and perception of physical activity formed during childhood, will determine whether a habit of daily activity will persist into adulthood (Weiss & Petlichkoff, 1989). Behavioral models from social psychology may help to provide guidelines for those intervention programs that will affect behavior in the future.

Social learning theory emphasizes mutual influences between the individual and the environment and includes the study of cognitive processes (Sallis et al., 1989). Of the core social learning variables, self-efficacy to perform activity and perceived benefits to activity are important determinants of participation in physical activity (Sallis et al., 1989). Self-efficacy is confidence in one's ability to set aside time to exercise and to exercise when feeling sad or under stress or when family or social demands are great. Dzewaltowski (1989) found that individuals who were confident they could adhere to an exercise program exercised more days per week.

Self-efficacy can be influenced by positive experiences with exercise, observation of others exercising (modeling behavior: number of adults in home and friends who exercise regularly), being encouraged to exercise, and exercising at a comfortable level. In addition, cognitive variables (especially knowledges that relate to health benefits) and perceived barriers to exercise are important (Sallis et al., 1989).

Socialization

Early positive socialization into physical activity and sport is probably an important factor in future exercise behavior. Socialization is "the process of social interaction through which people develop, extend, and change their ideas about who they are and how they relate to the world around them" (Coakley, 1987, p. 43). Parental physical activity patterns, parental encouragement to exercise and the time parents spend with their children in physical activity are emerging as influential factors (Johnson, 1989; Zwiren, 1992). However, parents should not pressure children to participate in sport or activity, since this may be viewed as a stressor and may contribute to negative feelings about physical activity (Weiss & Petlichkoff, 1989).

Self-esteem and Competence

Self-esteem is the value that individuals learn to place on themselves. Fox (1988), in presenting his motivational model of self-esteem and youth fitness, has shown that it is possible to discriminate among high-active, low-active, and inactive college students by their perceptions of strength, physical conditioning, and sports competence. Fox's model is a multidimensional approach toward self-esteem. Self-esteem varies in different areas (social relationships, academic abilities, physical appearance, physical domain). Fox states that there is evidence of a competence motive operating in the physical domain and that one will choose behaviors that provide a sense of competence and will avoid those that carry a high probability of failure.

Internal Versus External Rewards

"The frequent use of norm and percentile comparisons in fitness along with competitions, awards, or grading schemes based solely on fitness performance is more likely to encourage the ego-involved achievement pattern" (Fox, 1988, p. 240). This means, in developmental achievement theory, that the child who is ego oriented appraises his/her own competence primarily by peer comparison. The problem is that children who do not compare well (i.e., children with the lowest fitness level and in greatest need of improvement) will experience inferiority and failure, and will not seek to improve these abilities. The objective would be to try to develop task-involved youngsters who evaluate their competencies based on task mastery and personal improvement. Therefore, internal rewards based on realistic goal setting are important to allow children of all fitness abilities to experience a sense of mastery and competence (Fox, 1988).

Enjoyment

Exercise programs for promoting increased activity levels have little hope of being successful unless they are enjoyable. It seems unlikely that exercise that is prescribed for increasing cardiovascular fitness (at least three 30-minute sessions per week, or sustained large muscular activity that raises the heart rate to approximately 170 beats per minute) is appropriate (Rowland, 1990). Enjoyment, especially for the more sedentary child, involves feeling comfortable, avoiding embarrassment, not being bored, freedom (not being forced to exercise), and enthusiastic leadership with individual attention. Children also experience more enjoyment when they perceive that they have some control over their behavior (Stein, Keeler, & Carpenter, 1991).

> Unless activity is seen as immediately enjoyable, voluntary commitment will be deterred. . . . Hence, physical educators should judge activities in terms of fun and success, and in terms of their social value, excitement, and potential to develop a sense of physical mastery. Fortunately, children of this age (below the age of 9 or 10) find that most activities are fun as long as they feel actively involved and do not perceive a threat of failing if they do not perform well. (Fox, 1991, p. 37).

Barriers

Perceived barriers to exercising include such things as thinking exercise hurts or makes one feel uncomfortable. Children are inherently active but the lure of television and video games, lack of safe neighborhoods, and lack of appropriate facilities may lead to greater decreases in activity levels throughout childhood.

Implications for Elementary Physical Education

Elementary school physical education programs have many objectives, including the acquisition of various psychomotor skills, knowledge, and psychosocial perspectives, as well as physical fitness (Morris, 1991). The first objective includes the learning of fundamental movement skills, such as running and jumping, and the acquisition of basic sport skills, which are combinations of fundamental movement skills (e. g., throwing a ball in a game or a combination of running and jumping in dance and gymnastics) (Graham, 1987). It is possible that, with the increased emphasis on health promotion goals, physical education classes will become physical training classes devoted to narrow fitness objectives, or that components of the curriculum will be eliminated because they are not now perceived as contributing to lifetime sports. Does shifting the orientation of physical education to a health focus really represent a different curriculum from current, traditional programs? Is this a discussion of a whole new curriculum or a new emphasis of traditional programs? Is a varied content of elementary physical education incompatible with a health-related focus? Several aspects of physical education programs need to be explored to determine how the health-related emphasis has an impact on the physical education curriculum.

Physical Activity and Physical Fitness

It has been previously supported in this section of the monograph that the exercise prescription to increase health status should encourage the elementary school child to increase the amount of time spent in light to moderate activity. The fitness goal of improvement of VO_2max (evaluated by distance runs) involves increasing the intensity of activities like running, cycling, and swimming to heart rate about 170 beats per minute for a minimum of 15-20 minutes, 3-5 times a week. Elementary children may find engaging in repeated bouts of running, cycling, and swimming boring and repetitious. The research is not definitive as to whether the adult intensity, frequency, and duration guidelines for increasing VO_2max apply to children (Rowland, 1989). VO_2max value may not have the same meaning for children as it does for adults. In addition, children may be more physiologically and psychologically suited to perform repeated exercises that last a few seconds, interspersed with short rest periods (Zwiren, 1988). Present elementary physical education classes could achieve the goal of improving health status by increasing the amount of class time spent in activity without major curricular change. Changes could be made in skill practice drills and in games and game rules so that action is increased.

This does not mean that health-related fitness should be eliminated from the curriculum. Increasing cardiovascular fitness, flexibility, muscular strength, muscular endurance, and promotion of an appropriate body weight should be important components of the elementary physical education curriculum. Such a unit should encompass teaching the facts of fitness, including self-testing skills, personal fitness and activity planning procedures, and consumer fitness information so that children can maintain or improve their fitness and health independent of others (Corbin, 1987a). In addition, the goal of increasing activity levels and providing health benefit information should not be solely the job of the physical educator. Schools could increase the time spent in activity during recess, or school-wide or community-wide projects could be organized to increase activity levels in staff, parents, and children. Changes in behavior of children require support from family and peers, changes in school environment, and involvement of classroom teachers (Haywood, 1991; Perry et al., 1990). In chapter VIII, Hopper presents additional information on this. Several multidisciplinary, multifaceted programs exist:

- Heart Smart (see chapter VII).
- CATCH—an intervention program targeted for grades 3-5 focusing on eating habits, physical activity, and cigarette smoking. Components include classroom curricula, school environmental change, and family involvement programs (Perry et al., 1990).
- Health and Fitness Program for Youth—includes teaching modules for classroom teachers, grades 1-8. Involves units on body awareness, nutrition, substance abuse, and designing one's own fitness program.
- Spark—an ongoing project in California that has several components including a self-management fitness component. Children are actively involved in planning and being responsible for their own fitness activities (Sallis, 1991).
- Know Your Body—a classroom-based program with diet, physical activity, and cigarette smoking intervention programs. Developed for use with inner-city children (Walter, 1989).
- Go for Health Program (GHP)—designed to facilitate changes in school lunch, physical education, and classroom health education (Simons-Morton, Parcel, & O'Hara et al., 1988).

Development of Motor and Sport Skills

As discussed in the previous section, an individual's feeling of physical competence is an integral part of self-esteem and is probably a major determinant of future activity habits. Motor skills are the basis of all physical activities. Therefore, promotion of a physically active life-style should be based on a solid foundation of motor skills. As Fox states,

> It would appear that physical education programs have tremendous potential for establishing fitness as a desirable and available attribute for children. A public health perspective of fitness would tend to lean heavily on those aspects of fitness that are more directly linked with health and well-being. From the viewpoint of self-esteem theory, all aspects, including those that are skill-related would appear to have potential for contributing to children's emotional welfare and desire to be involved in exercise and sport as a source of competence. (Fox, 1988, p. 239)

Children do not automatically advance to use the best movement pattern or technique for executing a skill (Graham, 1987). Those who are not provided with the proper teaching environment and opportunities to practice motor skills may encounter a proficiency barrier even though they have achieved biological maturity. However, the learning of complex skills is extremely difficult if fundamental skills are poorly developed (Seefeldt, 1980; Ulrich, 1987). Unless children have some competency in running, jumping, throwing, catching, striking an object, or knowing how to control their body musculature through various types of movement, they will not have the competence and confidence to meet the physical challenges of an active life-style.

This problem of lack of skillful movement is more of a concern, in general, for girls than boys. Girls do not participate in playground activities or community-based sport programs to the same extent as boys (Raithel, 1987). Students who are weak or marginally satisfactory in motor skills will tend to have low levels of participation and will maintain a low level of movement ability and presumably less of an interest in establishing an active life-style.

To avoid encountering this proficiency barrier, some teachers may have to change the emphasis of instruction so that they do not move too soon from teaching the fundamental skills to specific sports skills (Haywood, 1991). When teaching motor skills, not only must varied and active practice drills be used, but teachers must focus on the child actually learning the qualitative aspects of the motor skill. Teachers must provide an adequate amount of feedback to let children know when they are not executing a skill correctly and provide specific cues to change the pattern (Graham, 1987).

In their article examining the role of physical education in public health, Sallis and MacKenzie (1991) promote the reduction of sports-oriented physical education programs, especially team sports. There might be a tendency to eliminate those sport skills that take a long time to teach and are primarily viewed as nonlifetime sports or as having a low aerobic benefit. This may be too narrow a view of which sport skills will have future benefits. The assumption is that adults do not play team sports or that the activity level in these sports is not high enough (Haywood, 1991). But, adults do play basketball, and who can predict whether or not soccer leagues will become a future venue of activity for adults. Children need to be exposed to a variety of activities. The team/individual sport distinction is not helpful; the important point is to make sure that children become competent and skilled movers so that they feel confident to engage in activity.

Competition Versus Cooperation

The view that team sports may be inappropriate for improving health status may be due to the false assumption of some teachers that students learn motor skills by playing games (Graham, 1987). The more physically mature and motor-competent student will tend to dominate the game-playing situation if the teacher spends a disproportionate amount of time in game play rather than in appropriate skill practice (Haywood, 1991).

The emphasis on competition and winning may have to change so that there is a redefinition of success. Stein et al. (1991) suggest utilizing mastery to de-emphasize winning as the sole focus when participating. Goal setting on mastery makes children focus on the process of physical activity and fitness and rewards learning, improving, and working hard. Mastery involves self-comparison so that students improve or work hard relative to themselves and not others. Therefore, personal performance is more important than winning or losing and students' enjoyment is enhanced.

When students can achieve their own goals only when others fail to achieve theirs, the goal structure is competitive (winners and losers). A cooperative goal structure is fostered when students achieve their own individual goals only by working in cooperation with others as they achieve their goals. Marsh and Peart (1988) conducted a study on high school girls to examine the differential effects of a competitive versus a cooperative fitness program on physical fitness and on multidimensional self-concepts. Both the competitive and cooperative programs significantly increased physical fitness (compared to control groups). However, the cooperative program also increased physical ability self-concept, while the competitive program lowered this component of self-concept. The study itself has several limitations. Results obtained on high school students may not apply to elementary school children, results on females may not apply to males, and the measures of physical fitness were mainly of anaerobic power and not health-related fitness. While more definitive research needs to be done, the implications of the study are that short-term improvement in physical abilities may not lead to corresponding changes in physical ability self-concept, but that a cooperative goal structure may affect future participation because of its affect on self-concept.

Summary and Conclusions

The Healthy People 2000 objectives (U.S. Public Health Service, 1990) will probably have a major impact on physical education programs. These health promotion and disease prevention objectives call for children to have daily physical education and to increase physical activity levels. The difference between changing behaviors to increase physical activity and the exercise prescription needed to increase cardiovascular fitness was discussed previously. The case was made that the elementary physical education curriculum should concentrate on increasing physical activity levels. The obese child should be targeted for major intervention programs to reduce the risk of becoming an obese adult with increased chronic disease risk factors (Parker & Bar-Or, 1991).

Another major goal of the Healthy People 2000 objectives is to have an impact on the future behavior of children so that they become active adults. Since there is extremely little research that tracks physical activity in childhood to adulthood, determinants of physical activity were presented. This section, however, did not explore how to quantify and qualify motivational factors across age and cultural backgrounds (McGinnis et al., 1991). The following suggestions were made for elementary physical education programs:

- The major goal of elementary physical education should be to increase physical activity. Physical education classes should be designed to maximize the activity level of each child. However, the responsibility for increasing activity of children should be the concern of the entire school community. Better use of recess time or the development of school-wide or community-wide projects could be used to increase children's activity levels and promote peer and adult support for an active life-style.
- Physical fitness units should be an integral component of the elementary physical education curriculum. In these units, children should be taught fitness facts, the relationship between activity and health, self-testing skills, and self-management skills, thereby becoming independent consumers of fitness (Corbin, 1987a). Fitness awards should be based on intrinsic rather than extrinsic rewards. Several examples of existing multidisciplinary, multifaceted programs were given.
- Physical education programs should remain varied with the emphasis on developing fundamental movement skills as well as a wide variety of sport skills. Units and teaching methods should be re-evaluated to make sure children who are weak in their motor skills will not encounter a proficiency barrier and avoid physical activity. Elementary physical education teachers need to spend time in analyzing students' state of motor development and allow time to practice the skill (maybe at the expense of playing the game). Activities should be enjoyable and cooperation should be emphasized over competition.

The health promotion emphasis in the elementary physical education programs should not result in major changes in the curriculum. Physical education programs must emphasize the process as well as the product. The emphasis of physical education should not be solely on making kids fit or active, but on promoting the commitment to remain physically active and physically fit. Functional time on task, success rate, and opportunity to respond (Siedentop, 1991) may be more valid indicators of appropriate instruction than placing the emphasis on how many minutes children are physically active. Physical educators and professional physical education associations must become actively involved in the process of developing elementary physical education programs to promote health and reduce disease risk. If not, curricular priorities may become solely based on maximizing vigorous physical activities and increasing fitness and may miss the boat on promoting a lifetime of fitness (Fox. 1991). In addition, health and physical education programs need to develop a new level of integration. While physical education programs need to take on a stronger health focus, health programs must incorporate physical activity as a behavior to facilitate healthful life-style changes. "The increasing interest of the public health community in physical education is a golden opportunity to improve the effectiveness, status, and possibly funding of school physical education. The opportunity should be seized and a solid, lasting partnership between health and physical education should be cemented (Sallis & McKenzie, 1991, p. 134).

Appendix

Year 2000 Fitness Objectives for the Nation

1. Reduce coronary heart disease deaths to no more than 100 per 100,000 people. (Age-adjusted baseline: 135 per 100,000 in 1987.)

2. Reduce overweight to a prevalence of no more than 20% among people aged 20 and older and no more than 15% among adolescents aged 12-19. (Baseline: 26% of people aged 20-74 in 1976-1980, 24% for men and 27% for women; 15% for adolescents aged 12-19 in 1976-1980.)

3. Increase to at least 30% the proportion of people aged 6 and older who engage regularly, preferable daily, in light to moderate physical activity for at least 30 minutes per day. (Baseline: 22% of people aged 18 and older were active for at least 30 minutes 5 or more times per week and 12% were active 7 or more times per week in 1985.)

4. Increase to at least 20% the proportion of people aged 18 and older and to at least 75% the proportion of children and adolescents aged 6-17 who engage in vigorous physical activity that promotes the development and maintenance of cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion. (Baseline: 12% for people 18 and older in 1985; 66% for youths aged 10-17 in 1984.)

5. Reduce to no more than 15% the proportion of people aged 6 and older who engage in no leisure-time physical activity. (Baseline: 24% for people aged 18 and older in 1985; 43% if aged 65 and older; 35% if disabled.)

6. Increase to at least 40% the proportion of overweight people aged 6 and older who regularly perform physical activities that enhance and maintain muscular strength, endurance, and flexibility. (Baseline: data available in 1991.)

7. Increase to at least 50% the proportion of overweight people aged 12 and older who have adopted sound dietary practices combined with regular physical activity to attain an appropriate body weight. (Baseline: 30% of overweight women and 25% of overweight men for people aged 18 and older in 1985.)

8. Increase to at least 50% the proportion of children and adolescents in grades 1-12 who participate in daily school physical education. (Baseline: 36% in 1984-1986.)

9. Increase to at least 50% the proportion of school physical education class time that students spend being physically active, preferably engaged in lifetime physical activities. (Baseline: students spent an estimated 27% of class time being physically active in 1984.)

10. Increase the proportion of worksites offering employer-sponsored physical activity and fitness programs.

11. Increase community availability and accessibility of physical activity and fitness facilities, e.g., hiking, biking, and fitness trails; public swimming pools; and areas of park and recreational open space.

12. Increase to at least 50% the proportion of primary care providers who routinely assess and counsel their patients regarding the frequency, duration, type, and intensity of each patient's physical activity practices. (Baseline: physicians provided exercise counseling for about 30% of sedentary patients in 1988.)

Adapted from U.S. Public Health Service (1990).

III

Understanding Children's Physical Activity Participation and Physical Fitness: The Motivation Factor

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Introduction

Much has been written in recent years discussing the notion of declining health-related physical fitness levels and sedentary life-styles of America's children (Corbin, 1987b; Sallis, 1987). Although controversy exists as to whether or not children's fitness levels have actually declined (Pate & Shephard, 1989; Simons-Morton, Parcel, O'Hara, Blair, & Pate, 1988), there is no doubt that the issue will continue to stir debate among researchers, teachers, and parents.

One of the major reasons why children's fitness has become a national concern relates to what is presently known about adults' fitness. Lack of health-related physical fitness is considered a potential health problem as low-fit adults have been shown to be at a significantly greater risk for coronary heart disease (CHD) than moderate- or high-fit adults (Blair, Kohl et al., 1989). The concern is that unfit children will develop life-style patterns that will contribute to their adult risk for CHD and other hypokinetic diseases. There is some evidence to suggest that this may indeed happen as several longitudinal studies have found some CHD risk factors, such as hypertension and hyperlipidemia, to track from childhood into adulthood (Clarke, Schrott, Leaverton, Connor, & Lauer, 1978; Freedman, Shear, Srinivasan, Webber, & Berenson, 1985; Webber, Srinivasan, Wattigney, & Berenson, 1991).

Because of the positive relationship between regular exercise and health-related physical fitness in adults, there has been an increasing interest in enhancing children's exercise patterns with the hope that these patterns will carry over into adulthood. Strong recommendations (Blair, Mulder, & Kohl, 1987; McGinnis, Kanner, & DeGraw, 1991; Sallis & McKenzie, 1991) have recently been put forth advocating an increased emphasis on children's moderate to vigorous physical activity and their health-related physical fitness.

In general, these are logical recommendations, but they could lead to an overemphasis on fitness. Simply offering physical education programs that emphasize health-related physical fitness and moderate to vigorous physical activity is no guarantee that children in those programs will adopt a physically active life-style that carries over into adulthood. For example, one of the more popular procedures adopted by many physical education curriculums has been to emphasize fitness testing as a means of motivating children to become more physically active. Although this is not inherently a negative approach, a number of authors have addressed the problem of utilizing fitness testing as a means of motivating young children to be active (Corbin, Whitehead, & Lovejoy, 1988; Fox & Biddle, 1988b; Whitehead & Corbin, 1991). Fox and Biddle (1988b) have pointed out that, although the use of fitness testing in schools is widespread, the motivational effects of such testing on children remains relatively unexplored. Limited research indicates that the feedback given by adults in fitness testing environments could have negative effects on some children's motivation to be physically active. Whitehead and Corbin (1991) found that children who were told that they performed below average (low percentile ranking) on an agility run decreased in intrinsic motivation. These results indicate that there are many factors involved in motivating children for physical activity, and, in this realm, fitness testing programs will not be sufficient.

In addition, some physical education programs for children have adopted a popular adult model of exercise motivation, primarily consisting of fitness testing and exercise prescription. Unfortunately, this approach to exercise motivation has been relatively unsuccessful in encouraging adults to adopt physically active life-styles (Dishman, 1988). Furthermore, children are not miniature adults and an understanding of their motivation for physical activity is required before any program designed to enhance their physical activity or physical fitness can be optimal in doing so. From a motivational perspective, then, it is assumed that programs designed to enhance the fitness and physical activity levels of children will not have a significant long-term affect on their participation unless psychosocial factors are considered (Godin & Shephard, 1984).

We suggest that the self-perceptions children have about their physical selves and the perceptions they have about physical activity situations play the most critical role in influencing their present and future physical activity behavior (Fox, 1991; Horn, 1987; Weiss, 1987). The answer to motivating children to become more active does not lie with developing better fitness tests and awards, but rather with understanding key self-perceptions and related motivational processes underlying children's physical activity.

Too much attention has been paid to children's desired levels of fitness and the types of physical activity programs that are most likely to help them achieve those levels. Children may develop negative or positive self-perceptions relating to physical activity and fitness in almost any context, whether it be competitive youth sports or a physical education class emphasizing health-related physical fitness. It all depends on how the physical activity context is structured and how significant adults influence the children's development of self-perceptions. The problem is that the relationship among significant adults, children's development of positive self-perceptions, and their motivation to be physically active has received scant attention (Fox, 1988).

The primary purpose of this chapter is to discuss how self-perceptions and their interactions influence the motivational process with respect to children's physical activity. This discussion will be followed by some suggestions for structuring children's physical activity environments that may not only help to develop positive self-perceptions and enhance present physical activity participation, but also help children carry over an active life-style into adulthood.

Self-perceptions and Physical Activity Participation

The assumption underlying the importance of self-perceptions is that a child's perception of reality is a more powerful predictor of motivation and behavior than is reality per se (Ames, 1984; Dweck, 1986; Nicholls, 1984; Weiner, 1986). A self-perception is a thought, a belief, a way of viewing oneself, and there are a variety of self-perceptions that have been shown to play important roles in influencing children's behavior in both classroom (see Ames, 1987) and physical activity settings (see Duda, 1987; Weiss, 1987). This chapter focuses on the individual self-perceptions that are most likely to influence children's participation in physical activity: (a) perceived physical competence, (b) perceived self-efficacy, (c) causal attributions, and (d) goal orientations. This chapter does not address two important issues concerning self-perceptions and physical activity. First, we recognize that perceptions of competence and efficacy, attributions, and goal orientations change with age (Duda, 1987; Weiss, 1987) but a developmental approach is not discussed. Second, we do not attempt to define such terms as sport, exercise, moderate or vigorous physical activity, and health-related physical fitness, as they may relate to children's self-perceptions. Although children's self-perceptions and motivation may differ depending on the context (e.g., competitive youth sport and physical education class), we focus our discussion on the broader aspects of how children's self-perceptions may influence their desire to be physically active or physically inactive.

Perceived Physical Competence

Competence, as a psychological construct, was originally proffered by White (1959), who considered it to be the single most important motivational determinant of human behavior. Harter (1978) refined and extended White's notion of competence by concentrating on the domain specificity of competence (e.g., social, cognitive, and physical competence). According to Harter, the perceptions of competence associated with a behavior are critical determinants of subsequent motivation to participate in that particular behavior. In sport and physical activity settings, perceptions of physical competence have been shown to influence children's motives for participation (Klint & Weiss, 1986) as well as actual participation (Feltz & Petlichkoff, 1983; Roberts, Kleiber, & Duda, 1981) and physical achievement (Weiss, Bredemeier, & Shewchuck, 1986).

The evidence is clear: children (and adults) are attracted to activities where competence is perceived. Relating to perceived physical competence, children may ask the question, "How good am I at this activity?" If their answer is "not very good," persistence will be minimal and chances for future participation will be low. It is likely that children with low perceptions of physical competence may begin a process of discounting the importance of physical activity in order to protect their self-esteem and avoid failure experiences (Fox, 1988). Is there any doubt that some of these children continue to avoid activity as they get older?

Hence, when trying to motivate children to be active, the type of physical activity (e.g., aerobic vs. anaerobic exercise) may not be as important as fostering children's perceptions of competence throughout the activity. By facilitating the development of perceived competence, more children should be attracted to performing physical activity.

Perceived Self-efficacy

Self-efficacy refers to the beliefs individuals have about their ability to perform a specific behavior (i.e., confidence) and is a major construct in Bandura's (1986) social cognitive theory of human behavior. According to Bandura, people who have high efficacy expectations are more likely to approach challenging situations and display greater effort and persistence than individuals who have low efficacy expectations. Recent research on adults has shown that self-efficacy is a psychological determinant of exercise adherence (McAuley & Jacobson, 1990).

Little research has examined the effects of children's perceptions of self-efficacy on their physical activity participation. However, research in classroom settings (Schunk, 1984a, 1984b) has shown that children's efficacy expectations increase persistence, effort expenditure, and improve actual task performance. It would seem logical to assume that developing children who are confident in their abilities to perform specific physical activities will lead to more active children. Not much is known, however, about how children develop high or low efficacy expectations regarding physical activity participation.

Bandura's theory would suggest that success experiences are an important precursor to fostering high efficacy expectations, but that success alone may not be sufficient as children need to recognize the contingencies underlying these success experiences, or high self-efficacy will not develop. With respect to efficacy expectations, children may ask the question, "Can I do this behavior or activity?" If the answer is "no" or "I'm not sure," (low self-efficacy), these children may try to avoid the activity or drop out from sport participation (see Weiss & Petlichkoff, 1989). If they are required to participate, as children are in physical education classes and, in some instances, competitive youth sport, they will begin to devalue the importance and salience of being successful at physical activity, put forth little effort, and approach the easiest tasks.

Causal Attributions

Attributions are explanations that people give for performance or performance outcomes (e.g., winning or losing a game or achieving or not achieving an exercise goal). According to attribution theory (Weiner, 1986), people ask themselves "why" questions whenever they perceive that an experience has been a failure, unexpected, or important. The answers people come up with have important motivational consequences as attributions are theorized to influence expectancies for future success or failure and the amount and type of affect experienced.

The critical elements of attribution theory are the three causal dimensions—locus of causality, stability, and controllability—not the attributions themselves. Expectancies and affect are determined by how each person classifies the attribution on these causal dimensions.

Locus of causality refers to whether the person believes the cause of success/failure was due to internal or external factors (i.e., is the cause something within the person, such as a high level of fatness, or outside of the person, such as a faulty piece of equipment). Stability pertains to the variability of the attribution over time (i.e., is the cause permanent or changeable?). The controllability dimension refers to the degree to which the person believes the cause is within her or his personal control or controlled by others (e.g., teachers, coaches, parents, teammates, etc.).

According to Weiner (1986), the stability dimension influences expectancies for future success or failure. For example, if a person sets an exercise goal (swimming 3 times this week), fails, and then attributes the cause to a stable factor such as "my busy work schedule prevented me from achieving my goal, and I always have a busy schedule," he or she will more than likely expect to fail in the future and may stop trying to achieve exercise goals. On the other hand, if the person had made an unstable attribution for the goal failure such as, "I just had a busy week and I'll get back at it next week," expectancies for future success will be enhanced.

The locus of causality and controllability dimensions are theorized to influence affect. For example, a success attributed to internal causes will induce more positive emotions such as pride or satisfaction than if an external attribution is given, whereas a failure experience attributed to internal causes may lead to feelings of guilt or shame.

In physical activity settings, children who consistently attribute failure to stable, internal causes may develop a pattern of low expectancies for future success and experience a great deal of negative affect. For example, if a child receives normative feedback from a fitness test that indicates he or she is in the bottom percentile rank on body composition, it is possible that the information may be interpreted as a failure. If the child then attributes the perceived failure to a stable, internal cause such as, "I'm just fat and I'll always be fat," he or she will develop low expectancies about changing body composition and not even want to try. In addition, negative affect such as guilt or shame will be experienced.

Within an attributional framework, success experiences in a physical activity context are no guarantee that children will adopt positive motivational patterns. Children who have a success experience, such as achieving an exercise goal, would need to make internal, stable attributions so that positive affect is experienced and expectancies for future success are enhanced. Children who make external, unstable attributions for a success experience ("The teacher made it easy for me this time") will experience less positive affect and expectancies for future success are in doubt.

Goal Orientations

Related to attribution concepts are children's goal orientations. These self-perceptions relate to how children define or construe ability, and goal orientations play a central role in a number of developmental theories of achievement motivation (Ames & Ames, 1984; Dweck & Elliot, 1983; Maehr, 1984; Nicholls, 1984). In general, there are two kinds of competence goal orientations that children have in achievement situations: (a) task-involved, and (b) ego-involved. The basic assumption is that the adoption of different orientations influences a wide range of children's cognitions and behaviors.

With a task-involved goal, importance is attached to developing new skills, self-improvement, effort, and a desire to attempt challenging tasks so that something new may be learned (Ames, 1987; Elliot & Dweck, 1988). Success is perceived when improvement, trying hard, or learning take place. Conversely, an ego-involved goal refers to a concern with comparing one's ability to others. Demonstrating ability by winning or doing better than others is the primary goal, and if that goal is threatened, a child may avoid challenging situations, put forth little effort, or quit in order to protect his or her perception of ability. Success is perceived only when the child does better than others. A variety of evidence in academic settings indicates that children with a task-involved goal are more likely to use effective learning strategies (e.g., planning for studying and monitoring progress), prefer tasks that are challenging, like their class more, and believe that effort and success co-vary (Ames & Archer, 1988; Nicholls & Miller, 1984).

Goal orientations have far-reaching implications for children's physical activity and physical fitness. Traditionally, sport and physical activity settings have encouraged children to adopt ego-involved goals by emphasizing winning and social comparison processes (Roberts, 1984). This is potentially a maladaptive approach if the goal is to develop children who want to pursue physical activity in the present and future.

Similarly, fitness testing environments that emphasize social comparison processes (ego-involved focus) may unwittingly foster an ego-involved goal orientation for those children who have low levels of fitness. These children will likely interpret the testing as highlighting their lack of fitness and be more concerned with the evaluative aspects than with the motivational aspects of the testing. Promoting task-involved goals in these settings is more likely to produce independent exercisers and sustained involvement in physical activity.

How Goal Orientations Are Related to Other Self-perceptions

It is important to understand that children's self-perceptions do not influence motivation and behavior independent of each other; rather they interact in a variety of ways. Although research examining the interaction of self-perceptions is in its infancy, some evidence indicates that goal orientations may be at the origin of the motivational process (Ames, 1987; Ames & Archer, 1988; Covington, 1984; Dweck, 1986).

Goal orientations influence how children perceive their level of competence. Research in academic settings suggests that self-perceptions of ability can be moderated by a task-involved goal (Covington & Omelich, 1984). The findings of Ames and Archer (1988) suggest that a task-involved goal may discount the importance of perceived competence. Children with a task-involved goal preferred challenging tasks and utilized effective learning strategies whether or not they perceived high or low competence at the task. This finding is especially important for children with low perceptions of competence. A task-involved goal can help these children to interpret actual competence as being irrelevant to their success. What matters is that they try hard and use effective learning strategies. Elliot and Dweck (1988) also found that children in the task-involved situation opted for challenging tasks and the opportunity to learn something new "even with public errors."

Little work has been done examining the relation between goal orientations and children's confidence to perform specific behaviors in either the classroom or physical activity settings. It could be hypothesized, however, that children with task-involved goals would be more confident in a variety of situations to perform certain behaviors, since their definition of success places less emphasis on the outcome. That is, since the goal of task-involved children is to "improve" or "try my best," efficacy expectations should be enhanced.

With respect to goal orientations and attributions, Ames & Archer (1988) found that when children adopted an ego-involved goal in a classroom setting they were more likely to focus on ability and attribute failure to lack of ability and difficulty of the work, a maladaptive attributional pattern. Children who perceived their classroom goals to be task-involved perceived success to be a result of their effort, an adaptive attributional pattern for continual learning and involvement. A similar pattern was found in a study by Elliot & Dweck (1988) as children who believed they had low ability when placed in an ego-involved situation responded in a learned helpless fashion.

In sum, it has been suggested that perceptions of competence, self-efficacy, causal attributions, and goal orientations are powerful mediators of children's motivation and behavior in physical activity settings. Although much of the work in this area has been conducted in academic settings, many of the findings are relevant to physical educators, coaches, and parents who are interested in enhancing children's physical activity behavior and their health-related physical fitness.

Significant Adults and Children's Self-perceptions

Adults structure many of the physical activity situations in which children are involved, thereby influencing the development of children's self-perceptions regarding physical activity (Horn, 1987). In general, adults can influence children's self-perceptions by the type of feedback they provide, expectancies for success, appraisals of ability, and their goal orientations (see Horn, 1987, for an in-depth review).

Adults do many things (good and bad) that influence children's development of perceived physical competence. It has been shown, for example, that parents exert substantial influence on their children's developing self-perceptions of academic competence (Phillips, 1987), primarily as interpreters of objective competence feedback. Parents' feedback regarding their children's ability directly influences resultant perceptions of competence. The problem is that parents are not always accurate in judging their children's competence. Phillips found that even bright children will view themselves as academically incompetent if their parents inaccurately judge their ability. Similar results have been demonstrated in youth sports (McElroy & Kirkendall, 1981) as boys who perceived their parents' ability judgments to differ from that of their own ability judgment, had significantly lower levels of self-esteem when compared to boys with ability judgments similar to their parents'.

Since perceptions of competence influence children's motivation to participate in a number of activities, it is critical that parents, teachers, and coaches provide accurate competence information based on appropriate outcomes. For example, many youth sport coaches base their competence feedback on whether or not the team wins or loses (outcome). Children who lose may begin to believe that they can only be competent if they win (Horn, 1987). This may be particularly true for young children as Horn and Hasbrook (1986) found that they rely more on outcome (win/lose) as a source of competence information than do older children. Coaches should make sure that they de-emphasize the relation between outcome and competence for young children, especially for children on losing teams.

Appropriate competence feedback is also important for youth fitness. For years the criteria for children's fitness rewards were based on normative comparisons and fitness outcomes (PCPFS, 1987a). Children who did not receive rewards were receiving competence information that was linked to an outcome (lack of fitness), rather than the process of being active. Recent fitness testing programs such as FITNESSGRAM (Institute for Aerobics Research, 1988) and Physical Best (AAHPERD, 1988) provide rewards not only for fitness outcomes but also for participation, providing children with a variety of alternatives to achieve success and enhance perceptions of competence.

Adult causal attributions also influence how they respond to children's behavior. Limited evidence (Dix & Grusec, 1985) suggests that parents will react differently to their child's misdeeds depending on the attributions they give for the behavior. That is, parents who attribute a child's bad behavior to controllable, stable, and internal causes are likely to be more upset, more motivated to respond, and more forceful in their reaction to the behavior. This attributional concept can be applied to how adults' attributions may influence the feedback they provide their children in physical activity settings. If a coach perceives that a child's sports skills are lacking and attributes that lack of skill to stable, internal factors, expectancies for the child's ability to improve may be low. The coach may subsequently pay less attention to the child, give insincere encouragement, and ignore situations that would be teachable moments. In addition, the child may begin to adopt a similar attributional pattern as that of the significant adult and develop learned helplessness tendencies.

Adults' goal orientations also have a significant influence on children's perceptions of competence and efficacy, and their causal attributions. Ames and Archer (1987) found that mothers with task-involved goals for their children's school learning valued effort, active participation, and self-improvement as criteria for success. In contrast, mothers with ego-involved goals for their children believed that ability, getting good grades, and doing better than other children was most important. Adults who adopt a task-involved goal or mastery emphasis for their children's physical activity participation should be more likely to develop children who perceive co tence and have a desire to continue to participate, as well as who make attributions that enhance positive affect and expectancies for future success.

In sum, coaches, parents, and teachers influence children's self-perceptions through the types of feedback they give and how they structure a variety of physical activity situations. It has been suggested that children's goal orientations influence other self-perceptions such as perceptions of competence and self-efficacy, and causal attributions. These self-perceptions then influence children's desire to pursue physical activity and how much intrinsic interest they have in the activity. Based on these relationships, the following section provides some general recommendations for enhancing the motivational structure of physical activity settings so that children develop positive self-perceptions regarding physical activity.

Structuring Environments to Enhance Children's Self-perceptions

In general, adults significant to children must structure educational environments that enhance the development of self-perceptions, which will play a positive role in motivating children to pursue physical activity throughout their lives. This is no easy task. Typically, recommendations are offered encompassing activities that will increase children's fitness levels as well as the frequency of their moderate to vigorous physical activity (Sallis & McKenzie, 1991). Although these recommendations make sense from a public health perspective, they are insufficient from a motivational perspective.

It is not so much the kind of activity that is offered to children, whether it be youth sports, a health-related physical education curriculum, or a family exercise program, that is important. Rather, it is the motivational structure of the activity and how the adults influence children's self-perceptions that could ultimately differentiate the children who learn to love physical activity from those who learn to love laying on the couch and watching television.

Here are some adult recommendations for developing self- perceptions that will help children learn to love physical activity.

No Matter What the Activity, Adopt a Task-involved Emphasis

Structuring the activity so that as many children as possible adopt a task-involved focus can only help to increase perceptions of competence, high self-efficacy, and adaptive attributional patterns. In other words, the emphasis should not be on having students compare themselves with others. This means putting an emphasis on personal improvement, not on performance outcomes. The emphasis of the program (e.g., fitness development vs. physical skill development) is not the key to getting children involved in activity, rather it is how each class is structured with respect to the goals that are emphasized for children. Within a task-involved class structure, mistakes and errors become an acceptable part of learning and children are more willing to take risks and challenge themselves (Ames, 1987; Dweck, 1986).

Provide Feedback that Enhances Self-perceptions

The feedback that teachers, parents, and coaches give to children directly influences the development of their self-perceptions. When a child is not successful at performing or learning a skill, adult attributional feedback is critical to how he or she will interpret the problem. Teaching children to assume a problem-solving approach to skill acquisition requires that significant adults help children attribute failure to incorrect learning strategies or, at times, lack of effort. The attributions children make for failure must be unstable so that they truly believe that they can improve or learn the skill. This attributional pattern is best fostered within a task-involved structure.

Feedback from adults should emphasize the process, not the product (Corbin, 1987b; Horn, 1987). Rewarding children for achieving the criterion on health-related physical fitness components (e.g., sit-ups) is feedback that indicates the product of fitness is most important. What is more important, however, is that children learn to love the process of getting fit. For long-term motivation, Harter (1982) suggests that it is far more important "to reward characteristics of the person and emphasize their role in the process" (p. 171). Feedback that focuses solely on the product could develop children that do not know how to experience the joy that is inherent in the physical activity process.

In general, when fitness testing is done with children, feedback should be given that fosters a task-involved orientation rather than an ego-involved orientation. Do not encourage children to compare their results with other children. For example, do not say, "Well, Jane, you scored better than most of the kids in the class on the sit-up test," or "Bobby, your score was low compared to most of the other kids who did the sit-up test." This kind of normative feedback reinforces an ego-involved orientation and focuses the child's attention on the product (fitness) rather than the process. In addition, children like Bobby, who are low in fitness, can be easily discouraged. Instead, use task-involved feedback, which focuses on personal improvement and effort, whenever possible. If Jane scores well on sit-ups, you can say, "That is an excellent score, Jane. You must be working hard at your sit-ups. Keep at it." For Bobby, the feedback could be, "This is your score from the sit-up test: ____. Next time I would like to see you score ___. We will work together on it in class."

Of course, children are going to compare fitness results with each other. Our society socializes them at an early age to do so. But adults who work with children oftentimes unwittingly foster ego-involved goals in very subtle ways depending on the type of feedback provided. With a conscious effort, adults can rephrase their feedback to promote a task-involved orientation that places less emphasis on the fitness product and more on the process of getting fit.

Allow Children to Enjoy the Activity Process

Forcing children into fitness-type activities because "they are good for them" may not be in the long run the best way to help them become fit. Offering adult-like exercise programs based on principles of physical fitness may get children active but they may not help children adopt positive self-perceptions about being active. If the program is boring, focuses on fitness outcomes rather than on the process of participating, and compares children's skills with others, only children who are genetically endowed with athletic prowess are going to succeed. Most children, however, will not develop an affinity for physical activity in these kinds of situations.

Children should be given the opportunity to experiment with a variety of physical activities without bearing the burden of whether or not the activities promote fitness. If a child loves baseball, should we discourage him or her from playing because young baseball players may grow up to be overweight, slowpitch softball players with a number of CHD risk factors? From a motivational perspective, this would not make any sense at all. We need to allow children time to have fun and enjoy their physical activity without being told that their chosen activity is not promoting long-term health or that they need to become exercise adherers.

Have Reasonable Expectations

With all of the emphasis on youth fitness, there is a danger of setting fitness expectations that are too high for children. Although criterion-referenced fitness standards are a motivational improvement over normative-referenced fitness criteria, are they necessary? Do children (and adults) really need to worry if they fall below the criterion for their age and sex on sit-ups? Are they unfit? To whom does it matter? Should we expect all children to meet the criterion-referenced standards? The expectations that even criterion-referenced fitness tests place on children are unnecessary and not very useful in promoting the development of positive self-perceptions. Most children should be introduced to fitness concepts but should not have to worry about their fitness nor about maintaining exercise programs. These expectations are for adults, not children. Childhood is a time for riding bikes and racing the wind, for shooting baskets in the twilight of the backyard when you can barely see the rim, for running from the store to home for no good reason but for the feeling of speed, for doing a belly whopper into the pool on the summer's hottest day.

If more adults would structure children's physical activity environments with a task-involved focus, more children would develop high perceptions of physical competence, the confidence to try in the face of failure, and make causal attributions that would enhance their ability to come back and try another day. Isn't that enough? After all, they are only children.

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Fitness Education and Programming

IV

Trainability of Prepubescent Children: Current Theories and Training Considerations

Scott O. Roberts

Introduction

Concern over the health of American children has led many educational, governmental, and medical organizations to make recommendations for improving the exercise habits of children. (See chapter II for a discussion of the Healthy People 2000 objectives.) The American College of Sports Medicine (ACSM) has recommended that children engage in 20-30 minutes of exercise each day to develop and maintain optimal health and well-being (ACSM, 1988a). The rationale for getting children started on an exercise regime at an early age includes, but is not limited to, (a) improvment in ability to meet the demands of daily physical activities, (b) improvement in physical performance tests, (c) improved self-image and self-confidence, (d) improvement in motor skills, and, perhaps the strongest reason, (e) the evidence that physically active children have fewer chronic health problems and are at lower risk for developing chronic health conditions than sedentary children (Richmond & Kotelchuck, 1984).

Trainability is the degree to which a tissue or a body system responds to a training stimulus with morphological and/or functional changes (Bar-Or, 1990). Within the last decade, a great deal of research has focused on the effects of exercise training in children. From these studies it appears that children respond to training much the same way as adults do (Bar-Or, 1984). Studies have demonstrated that important health and performance characteristics can be improved through exercise.

The purpose of this chapter is to briefly review the current literature on the trainability of children and to offer suggestions for training programs. The first section discusses some of the aerobic and anaerobic characteristics of children and how both systems are affected by maturation and training. The second section provides guidelines for endurance training. And the final section is dedicated to the effects of resistance training on children's strength development.

This review deals primarily with prepubescent children, defined as the maturation level of Tanner Stage 1 (Tanner, 1962). Most of the studies cited in this review used boys and girls ages 7-13 years. Excellent sources for more information on physical maturation can be found in *Sports Medicine: Health Care for Young Athletes* (American Academy of Pediatrics, 1983a) and *Growth, Maturation, and Physical Activity* (Malina & Bouchard, 1991).

Effects of Training on the Aerobic and Anaerobic Capacities of Children

Aerobic power is commonly used as a measure of aerobic fitness and is expressed in terms of maximal oxygen uptake (VO_2max). Maximal oxygen uptake is defined as the maximal volume of oxygen consumed and utilized per minute during a maximal bout of exercise (Astrand & Rodahl, 1986). VO_2max can be expressed either as absolute aerobic power ($L \cdot min^{-1}$) or relative to body weight ($ml \cdot kg^{-1} \cdot min^{-1}$). Another measurement of aerobic power is peak oxygen uptake (VO_2peak), the highest oxygen consumption achieved during a maximal exercise test. VO_2peak is a more accurate measurement of aerobic power in children than is VO_2max because of the difficulty in getting children to reach a true maximal effort during an exercise test (Bar-Or, 1983). Although studies commonly report aerobic power as VO_2max, with children it is VO_2peak that is often being measured.

Table 1 compares the aerobic capacity of a child to that of an adult, using different ways to normalize data. In absolute terms, the maximal oxygen uptake of children is much lower than adults, but when corrected for body weight, the VO_2max of boys is similar to that found in young men (Robinson, 1938; Bar-Or, 1984). Girls also have a greater VO_2max per kg body weight than young women, primarily due to differences in adipose tissue (Bar-Or, 1984).

Table 1
Comparison of VO_2max of an 8-Year-Old Boy and an 18-Year-Old Man Using Different Ways to Normalize Data

Mode of Comparison	VO_2max—Observed or Expected: Child[a]	Adult	Child's Aerobic Capacity Compared with Adult
Absolute values L/min^{-1}	1.4	3.2	Much lower
Per kg body weight $ml/kg^{-1}min^{-1}$	50.0	50.0	Equal
Per height^2 L/m^2	0.83	1.20	Lower
Per height$^{2.46}$ L/m^2	0.73	0.81	Slightly lower

From Bar-Or (1984). Reprinted with permission.
[a] The child weighed 28 kg and was 130 cm tall; respective values for the adult were 68 kg and 175 cm.

VO_2max expressed relative to body weight is the best measure of cardiorespiratory fitness and endurance performance in adults (Taylor, Buskirk, & Henschel, 1955; Hammond & Froelicher, 1985). VO_2max can also be used as a measure of cardiorespiratory fitness and an indicator of response to training in children (Day, 1981), but it does not appear to be strongly linked to predicting endurance performance in children (Krahenbuhl, Skinner, & Kohrt, 1985). VO_2max values are significantly greater in well-trained prepubertal endurance athletes than nonathletes (Mayers & Gutin, 1979) and in trained versus sedentary nonathletes (Ekblom, 1969; Rotstein, Dotan, Bar-Or, & Tenenbaum, 1986; Vaccaro & Clarke, 1978; Massicotte & MacNab, 1974; Docherty, Wenger, & Collis, 1987). The improvement in VO_2max following training in prepubescent children averages 8-10%, depending on the mode of training, the intensity of the exercise, and the length of study.

Maximal oxygen uptake is directly related to the growth and development of the individual (lean body mass, height, weight, and age). As children mature, absolute values of VO_2max progressively rise with age (Bar-Or, 1983). When related to lean body mass, VO_2max values for boys and girls do not significantly increase during childhood and, in fact, girls actually show a decline in VO_2max throughout childhood (Krahenbuhl et al., 1985).

There are a variety of tests available to assess aerobic power. Most of the studies in this review used either a cycle ergometer or a treadmill. Of the two, treadmill testing normally yields higher VO_2max values, because walking and running are more natural to children than cycling.

Exercise capacity and maximal oxygen uptake increase throughout childhood. The increase in endurance capacity is the result of numerous physiologic changes (see Table 2). The reader is also referred to several excellent reviews that have looked at the effects of phy. ical activity on the trainability of prepubescent children (Pate & Ward, 1990; Bar-Or, 1989; Wells, 1985; Rowland, 1985).

Table 2
Physiologic Changes in Children Resulting from Training and Physical Growth and Maturation

Characteristic	Change
Heart rate, resting and submaximal	Decrease
Arterial blood pressure, maximal	Increase
Minute ventilation, submaximal	Decrease
Minute ventilation, maximal	Increase
Respiratory frequency, submaximal and maximal	Decrease
Ventilatory equivalent, submaximal and maximal	Decrease
Oxygen uptake, submaximal (per kg body weight)	Decrease
Oxygen uptake, maximal ($L \cdot min^{-1}$)	Increase
Blood lactate, maximal	Increase
Muscle lactate, maximal	Increase
Lowest blood pH	Decrease
Muscle strength	Increase
Anaerobic power (in watts and per kg body weight)	Increase
Muscle endurance* (in watts and per kg body weight)	Increase

From Bar-Or (1989). Reprinted with permission.
*Represented by mean power in the Wingate Anaerobic Test.

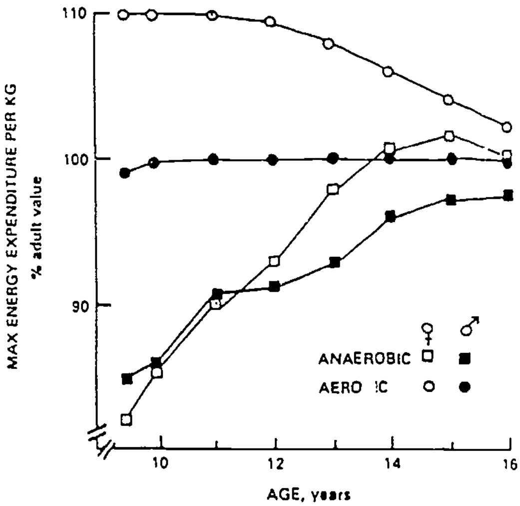
Anaerobic power is defined as the maximal rate at which energy can be produced or work can be done without relying on any significant contribution of aerobic energy production. Anaerobic activities are those that are high in intensity and short in duration (less than 2 minutes). Young children have distinctly lower anaerobic capacities when compared to adolescents and adults (Bar-Or, 1983). Some of the reasons for these differences may be related to children having (a) lower levels of acidosis at maximal exercise, (b) a lower glycolytic capacity, (c) lower lactate production during exercise, (d) an inability to remove lactic acid during exercise, (e) lower rates of anaerobic utilization of glycogen during exercise, and (f) higher ventilatory thresholds (Inbar & Bar-Or, 1983; Bar-Or, 1983, 1984; Macek, 1986).

Although there are several tests available to assess anaerobic power, one of the most frequently used, and the one used by most of the studies in this review, is the Wingate test. The Wingate test is designed to determine both peak anaerobic power and mean power output during a 30-second test.

As children mature, their ability to increase anaerobic power improves (Docherty et al., 1987; Grodjinovsky, Inbar, Dotan, & Bar-Or, 1980). Several studies have looked at the effect of training on the anaerobic capacity of children, and it appears that prepubescent children can improve their anaerobic capacities following training (Inbar & Bar-Or, 1983; Rotstein et al., 1986).

In summary, as children mature, their responses to both aerobic and anaerobic training improve, see Figure 1.

Figure 1
Development of Aerobic and Anaerobic Characteristics. Based on Age and Maximal Energy Expenditure Per kg Body Weight



From Bar-Or (1983). Reprinted with permission. Mean values are precentages, taking the value at 18 years as 100%.

Endurance Training Guidelines

Sufficient evidence exists that children do physiologically adapt to endurance training. Lacking, however, is a general consensus on the quality and quantity of exercise required to improve and maintain a minimum level of fitness in children. Recommendations for adults have been published by the American College of Sports Medicine (ACSM) in its position statement (ACSM, 1990). In 1988 ACSM published an opinion statement on physical fitness in children and youth and stated that, "until more definitive evidence is available, current recommendations are that children and youth obtain 20-30 minutes of vigorous exercise each day" (ACSM, 1988a).

Several investigators have recommended that adult standards for exercise intensity be used when establishing what constitutes "vigorous" exercise for children, as well as in establishing the frequency and duration of children's fitness programs (Rowland, 1985; Bar-Or, 1983). Rowland (1985) found that of eight studies he reviewed, only the six that used adult standards for aerobic training in children showed significant improvements in aerobic power; no significant improvements were noted in the two studies that did not use adult standards. Until further research establishes specific guidelines for children, the adult standards should be employed. These are briefly reviewed here; see also ACSM's *Guidelines for Exercise Testing and Prescription* (1991).

Type of Activity

Although cl, ~~e generally quite active, many of their activities seem to consist of short-burst, high-energy bouts of exercise. Such activities are not sustained over a long enough period of time to improve aerobic fitness. Children should be encouraged to participate in sustained activities that use large muscle groups (swimming, running, walking, and aerobic dance). Other activities, such as recreational sports, may also contribute to aerobic fitness. See Appendix for sample aerobic training programs for different age groups.

Exercise Intensity

Exercise should start at a low intensity and progress gradually to a higher intensity. Until further research provides more definitive recommendations for the use of target heart rates during exercise for children, application of adult standards to children is recommended (Rowland, 1985; ACSM, 1988a). If fitness testing results are available, the heart rate achieved at maximal effort can be used to establish a training heart rate. Another way to monitor exercise intensity is with Borg's rate of perceived exertion (RPE) scale. Borg's scale should be modified for children to make it easier to understand. For example, the numbers of exertion levels could be related to drawings of children exercising. Using Borg's original scale, the number 11, which equals "fairly light," might be a drawing of a child perspiring a little. The number 17, which is equivalent to "very hard," could be illustrated as a child sweating profusely and breathing hard. Children may find Borg's revised scale, which uses numbers 1 through 10, easier to understand. It is important to monitor carefully and supervise each exercise session and talk with children individually to assess response to exercise intensity.

Figure 2
Rate of Perceived Exertion Scales

Original Scale		New Scale	
6		0	Nothing at all
7	Very, very light	0.5	Very, very weak
8		1	Very weak
9	Very light	2	Weak
10		3	Moderate
11	Fairly light	4	Somewhat strong
12		5	Strong
13	Somewhat hard	6	
14		7	Very strong
15	Hard	8	
16		9	
17	Very hard	10	Very, very strong
18			Maximal
19	Very, very hard		

Adapted from Borg (1982) and Noble, Borg, Jacobs, Ceci, & Kaiser (1983).

Duration

Since children are involved in many different activities during and after school, a specific time should be committed to aerobic and strength conditioning activities. These exercise sessions should last between 20-30 minutes, starting at a shorter duration initially if necessary and progressing to longer duration.

Frequency

Ideally, children should exercise every day, but at a minimum exercise sessions should be conducted 2 or 3 times per week. This will allow adequate time for participation in other activities and yet be sufficient enough to cause a training effect.

Progression

In order to make continued improvements, the cardiorespiratory system must be overloaded by adjusting the intensity and duration of exercise. The rate of progression will depend on the individual child's initial fitness level, health status, age, and individual preferences. The initial conditioning period should consist of activities that are low in intensity and duration so that muscle soreness and injuries are avoided. This is a period which, for some children, may constitute their first exposure to structured exercise. Exercise must be fun and diverse. Changes in a child's exercise program can be made by: (a) assessing the child's response to current type and level of exercise; (b) getting feedback from the child; (c) talking with parents regarding the child's behavior and attitude towards exercise; and (d) monitoring heart rate and/or rate of perceived exertion during exercise. In the next stage of conditioning, the child can progress at a more rapid rate. This is a time when new activities can be introduced and more attention dedicated to improving skill and technique. In the last phase of conditioning, the goal is to maintain the current level of fitness through a variety of activities.

Warm-up Period

The objective of the warm-up is to prepare the muscles, joints, ligaments, and cardiovascular system for exercise. A brief but active set of warm-up activities will increase muscle temperature, increase blood flow to the working muscles, and stretch the active tissues involved. Warm-up exercises should involve the major muscles that will be used in training. Warm-up activities might include slow jogging, brisk walking, rope-jumping, light calisthenics, and stretching exercises.

Cool-down Period

The purpose of the cool-down is to prevent blood from pooling in the lower extremities following aerobic exercise. Light activity during the cool-down period also helps to prevent muscle soreness. Cool-down activities are similar in nature to warm-up activities. Exercise intensity is gradually decreased, followed by a period of stretching.

Thermoregulation

During exercise, a large amount of heat is generated as a result of metabolic processes involved in energy production. Because humans are homeotherms, the internal body temperature must be maintained at a constant level to survive. This means that heat produced during exercise must be dissipated via the thermoregulatory system, which maintains temperature homeostasis (a balance of heat gain and loss). During exercise, increased sweating and evaporative cooling are the most important means of heat loss.

In moderate climates children are able to dissipate heat quite effectively (Davies, 1981). During exercise, however, children are less efficient than adults in heat dissipation (Bar-Or, 1980a). Children are limited in their abilities to dissipate heat because they have greater production of heat per kg of body weight, a lower capacity for evaporative cooling, and a lower capacity for heat convection from the internal to the external environment (Bar-Or, 1982). Children can acclimatize to hot conditions, but the process takes considerably more time (repeated exposures) than with adults (Inbar, 1978).

The American Academy of Pediatrics (1982a) recommends that:

- Because children are at greater risk for developing heat-related illness such as heat stroke or heat exhaustion, precautions to be taken for their prevention are listed below in Table 3.
- Children must be monitored carefully when exercising in the heat, since they are more susceptible to heat-related illness than adults.
- The intensity of the exercise should be gradually increased over a 10-14 day period when moving to a warmer environment.
- In hot and humid environments, clothing should be lightweight in order to facilitate evaporation of sweat. In colder environments, layers of clothing provide an insulating barrier of air and can be changed as the ambient temperature increases or decreases.

Table 3
Guidelines and Precautions for Children Exercising in the Heat

WBGT°C[a] (°F)	WBT°C[b] (°F)	Changes in Activity
<25 (<77)	<15 (<59)	All activities allowed
25-27 (77-81)	15-21 (59-70)	1. Longer breaks in the shade 2. Drinking each 15 minutes 3. Alert for warning symptoms of heat-related illness
27-29 (81-84)	21-24 (70-75)	As above plus: 1. Stop activities of all unacclimatized, unconditioned, and high-risk persons 2. Limit activities of all others (drastically cut down duration of each activity, increase rest periods, disallow long-distance races)
>29 (>84)	>24 (>75)	Stop all athletic activities of all participants

Adapted from Bar-Or (1983).

[a]WBGT (Wet Bulb Globe Temperature)= 0.7 WB - 0.2 G - 0.1 DB, where WB is wet bulb, G is black globe, and DB is dry bulb, measuring humidity, radiation, and air temperature, respectively.

[b]WBT = 0.7 WB - 0.3 DB (for indoor use when radiant heat is less important).

To summarize, special precautions should always be taken when children are exercising in extreme environmental conditions. Because children have limited thermoregulatory capacities, the risk of thermal injury is much greater in children than in adults.

Fluid Replacement

Several authors have established guidelines for fluid replacement in exercising children (Nadel, 1988; Bar-Or, 1983; American Academy of Pediatrics, 1982a):

- Fluids should never be restricted during exercise.
- 2.5 cups of fluid should be consumed before practice or competition.
- At least 1 cup of fluid should be consumed every 15-20 minutes during exercise.
- The fluid should contain no more than 10-20 mEq/L of sodium and no more than 6-8% glucose or sucrose.
- The fluid should be cool (8-13° C).
- For each pound of weight lost during exercise, 2 cups of fluid should be consumed before the next exercise session.
- The exercising child should always be fully hydrated prior to exercising in either a hot or cold environment. Children should be forced to drink during exercise, since at least one study has shown that children will voluntarily dehydrate themselves during exercise (Bar-Or, 1980b).

Injury Prevention

Before beginning an exercise program, children should have a thorough physical examination. Children should wear proper clothing and footwear during exercise to reduce the risk of injuries. Warm-up and cool-down periods are essential, and children should be cautioned about abruptly increasing the intensity, duration, or frequency of exercise. To further reduce the risk of injury, children should be instructed to stop exercising if they feel any dizziness, lightheadedness, nausea, or pain.

The Effects of Resistance Training on Strength Development in Children

The benefits of resistance training in adults is well documented (Atha, 1981). However, there is considerably less documentation of the benefits of resistance training in children. Early investigators reported that strength gains were not even possible in prepubertal children (Vrijens, 1978) and that strength training could cause irreversible injury to the developing growth plates in bones (Wilkins, 1980). Thus there was not wide acceptance of prepubertal resistance training until recently.

There is substantial evidence demonstrating increases in strength following structured resistance training in children (Ramsay et al., 1990; Pfeiffer & Francis, 1986; Sewall & Micheli, 1986; Weltman et al., 1986; Servidio, Bartels, & Hamlin, 1985; Siegel, Camaione, & Manfredi, 1989; Blimkie et al., 1989). These increases are similar to those observed in older age groups. Furthermore, the safety and efficacy of resistance training programs for prepubescent children has been well documented (Weltman et al., 1986; Ramsay et al., 1990). The purpose of this part of the chapter is to review the literature regarding strength development and resistance training programs for prepubescent children.

Strength Development in Children

Adequate strength is an important part of health-related fitness and optimal physiological function for both adults and children (Pollock & Wilmore, 1990; ACSM, 1988a). It is also recognized as an important contribution to improved motor performance, self-image, and athletic performance (Nielsen, Nielsen, Behrendt Hansen, & Asmussen, 1980; National Strength and Conditioning Association, 1985). Unfortunately, it is apparent that strength, specifically upper body strength, is poor among children (Ross & Gilbert, 1985).

During the first 7 years of life, there is a steady growth of muscle tissue, followed by a slowing trend in the years immediately preceding puberty. The ability of children to develop muscular strength prior to sexual maturity is dependent upon the following: (a) rate of maturation, (b) body build, (c) hormonal influence on muscle tissue, (d) neural myelination, and (e) the type and amount of physical activity involvement.

Muscular strength is defined as the maximal force that can be generated by a muscle or group of muscles. For many years, strength development in humans was thought to be the result of hyperplasia, an increase in the number of muscle fibers (Gonyea, 1986). This theory remains highly controversial, at least in humans. Most current evidence supports the belief that increases in muscular strength due to training result from muscular hypertrophy, an increase in the size of a muscle fiber (Costill, 1979; Gollnick, 1981), and improved motor unit recruitment (Moritani & DeVries, 1979; Sale, 1988; Komi, 1986). In children, the evidence supports the belief that strength changes are primarily related to changes in neural factors rather than hypertrophy (Sale, 1989).

Changes Associated with Strength Training in Children

It is frequently cited in the literature that prepubertal children cannot increase strength through resistance training because they lack adequate concentrations of circulating androgens (American Academy of Pediatrics, 1983a; Vrijens, 1978; Legwold, 1982). Although androgens are an important contribution to the development of strength, especially maximal strength, some studies have demonstrated significant strength gains in prepubertal children (Ramsay et al., 1990; Pfeiffer & Francis, 1986; Sewall & Micheli, 1986; Weltman et al., 1986; Servidio et al., 1985; Siegel et al., 1989; Blimkie et al., 1989).

The mechanisms responsible for strength development in children following training are, for the most part, the same as those for adults, with the exception of the role that androgens play in hypertrophy. Important for children is the realization that in the early stages of training, rapid strength gains are the result of neural factors, such as increased motor unit recruitment and coordination, with perhaps some muscle hypertrophy. After several weeks, muscular adaptation, in the form of hypertrophy, begins to occur. Through playing and practicing skills, children are also able to activate and coordinate relevant muscles in such a fashion that muscular adaptations can occur.

In addition to improvements in muscular strength, other fitness and performance-related effects of resistance training include (a) increased flexib.''ty (Siegel et al., 1989), (b) improved physical performance (Weltman et al., 1986; Nielsen et al., 1980), (c) improvements in body composition (Siegel et al., 1989), (e) reduction in serum lipids (Weltman, Janney, Rians, Strand, & Katch, 1987), and (f) injury prevention through better physical preparation (Micheli, 1986). With further research, additional benefits may be realized.

Safety of Strength Training Programs for Children

The possible risks of musculoskeletal injuries associated with strength training programs for children continues to be a concern to members of the medical community (American Academy of Pediatrics, 1983a). Many of those raising concerns believe that the developing bones and musculature of young children are more susceptible to injuries than adults (Wilkins, 1980). Thus, many have recommended that children avoid any formal strength training programs until reaching puberty, at which time the epiphyses (growth plates) will have fused, making the long bones less susceptible to injuries. According to Micheli (1988):

> At the present time, there have been no epidemiological studies on the rate of injury occurring with resistance weight training in prepubescents. Therefore, the rate of injury in this activity cannot be compared to any other activity of prepubescence. As with the adult weight trainer, the potential for musculoskeletal injuries such as muscle strains or joint sprains is, of course, present. In addition, the prepubescent shares with the pubescent, or adolescent, the potential for growth plate injuries. This potential for growth plate injury may actually be less in the prepubescent than in the pubescent, however, because the growth plate is actually much stronger and more resistant to sheer stress in younger children than in adolescents.

Weltman and colleagues (1986) found no evidence of damage to the epiphyses, bone, or muscle in 26 prepubescent males as a result of a 14-week supervised hydraulic strength training program. Before and after the program, computerized musculoskeletal scintigraph studies were used to track changes in the structure of tissue and bone. The authors concluded that "supervised concentric strength training using hydraulic equipment is safe and effective in pre-pubertal boys."

Growth plate injuries have occurred in adolescents during resistance training, although they are rare (Ryan & Salciccioli, 1976; Gumps, Segal, Halligan, & Lower, 1982). The type of injury reported in the two studies cited above were wrist injuries that occurred during excessive overhead lifts. Common types of injuries associated with resistance training in adults include injuries to the back and knees. There have not been any reported cases of back or knee injuries following supervised resistance training in prepubertal children. In addition, none of the training studies in this review caused any injuries as a result of the resistance training (Ramsay et al., 1990; Pfeiffer & Francis, 1986; Sewall & Micheli, 1986; Weltman et al., 1986; Servidio et al., 1985; Siegel et al., 1989; Blimkie et al., 1989).

Prevention of Injuries

The risk of injuries to children participating in resistance training programs is low (National Strength and Conditioning Association, 1985). However, injuries can occur in any sport or strenuous physical activity. To minimize the risk of injury during resistance training, the following recommendations are suggested:

Medical Clearance. Prior to participating in a resistance training program, children should have a medical examination.

Proper Supervision. Proper supervision is perhaps the most important variable in reducing potential injuries. Not only must the supervisor be responsible for the overall safety of the facility but must also possess sufficient knowledge to demonstrate proper technique.

Training Facility. The weight training facility should be set up with children in mind. In many instances, adult facilities are not appropriate for children. Children should not be allowed to exercise unless the weight training facility is safe.

Types of Lifts. Children should never perform single maximal lifts or sudden explosive movements. Performing these types of lifts can predispose children to significant risk of injury.

Proper Breathing. Children should be taught to exhale when exerting the greatest force and to inhale when moving the weight into position for the active phase of the lift.

Recommendations for Resistance Training

The evidence suggests that strength gains do occur in children following structured resistance training programs. Although the exact mechanisms responsible for increases in strength, as well as the long-term effects of prepubescent strength training, are not completely known, recommendations for prepubertal resistance training programs are possible. Based on the results of several well-controlled investigations and several excellent reviews on the subject (Sale, 1989; Kraemer, Fry, Frykman, Conroy, & Hoffman, 1989; Micheli, 1988), the following guidelines are offered for implementing a resistance training program for children:

Resistance Training. Children should be encouraged to participate in regular exercise that involves repetitive movements against an opposing force. It is important to note that children can develop strength through a variety of activities including (a) participation in sports, (b) weight training, (c) manual resistance exercises, and (d) simply playing.

Power Lifting. Power lifting, or lifting in a competitive setting to determine the maximum amount of weight an individual can lift, is not recommended for children. This type of lifting is discouraged because of a higher risk of injury. Initially, the primary focus of resistance training should be (a) developing proper technique, (b) learning the exercises, and (c) developing an interest for lifting. Maximal lifting, 1 repetition maximum (1RM) lifting, or competitive lifting should be discouraged when working with children.

Manual Resistance Training. Manual resistance exercises use cooperative efforts between partners to develop strength. Manual resistance exercises are an ideal substitute for conventional resistance routines. For a more complete description of manual resistance see Munson and Pettigrew (1988).

Isometric Training. Isometric training occurs when muscles are contracted but do not change in length. This type of resistance training has been shown to increase muscular strength in prepubescent children (Nielsen et al., 1980). Isometric training programs, like manual resistance training, can be used as a substitute to conventional resistance training programs.

Overload. Gains in strength result from repeatedly overloading the muscle through a combination of increases in intensity and/or duration. Children's training programs need to be monitored and adjusted with time, just as with adult programs, so that muscles are stressed and forced to adapt. The components of overload are:

- **Load**—refers to the amount of resistance or weight used. Before any weight is utilized, proper technique should be demonstrated for each exercise. The next step is to gradually apply weight until the child can lift the weight for the repetition range (i.e., 8-12).
- **Repetition**—refers to the number of times an exercise is performed per exercise session or set. Children should perform 8-12 repetitions for

upper body exercises, and 15-20 in lower body exercises. Once children are able to lift a weight the predetermined maximum number of repetitions per set, then the weight or the maximum number of repetitions should be increased.

- **Sets**—1-3 sets of each exercise should be performed, utilizing approximately 8-10 different exercises. In the early stages of training, 1 set of each exercise should be performed until such time as the child has demonstrated proper form and is acclimated to resistance training.
- **Rest**—is the amount of time between sets. Children should be encouraged to rest for 1-2 minutes between exercises.
- **Frequency**—refers to the number of training sessions per week; 2-3 exercise sessions per week is recommended, with at least 1 day of rest between workouts.

Progression. As children develop strength, the training stimulus will need to be adjusted. To maintain maximal training stimulus, the resistance and/or number of repetitions must be increased. Once a child is able to lift the pre-established number of repetitions, a small (5-10%) increase in resistance should be made. When there is an increase in the weight being lifted, there should be a reduction in the repetitions (i.e., if the pre-established repetitions were 12, after an increase in weight, a new repetition maximum might be 7 or 8). As the child adjusts to the new training stimulus, he/she will soon be able to lift the new weight 12 times, at which point a new weight and repetition maximum will be established.

Specificity of Training. Training programs should be designed with specific goals and objectives in mind. The exercises chosen should reflect the desired outcome. For the majority of children, specificity of training is not as important as it will be in later years. Children should participate in a variety of activities to develop a range of skills.

Warm-up. Children should be encouraged to warm-up before lifting. Warm-up exercises increase the temperature of the muscle and increase its elasticity, both of which improve the muscle's ability to perform work, as well as reduce the risk of muscle and/or joint injury. The warm-up exercises should involve the major muscles that will be used in training. Warm-up activities might include slow jogging, brisk walking, rope-jumping followed by light calisthenics, and stretching exercises.

Cool-down. The purpose of cooling down is to lower the muscle temperature and metabolic rate. Cool-down activities are similar in nature to warm-up activities. The exercise intensity is gradually decreased, followed by a period of stretching.

Program Design

Designing fitness programs is an art as well as a science. There are literally hundreds of books available on the subject of weight training, although few that cover the special needs and requirements of children. Perhaps the single most important factor to consider when designing a resistance training program is individualization. Educators should make every effort to evaluate each child individually for his/her (a) physical and mental ability, (b) interest level, (c) prior experience, and (d) individual goals. Coaches or teachers should also make a point of communicating with the child's parents to obtain information that is useful for individualizing a program (for example, present physical activity level, past experiences with weight training, goals).

Free Weights. Free weights are the most commonly used type of weightlifting equipment available. However, free weights require greater supervision and instruction than weight machines. Proper lifting technique and safety are the two most important program variables to consider when training with free weights. Safety considerations include:

- always using collars on bars,
- not lifting more weight than one is capable of handling safely,
- using spotters at all times, and
- avoiding horseplay in the weightroom.

Proper mechanics of lifting include:

- keeping the weight as close to the body as possible,
- avoiding twisting movements when lifting,
- lifting the weight smoothly,
- lifting within one's own capacity, and
- allowing adequate rest between lifts.

Weight Machines. If hydraulic, isokinetic, or pneumatic devices are available, several factors must be considered. First, children must be fitted properly for the machines. With the exception of several companies that manufacture weight training equipment specifically for children, most exercise equipment is designed for adults. Thus, it will often be impossible to properly fit all children for certain machines. Children should never be allowed to use any exercise equipment that cannot be properly adjusted for height and body size. Second, the initial resistance will need to be established. This can be accomplished by having the subjects lift various loads until they can perform a desired number of repetitions (ex., 8-12 for upper body or 10-15 for lower body). The advantages of weight training machines over free weights are the convenience and ease of use, as well as safety. When using either free weights or weight machines, it will be necessary to modify the weight increments, since children may not be able to lift the normal weight increment of 10 pounds.

Manual Resistance. In manual or cooperative resistance training, resistance is provided by a partner. Muscles are overloaded as partners provide more resistance and/or increase repetitions. This type of program has the obvious advantage of no equipment needed, and large groups of children can participate at the same time. For a more complete review of the subject, see Munson and Pettigrew (1988).

Additional Programs. Designing programs takes a great deal of creativity. Other types of strength training programs include: using a par course, pull-ups and push-ups, using a medicine ball in group activities, and rubber exercise bands. For more information on program design, see Rupnow (1985).

Other Program Design Considerations

Resistance training should be part of a total conditioning program. Children should have time to participate in aerobic conditioning activities, as well as sport, recreational, and skill development activities. Above all, children should be taught that exercise is fun and a lifetime endeavor.

Training Considerations for Children with Special Health Problems

Children with Asthma

Several investigations have demonstrated that children with asthma can improve their fitness level without adverse effects (Orenstein, Reed, Grogan, & Crawford, 1985; King, Noakes, & Weinberg, 1989). Asthmatic children should be encouraged to participate in regular physical activities at school and after school (King et al., 1989). The benefits of such training may lead to a lowering of the intensity and frequency of exercise-induced asthma (EIA) attacks (Bar-Or, 1990). Swimming is highly recommended because it is the least asthma-provoking form of exercise (Fitch & Godfrey, 1976).

Children with Diabetes

The benefits of exercise on diabetic control are well documented in adults (Bjorntorp & Krotkiewski, 1985; Kemmer & Berger, 1984). There does, however, appear to be controversy regarding the improvement of diabetic control in children who exercise (Bar-Or, 1990). Children with controlled diabetes should be encouraged to exercise in an effort to expend energy, reduce body fatness, and improve diabetic control, since sedentary diabetic children do tend to be less fit than nondiabetic sedentary children (Etkind & Cunningham, 1972). It is important that the diet and insulin therapy be carefully controlled and monitored during the initiation of an exercise program.

Obese Children

Obesity is one of the most prevalent chronic diseases among adults and children (U.S. Department of Health, Education & Welfare, 1976). Numerous studies have demonstrated the beneficial effects of exercise, alone or in combination with dieting, in the treatment of obesity (Brownell, Kelman, & Stunkard, 1983; Moody, Wilmore, Girandola, & Royce, 1972; Parizkova & Vamberova, 1967). Other benefits of exercise for obese children include improved self-image, reductions in blood pressure, and reductions in serum lipids (Bar-Or, 1990). Exercise sessions should be structured to maximize energy expenditure (i.e., low-intensity, long-duration aerobic exercise).

Conclusion

An abundance of literature exists describing the many physiological adaptations that occur following exercise in adults. It appears that children respond to training much the same way as adults do. In fact, children may even have certain advantages over adults, including a faster rate of recovery from exercise and a certain innate drive to be physically active. With proper motivation, healthy children are eager to pursue physical activities.

Early involvement in regular exercise can have an immediate and a lasting effect on the overall well-being of the child. The benefits of regular exercise for children include cardiovascular disease prevention, reduction and control of high blood pressure, improvement in basic motor skills, prevention of injuries, improved self-confidence and self-image, early development of good posture, greater ease and efficiency in performing motor tasks and sport skills, better performance on fitness tests, early development of coordination and balance, the establishment of fitness as a lifetime interest, improved flexibility, and favorable improvements in body composition (Roberts, 1989).

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Appendix

Sample Aerobic Training Programs for Different Age Groups

Runnin

Children are less efficient at running compared to adults. Poor running economy has been attributed to greater stride frequency, as well as differences in running mechanics. Running economy does, however, improve steadily throughout childhood and adolescence.

The American Academy of Pediatrics states that, "Under no circumstances should a full marathon be attemped by immature youths, less than Tanner Stage 5" (American Academy of Pediatrics, 1982b). Heavy, prolonged distance running is not recommended for prepubescent children because of the susceptibility to trauma and chronic overload to the developing musculoskeletal system. A variety of injuries have been reported in the literature in prepubescent and adolescent long-distance runners (Caine & Linder, 1984).

As with any physical acitivity for children, the intensity, duration, and frequency should be carefully monitored. Younger children may fatigue easily when beginning a running program. Excessive running should be discouraged for prepubescent children. Once children have matured, the quantity and quality of running can be increased.

Table 4 outlines a sample running program for children. Children can progress through the different stages, based on their initial level of fitness, their adaptation to the training, and individual goals and objectives of training.

Table 4
A Running Program for Children

Stage	Week	Monday	Wednesday	Friday	Week Total
I	1	Run 1/8 mile Walk 1/8 mile Run 1/8 mile Walk 1/8 mile	Same	Same	1.5
	2	Run 1/4 mile Walk 1/4 mile Run 1/4 mile Walk 1/4 mile	Same	Same	3
	3	Run 1/2 mile Walk 1/4 mile Run 1/2 mile Walk 1/4 mile	Same	Same	4.5
	4	Run 3/4 mile Walk 1/4 mile Run 3/4 mile Walk 1/4 mile	Same	Same	6
II	1	Run 1 mile	Same	Same	3
	2	Run 1.5 miles	Same	Same	4.5
	3	Run 2 miles	Same	Same	6
	4	Run 2.5 miles	Same	Same	7.5
III	1-4	Run 3 miles	Same	Run 3 miles under 30 min.	9
IV	1-4	Run 3-4 miles	Same	Run 3 miles under 27 min.	9-11
V	1-4	Run 3-5 miles	Same	Run 3 miles under 24 min.	9-13
VI	1-4	Run 3-5 miles	Same	Run 3 miles under 21 min.	9-13

From Rowland (1990). Reprinted with permission.

Swimming

Swimming is an excellent way to develop cardiorespiratory fitness. Obviously, children should be well acquainted with water before starting a swimming training program. Table 5 outlines suggested distances for children beginning a swimming program.

Table 5
Suggested Beginning Distances for a Childr .a's Swimming Program

Age (years)	Distance (yards)
Under 8	400
8 to 10	600 to 1200
11 to 12	1000 to 2000
13 to 14	2000 to 4000

Adapted from Maglischo (1982).

Aerobic Dance

Aerobic dance has become an extremely popular forr.. of exercise. In recent years, children's aerobic dance programs have gained in popularity. In most cases, it is not recommended that children participate in adult aerobic classes. The intensity and degree of difficulty of the movements in adult classes are not appropriate for most children. Adult aerobic classes can certainly be modified for children. Listed below are some important points to consider when setting up a program or when enrolling a child in an aerobic class:

- **Choice of exercises**—exercises should be carefully chosen based on age and skill of participants. Children should b corrected when they use incorrect mechanics in performing a movement.

- **Instructor**—The instructor of a children's aerobic dance class should have some experience working with children and, if possible, have some specialized training in teaching children's fitness programs.

- **Monitoring intensity**—The instructor should explain to the class how exercise intensity is going to be monitored. With younger children, using heart rate may be inappropriate. Creating a rate of perceived exertion (RPE) scale that children can understand is often the best way to monitor exercise intensity with a group of children. Information on this is provided in chapter IV.

- **Music**—Music should be chosen that is appropriate for the types of movements being performed in the class. In addition, music should be selected that motivates children to exercise.

More complete information on aerobic dance programs for children can be found in Staver (1992).

Cycling

Most children love to ride their bicycles. Children should be carefully fitted for a bicycle. Unfortunately, because children grow so fast, parents often buy a bicycle that is slightly larger, which increases the risk of accident if the child cannot control the bike.

All children must wear a safety helmet when riding a bicycle. There are a variety of manufacturers that make excellent helmets for children. In addition, other protective gear such as gloves and elbow and knee pads are recommended.

Children should be schooled in the rules and regulations of riding in the streets. Most police and sheriff departments will come to a school or event and provide bicycle safety programs for children.

Walking

Children often do not realize that walking is exercise. Walking can be done as a group activity or individually. Children should be encouraged to progress gradually when beginning a walking program. Walking can be incorporated into a running program, too. In addition, walking is highly recommended for children who are obese or have medical conditions that limit their participation in physical activities.

V

Fitness Activities for Children with Disabilities

William R. Forbus

Introduction

Physical fitness has been defined as "a set of attributes that people have or achieve that relates to the ability to perform physical activity"(Caspersen, Powell, & Christenson, 1985, p. 129). It has also been defined by the President's Council on Physical Fitness and Sports (PCPFS) as "the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies" (PCPFS, 1971, pp. 1-2). A more recent definition is based on the health-related factors of physical fitness rather than on those factors that are skill-related. The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1989) has endorsed its National Youth Fitness Task Force report that describes physical fitness as a physical state of well-being that allows people to:

- Perform daily activities with vigor
- Reduce their risk of health problems related to lack of exercise
- Establish a fitness base for participation in a variety of physical activities. (p. 1)

Most epidemiologic studies have examined the relationship between health and exercise or physical activity, rather than physical fitness (Powell, Thompson, Caspersen, & Kendrick, 1987). While there is evidence on the effect of physical activity and exercise on coronary heart disease (Kannel & Sorlie, 1979; Kannel, Belanger, D'Agostino, & Israel, 1986; Lie, Mundal, & Erikssen, 1985; Peters, Cady, Bischoff, Bernstein, & Pike, 1983; Wilhelmsen et al., 1981), hypertension (Blackburn, 1986; Blair, Goodyear, Gibbons, & Cooper, 1984; Paffenbarger, Wing, Hyde, & Jung, 1983), diabetes (Ronnemaa, Mattila, Lehtonen, & Kallio, 1986; Schneider, Amorosa, Khachadurian, & Ruderman, 1984), osteoporosis (Cauley et al., 1986), and colon cancer (Paffenbarger, Hyde, Wing, & Steinmetz, 1984), the effects of physical fitness on the above diseases "are less well studied but are probably equally important"

(Folsum, 1988, p. 34). Levels of physical fitness should be of utmost concern based on the available data from the National Children and Youth Fitness Studies I & II (NCYFS I & II). Data indicated that only 58.9% of 5th- through 12th-graders participated in appropriate physical activity year-round (Ross & Gilbert, 1985) and current programs for 1st- through 4th-graders may be inadequate to promote lifetime physical fitness (Ross & Pate, 1987). Vogel (1986) stated that there is "convincing evidence that participation in physical education programs can improve physical fitness" (p. 498).

Fitness Needs of Children with Disabilities

As important as physical fitness seems to be to the well-being of all individuals, it may be even more essential for individuals with disabilities (Emes, 1981; Fitzgerald, 1982; Forbus, 1990; Gass & Camp, 1979; Lundberg, 1976, 1978; Rarick, Widdop, & Broadhead, 1970; Seelye, 1983). Studies have shown that children with disabilities have a significantly lower physical work capacity, a lower physical efficiency, and spend less time in daily life on heavy physical activity than do nondisabled children (Dresen, de Groot, Brandt Corstius, Krediet, & Meijer, 1982; Dresen, Vermeulen, Netelenbos, & Krot, 1982). Both low physical efficiency and low physical work capacity are considered detrimental to the performance of daily life activities. Therefore, physical fitness would not only be important for health reasons, but because some disabling conditions tend to restrict certain forms of movement, it may be "more important for individuals with mental, physical or emotional disabilities to pursue" (Morris, 1986, p. 394) an appropriate level of physical fitness.

Persons with disabilities may be more susceptible to disease and therefore must have stronger immune systems (Nosek & Nofi, 1984). These individuals may well have lived in protected environments and have a low tolerance for physical activity. Certainly, activities of daily living, even propelling a wheelchair, are not sufficient to increase cardiorespiratory functioning. A positive life-style change that encompasses aerobic activities and muscular strength and endurance training is necessary if individuals with disabilities are to reach their full potential as independent members of society.

Although the literature on physical fitness for individuals with disabilities is limited, what is available reveals quite clearly that their fitness needs "are identical to those of the able-bodied population" (Sullivan, 1984, p. 15). Sullivan (1984) has also listed several factors that contribute to the low levels of physical fitness exhibited by individuals with disabilities: (a) lack of access to facilities and programs, (b) fear of failure, (c) noncorrective postural problems, (d) lack of motivation, (e) negative attitude toward perspiration, (f) negative body image and self-concept, (g) negative attitude toward fitness, (h) hereditary qualities, (i) poor physical and motor development, (j) lack of understanding of fitness concepts, (k) sedentary life-styles, and, (l) overeating.

The achievement of total fitness is necessary in order for disabled individuals to perform activities of daily living, become self-dependent, and live healthy and beneficial lives.

Teaching Physical Fitness

At what age do we begin to emphasize physical fitness in the curriculum? Do we plan separate units on physical fitness? What are the indications and contraindications for the training of disabled individuals? How are activities modified for these populations? Are there separate equipment needs?

Values of Physical Fitness

Other than the obvious general physiological improvements of body composition, functional capacity, lowered resting heart rate, and increase in lean body mass and muscle force, there are some potential benefits of physical fitness that are specific to the student's disability or health impairment:

- Asthma
  - improves emotional well-being
  - improves configuration of the thorax and posture
  - decreases fear of exertion
  - improves overall strength and skill
  - decreases use of medication
- Diabetes
  - assists in diabetes control
  - dispels the feeling of disability
  - combats vascular disease
  - improves self-confidence
- Obesity
  - decreases body fat
  - improves mobility
  - improves self-confidence
  - reduces joint and orthopedic injuries
- Cerebral Palsy
  - improves peripheral circulation
  - improves motor control
  - improves body composition
  - improves maximal oxygen consumption
- Mental Disabilities
  - enhances cognitive development
  - improves functional performance

- Behavior Disorders
  - improves interpersonal relationships
  - increases cognitive development
  - decreases moods of unhappiness and depression
  - improves self-confidence
  - improves socialization and communication skills
- Learning Disabilities
  - improves expression
  - enhances self-confidence
  - improves cognitive functioning
- Visual Impairments
  - improves self-confidence
  - decreases "blindisms"* through self-knowledge

Physical Fitness in the Curriculum

In the elementary grades, it has been commonplace to emphasize basic fundamental skills. During the middle school and high school years, sports skills have been emphasized. From the results of the National Children and Youth Fitness Studies I & II, it is evident that programming must consider the integral role of physical fitness. We can do this at all grade levels by infusing principles of physical fitness into activities in which the primary purpose is to improve fundamental motor or sports skills. Physical fitness should be viewed in terms of the holistic approach of educating the person to improve the quality of life.

Not only is this important for individuals with disabilities for the obvious health reasons, but it is also critical for establishing a basis for independent living. A high level of physical fitness may help prepare a student for a career. Although physical fitness has been thought of in terms of educating the physical being, it should be thought of as a vehicle for enhancing the quality of life of an individual through positive life-style changes.

Physical fitness can be infused into most activities in the physical education program. This should be done at as early an age as possible. And, each year of school, more emphasis should be placed on fitness. It is important, however, to recognize the functional limitations involved and the abilities of disabled students in fitness programming. Most students with disabilities can participate normally in all activities, unless a contraindication is evident for medical reasons or functional limitations.

*Blindisms are repetitive mannerisms that are purposeless, but commonly observed in blind individuals.

General Guidelines for Instruction

- Present a variety of fitness activities based on current level of functioning.
- Use homework to encourage activity at home and in the community.
- Plan activities that are appealing and motivating such as jogging, vigorous walking, stationary bicycling, swimming, rope skipping, cycling, or wheelchair road racing.
- Use teaching stations to enhance individualized instruction.
- Use peer tutors for instruction, modeling, and reinforcement.
- Ensure the safety of all participants through adaptations/modifications.
- Approximate the regular activity as much as possible when adaptations/modifications are used.
- Use other strategies for integrating students into regular physical education classes:
  - adapt rules;
  - adapt equipment;
  - adapt space;
  - modify techniques, e.g., encourage successful approximations of a skill; and
  - vary instructional approaches.

In addition to the general guidelines listed above, instructional strategies for students with various disabilities are presented.

- Mentally Disabled
  - All activities and adaptations/modifications should be age-appropriate.
  - Offer a wide array of fitness activities.
  - Early intervention might help lessen or alleviate the low fitness levels that are evident in this population.
  - Be consistent in class structure and communication.
- Emotionally Disturbed
  - Gradually introduce new activities to the reluctant student.
  - Use appropriate behavior management techniques.
  - Use appropriate reinforcement for fitness activities.
  - Design the fitness activities in a manner that also addresses the affective domain.
- Learning Disabled
  - Infuse perceptual-motor activities with fitness activities.
  - Present activities, instructions, and class material in the dominant sensory modality.
  - The environment should be structured in such a way as to limit distractions and ensure consistency to optimize learning.
  - Be aware of any medications the student may be taking.

- Hearing Impaired
  - Use visual aids in presenting material.
  - Learn common signs for manual communication.
  - Be aware of possible balance problems and ensure the safety of the student.
  - Make sure that the student has an unobstructed view of your face when relaying instruction.
- Visually Impaired
  - Have a variety of activities to reach fitness goals.
  - Use a sighted peer tutor for activities.
  - Use brightly colored equipment and area markers.
  - Ensure that the student is oriented to the facility.

Neurological and Muscular Disabilities

- Seizure Disorders
  - Be aware of factors or conditions that might precipitate seizures.
  - Be aware of first aid procedures for seizures.
  - Be aware of the adverse effects of anticonvulsant medications.
  - Present a variety of fitness activities while ensuring the safety of the student.
- Cerebral Palsy
  - Fitness activities should be individualized as much as possible due to the variety of symptoms.
  - Students who have athetoid or ataxic cerebral palsy should have opportunities for relaxation and stabilization between fitness activities.
  - Students with rigidity need strength and flexibility exercises for agonist and antagonist muscles.
  - Students with spasticity require flexibility exercises for flexor muscles and strength exercises for extensor muscles.
- Spina Bifida
  - Be aware of fitness activities that are contraindicated because of shunts.
  - Be aware of toileting procedures (e.g., collecting bags, catheters, etc.).
  - Base fitness activities on individual needs.

Other Health Impairments

- Obesity
  - Design exercise programs that revolve around aerobic activity.
  - Work cooperatively with the parents and school dietician to develop a weight loss/management program.
  - Use appropriate behavior management techniques (e.g., contracts, positive reinforcement, etc.) when necessary.

- Diabetes

  Be aware of first aid and emergency procedures for hyperglycemia and hypoglycemia.

  Physical activity must be coordinated with food intake and insulin use.

  Fitness activities should also be coordinated with weight control and proper diet.

- Asthma

  Be aware of environmental conditions that may trigger asthma attacks.

  Be aware of any medications the student may be taking.

  Be aware of appropriate first aid procedures for asthma attacks.

  Allow periods of rest during prolonged physical activity of an intense nature.

  Monitor asthmatics closely during the postexercise period.

- Orthopedically Impaired

  Design activities and structure the facility to ensure accessibility for wheelchair users.

  Fitness activities should be selected based on individual needs and abilities.

  Modify ambulatory or locomotor activities for those with lower extremity impairments.

  Be aware of the dangers of twisting, bending, falling, and lifting motions for those students with spinal cord injuries.

Activity Modifications/Suggestions

- Cardiovascular Endurance

  Use a variety of aerobic activities to reach individualized goals (e.g., swimming, cycling, rowing machine, stair climber, jogging, vigorous walking, wheelchair road racing, rope skipping, etc.).

  Vary the duration and intensity of activities.

  Allow for rest periods during intense prolonged physical activity by utilizing an intermittent protocol.

  With younger children, use games and relays to motivate students.

  Adapt activities that promote motor development to address aerobic fitness.

  Aerobic activities can be done in the water; this environment provides support for the body and uses the water as resistance.

- Muscular Strength and Endurance

  Use weight machines such as the Universal or Nautilus fitted properly for children.

  Use manual resistance exercises when needed.

  Surgical tubing can be used to provide resistance during exercises.

Decrease the number of repetitions in an activity.
Use lighter weights when strength training.
Use a student's body weight to provide resistance for certain exercises.
Approximations of pull-ups (Baumgartner modified pull-up, Vermont pull-up, flexed-arm-hang) and push-ups (isometric push-ups, push-ups from the knees) are beneficial.
Certain exercises can be performed in the water using the water as resistance.

- Flexibility
  Passive stretching can be used with certain populations that have cerebral palsy or are in wheelchairs.
  Progressive relaxation techniques can be used in concert with flexibility exercises.
  Stretching exercises should be an integral part of the warm-up, aerobic activity, and the cool-down.
  Use slow static stretches that are more effective at increasing the range of motion rather than ballistic exercises.

Family Involvement

There are several ways that the family can become involved in fitness activities. The major factor for involvement is total compliance by all family members. Family members can reinforce each other and more time will be spent as a family unit. How can the family become involved?

- **Sign contracts**—have each family member write down one fitness goal for the month; e.g., "I want to be able to run 1 mile without stopping." Sign and date the contract and have it cosigned by another family member.
- **Exercise as a family**—agree to exercise one half hour before watching television or just before dinner. If schedules are too complicated during the week, set a specific time on the weekend.
- **Record scores**—post a chart on the refrigerator for the scores of each family member. Update the chart each time an assessment is done and record each workout. It should be remembered, however, that this is not a competition; it is cooperation. Family members should act as a support team for each other.
- **Reward achievements**—when a fitness goal is reached it should be rewarded (e.g., fitness clothing, sports equipment, etc.). When all family members reach a certain goal, reward the family as a unit with an activity that all will enjoy and participate in as a family.

Summary

It is evident that physical fitness is just as important for individuals with disabilities as for their able-bodied peers; perhaps, even more so. In addition to the obvious physiological changes that can occur are the inherent values of increased self-confidence, self-image, body awareness, and an acceptable outlet for aggression.

The key to development of fitness is that there must be sufficient intensity, duration, and frequency of activity to produce a physiological effect that is suited to the needs of the individual student. The program should be moderate to high in energy expenditure coupled with dietary control. Objectives will be dependent on the student's individual needs, interests, and initial fitness level.

Most students with disabilities can participate successfully in the regular physical education program with few adaptations or modifications. The adaptation or modification of fitness activities is a matter of common sense. One should use creativity in making changes in teaching style and activities. The modification/adaptation should closely approximate the activity. However, one must not detract from the activity for the entire class.

Teachers should discuss disabilities with their nondisabled students. Many conditions or disabilities have a social stigma attached. Respect for others' abilities as individuals is required. Able-bodied students can be used as peer tutors once they are comfortable and at ease with their disabled peers. This type of cooperation enhances the learning environment for all involved.

Physical fitness is a way of life. As students with disabilities make positive life-style changes and become more physically fit, a higher quality of life is realized. More opportunities will present themselves for involvement in athletics, community sports, and lifetime activities.

Because of federal legislation, the recent fitness boom, and the obvious benefits of physical fitness, physical educators have been made aware of the need for development of this component of life. It is the responsibility of the physical educator to assess physical fitness and to plan programs for students with disabilities, thereby enabling their participation in everyday activities and promoting a positive life-style.

VI

Weight Control and Obesity

Dianne Bartley

Obesity, a major public health problem in America today (Foster & Burtin, 1985), is defined by Dorland's medical dictionary as an "excessive accumulation of body fat" (Friel, 1968). According to Bray (1987), for 5- to 16-year-old boys and girls, fat is excessive when it makes up more than 25% of weight in boys and more than 32% of weight in girls.

Childhood obesity has become a particular concern for health professionals because precursors of the diseases associated with obesity in adults have been found in obese children (Heston, ‿3). Underscoring the seriousness of obesity is the fact that it is associated with diseases like diabetes, atherosclerosis, and hypertension (Heston, 1983; Brownell & Kaye, 1982).

Incidence of Obesity in Children

In 1979 Humphrey estimated that between 12-30% of American school-age children were obese (Humphrey, 1979). By 1987 it was estimated that there had been a 10% increase in the number of obese children from the 1960s to the 1970s, when obesity was defined as a triceps skinfold measure at or above the 85th percentile (Gortmaker, Dietz, Sobel, & Wehler, 1987). These same authors found even greater increases in the number of children who would be classified as superobese, i.e., those having triceps skinfold measures in the 95th percentile. The National Children and Youth Fitness Study (NCYFS) found that 5th- through 12th-graders had sum of two skinfold measures that were 2-4 millimeters larger than children of comparable ages 20 years ago (Raithel, 1988; Ross & Gilbert, 1985; Ross & Pate, 1987). When pre- and postpubescent children are examined separately, it is estimated that about 5% of prepubescent children and 15% of postpubescent boys and girls are obese (Lohman, 1987). For additional prevalence data, see chapter I, Table 1.

Assessment of Obesity in Children

Obesity may be assessed with growth charts or skinfold measurements. When using growth charts, pediatricians generally agree that an infant or child who is above the 85th percentile for weight in relation to length or height is classified as obese; the child above the 95th percentile is considered superobese (Wishon, Bower, & Eller, 1983).

Percent fat of children may also be estimated from skinfold measures, the most common sites being the triceps plus subscapular or the triceps plus calf. In a school setting, the triceps and calf skinfolds may be preferable, since both sites can be accessed without having children lift shirts. Charts are available that permit the teacher to estimate percent fat from the sum of skinfolds (Lohman, 1987).

Factors Related to Obesity

Childhood obesity may be promoted by numerous factors, the most prominent including improper activity, excessive television viewing, lack of proper nutrition, overeating, and heredity.

Lack of Physical Activity

In young children, lack of exercise is often related to television watching. According to the American Academy of Pediatrics, children ages 2-12 watch approximately 25 hours of television per week (Dauer & Pangrazi, 1989). Dietz and Gortmaker (1985) demonstrated that, for each hour of television viewing, a 2% increase in obesity occurred. Tucker (1986) also reported that high levels of television viewing are strongly associated with low scores in fitness tests, specifically pull-ups, sit-ups, and push-ups. This occurs for two reasons: (a) while watching television the child is usually not burning calories through exercise, and (b) at the same time, the child may be snacking on high-calorie junk foods (Groves, 1986; Tucker, 1986; Barcus & Workin, 1977; Jeffrey, McLellam, & Fox, 1982). Consumption of low-nutrition, high-calorie foods is further promoted through advertisements specifically aimed at children (Barcus & Workin, 1977; Jeffrey et al., 1982). Tucker and Bagwell (1991) summarized the situation as a cycle: television viewing increases, exercise decreases, and snacking increases. Resultant obesity further contributes to passive exercise, such as more television viewing.

Also contributing to reduced physical activity for children is the elimination or curtailment of school physical education programs as education budgets are reduced. In addition, latch-key children may have physical activity restrictions as parents, citing safety concerns, require them to stay indoors. Groves (1988) suggests that a lack of play areas and an increase in drugs and crime in urban areas interrelate to reduce children's physical activity.

Family Eating Patterns/Eating Behaviors

The entire family's eating habits can stimulate overeating in general and overconsumption of specific high-calorie foods. Therefore, and ample evidence supports this, the whole family and not just the obese child must be treated if long-term success is desired (Klesges, Stein, Eck, Isbell, & Klesges, 1991; Epstein, Wing, Koeske, & Valoski, 1987; Foreyt, Ramirez, & Cousins, 1991).

Heredity

In addition to behavioral factors, heredity may influence the development of obesity (Wishon et al., 1983; Blessing, 1986; Bouchard, 1991; Bray, 1981). It is generally accepted that some individuals are prone to excessive accumulation of fat and for them, reducing body fat is a continuous battle, while others seem relatively well protected against such a threat (Bouchard, 1991). Dr. Albert Stunkard, who has studied genetic influences on obesity, maintains that the genes an individual inherits will not themselves make the individual become obese. The genes, however, make the individual more vulnerable to environmental influences on body weight, such as improper eating behaviors and lack of physical activity (Blessing, 1986). In addition, individuals may inherit other factors that can affect fatness, such as low spontaneous activity level, suppressed metabolic rate, reduced caloric cost of exercise, and diminished diet-induced thermogenesis.*

The Impact of Obesity on Risk of Coronary Heart Disease

Coronary heart disease (CHD) continues to be the leading cause of adult death in the United States (National Center for Health Statistics, 1984; U.S. Public Health Service, 1990). The major modifiable risk factors for CHD are smoking, increased blood cholesterol and triglycerides, hypertension, lack of exercise, obesity, diabetes, and stress. (Family history, gender, and race are also risk factors, but they cannot be modified.) Several modifiable risk factors for CHD begin early in childhood, such as obesity, increased blood lipids, hypertension, and lack of exercise. In fact, CHD typically develops slowly as risk factors increase and combine.

That childhood obesity may persist into adulthood has important implications for adult risk of CHD. Over a 5-year period, Aristimuno, Foster, Voors, Srinivasan, and Berenson (1984) observed skinfold thickness distribution of 2-1/2-14-year-old children. They found a tendency for a child to maintain over time the same relative rank in skinfold distribution. The lean children usually remained lean, whereas the obese children (> 70th percentile for skinfolds, according to these authors) remained obese. Similar observations have been made by Abraham and Nordsieck (1960) and Going and Williams (1992).

*Diet-induced thermogenesis is defined as heat production in the body that results from the consumption of food.

In addition to increasing the likelihood of obesity persisting into adulthood, childhood obesity is associated with other CHD risk factors. Higher levels of systolic and diastolic blood pressure, blood triglycerides, and low-density lipoprotein cholesterol (LDL-C) have been observed in obese children, while the so-called "good" cholesterol, high-density lipoprotein cholesterol (HDL-C) was lower in obese and very obese children (Aristimuno et al., 1984; Lauer, Conner, Leaverton, Reiter, & Clarke, 1975).

Normally, blood pressure tends to be lower in children than adults and to increase with age, weight, and height. Black children tend to have higher blood pressures than White children and do not demonstrate the blood pressure-obesity relationship seen in White children (Nicklas, Arbeit, Srinivasan, & Berenson, 1991). Children who persistently have blood pressure readings at or above the 90th percentile have increased heart size, evidence of hypertensive disease (Nicklas et al., 1991).

Blood lipids change throughout early childhood; nevertheless, by the age of 2 years, the average child's total blood lipid levels are approaching adult levels. The child's blood lipid profile, however, is typically different from that of an adult. It is not until puberty that there are observed increases in very-low-density lipoprotein cholesterol (VLDL-C), LDL-C, and triglycerides, and decreases in HDL-C (Going & Williams, 1992; Nicklas et al., 1991). Obese children who have the abdominal pattern of fat deposition do not seem to have increased disease risk until sexual maturation, when the lipid profile changes (Going & Williams, 1992). The fat patterning/CHD risk relationship appears to be independent of total body fat; thus, the less obese adolescent with more abdominal fat would have greater risk than the more obese adolescent with greater hip fat.

A connection between elevated serum lipids and hyperinsulinism has also been observed in obese children (Voors et al., 1982; Deschamps, Giron, & Lestradet, 1977). The association of obesity, insulin resistance, and diabetes mellitus has been well documented (Gibson, Horton, & Whorton, 1975; Stamler & Stamler, 1979). Nicklas et al. (1991) suggest that with mild obesity (as low as 15% above ideal body weight), a strong relationship will be displayed between cardiovascular risk factors and underlying deviations in carbohydrate and lipid metabolism.

Impact of Obesity on Physical Development and Performance

Obesity has a cumulative negative effect upon the physical characteristics of the child. Because of overnutrition and greater body mass, obese children typically display advanced skeletal maturation, resulting in longer and thicker bones. During the process of maturation, greater accumulation of lean tissue and greater height are also observed (Garn, Clark, & Guire, 1975). Heald (1975) suggests that early skeletal maturation may later be a disadvantage to the obese child. If the epiphyses (growth plates) close earlier, there will ultimately be less height and shorter stature.

Although obese children display greater total lean body weight than their nonobese counterparts, they also display a higher percentage of body fat and a lower proportion of lean tissue to total body weight. The greater percentage of body fat will eventually neutralize gains in motor performance and strength, which the child may have demonstrated earlier as a result of greater weight and height. A higher percentage of body fat has been shown to be associated with poorer performance in the AAHPER physical fitness tests (Cureton, Boileau, & Lohman, 1975).

Reduced movement efficiency may also be the result of anatomical differences such as rounded shoulders, abdominal distention, flat feet, knock knees, ankle pronation, and sway back (Heston, 1983; Sherrill, 1976). Increased fat deposits in the inner thighs may widen the child's base of support and further hamper smooth locomotion. Mayer (1975) observed that the obese child may have difficulty in performing rhythmic movements of large muscle groups, further impairing locomotor skills.

The lack of motor proficiency may be inadvertently emphasized by lack of encouragement from adults and perhaps even ridicule from peers. This may cause the obese child to avoid pursuing motor skills and, subsequently, to a lack of participation in aerobic activities and sports. Heston (1983) suggests that physical educators must first present equal opportunities for obese children to learn and participate in the regular school physical education program. At the same time, there may be advantages to a school-sponsored obesity intervention program of which physical activity would be an essential component. Nutrition education and family involvement should also be components of this program.

Psychological Impact of Obesity

Obese children are at greater risk for developing psychological and social problems than nonobese children, and this psychological burden may be the greatest adverse effect of obesity on children (Consensus Conference Statement, 1985). Prejudice against obese individuals has been observed in children as early as 6 years old (Wadden & Stunkard, 1985). It is also well documented that older obese children and obese adults are subjected to more ridicule and are perceived as less likeable and desirable than those who are nonobese (Wishon et al., 1983). If an obese child accepts the negative evaluations and prejudices of others, low self-esteem may result.

It is the responsibility of the physical educator to not allow ridicule in class and to afford situations that will build self-esteem in all children. Competitive activities should be de-emphasized, since the purpose is to allow the obese child to participate in the activity to produce a caloric deficit, while at the same time afford a positive learning environment. The positive attitudes that the physical educator instills in children toward physical activity may last a lifetime.

Parent education should be another focus when dealing with obesity in children. When prevention of childhood obesity fails, parent education should focus on psychological issues as well as increasing the child's self-esteem (Summerfield, 1990).

Intervention and Treatment

A variety of approaches have been found to be effective in the treatment of childhood obesity, including behavior change, diet modification, and exercise programs. Increasing the child's physical activity is particularly effective, since it not only reduces body fat but also reduces disease risk and improves health.

Becque, Katch, Rocchini, Marks, and Moorehead (1988) provided an in-depth investigation of intervention and treatment for obese children who averaged 12 years of age. Children were put into one of 3 groups for 20 weeks: control group; diet and behavior modification; or exercise, diet, and behavior modification. Caloric intake was set to permit a weight loss of 1-2 pounds per week. Exercise consisted of 50 minutes of flexibility and aerobic activities, 3 times per week. Behavior modification sessions were held once per week. The subjects in the control group were encouraged not to change their basic life-style, and they were given a postintervention questionnaire in order to verify any behavioral change.

Initially, study children had triglyceride levels above 100 mg/dl, HDL-C levels less than the 10th percentile of the Lipid Research Center, and total blood cholesterol levels greater than 200 mg/dl, factors representing moderate CHD risk. Systolic blood pressures were from 1-3 standard deviations higher than mean values for their sex and age. At the same time, these subjects displayed a low physical work capacity, and 61% of the children had a family history of CHD.

After treatment, the control group was found to have a 10.3% reduction in total CHD risk (the modifiable risk factors: triglycerides, total cholesterol, HDL-C, systolic and diastolic blood pressure, body fat, and physical work capacity). The diet-behavior group showed a 14.8% reduction of total risk, and the exercise-diet-behavior group a 41.4% reduction. The 41.4% decrease in risk was significantly greater than that of any other group.

The data further demonstrated the possibility of reducing CHD risk by dietary change and exercise, without a significant reduction in body weight and body fat. The authors suggested that exercise was the treatment variable that had most likely altered the multiple CHD risk for these obese children. They further stated that most of the subjects in the exercise-diet-behavior modification group had four or more risk factors at the beginning of the study and three or less at the end. However, in the other groups, only a few subjects dropped below four risk factors by the end of the study. The American Heart Association is in agreement that exercise is important to obtain and maintain a more efficient cardiovascular system and also in reducing the risk of atherosclerosis (Riopel et al., 1986).

The role of exercise in the intervention and treatment of hyperinsulinism and its relationship to obesity is addressed by Parker and Bar-Or (1991), who suggest that one benefit of exercise is that plasma insulin concentrations are decreased and cell receptor sensitivity to insulin is increased. This results in improved glucose tolerance. The exercise-insulin relationship was documented in adolescents by Nichols, Bigelow, and Canine (1989), who provided 14 year olds with 30-60 minutes of aerobic training, 2-3 times per week for 6 weeks. As a result of training, the subjects demonstrated a reduced insulin response to a glucose load, indicating improved glucose tolerance.

Exercise

The exercise component of an obesity treatment program should be at least 20 minutes long, with an added warm-up and cool-down period. Aerobic activities such as brisk walking, dancing, stationary or moving bicycle, step aerobics, and aerobic games may be used. Some basic strength exercise may also be utilized, using as resistance either the body or exercise bands. The exercise session should remain at a moderate intensity and be performed for time (duration) rather than for speed (intensity), in order to allow for a higher degree of fat burning. Very vigorous and high-resistance activities, such as chin-ups, push-ups, and rope climbing, should be avoided. Above all, the session should be fun and, ideally, involve the whole family. Maione (1989) offers excellent suggestions for program design.

Nutrition

Proper nutrition is an integral part of the obesity intervention and prevention program. Proper nutrition must start as early as during pregnancy, as some research suggests that one period of fat cell growth is during the last trimester of pregnancy (Leibel, Berry, & Hirsch, 1983). Preventive nutrition is lifelong.

Two of the greatest contributors to poor nutrition in childhood are excess dietary fat and sugar. Dietary fat is the more obvious obesity-producer, although dietary sugar has been shown to cause severe obesity in rats. When rats ate either high-sugar or high-fat diets or a diet rich in both sugar and fat, they developed obesity, even when there was not an excessive caloric intake (Oscai, Miller, & Arnall, 1987).

Berenson, Srinivasan, Nicklas, and Webber (1988) stated that children 6 and over consume 36% of their calories from total fat, 14% of calories from saturated fat, and 249 mg (females) to 305 mg (males) of cholesterol per day.

It has been recommended that children over the age of 2 years consume (a) no more than 30% of total calories as fat, (b) no more than 10% of calories as saturated fat, and (c) less than 300 mg cholesterol per day (Riley et al., 1986; Newman et al, 1986; Snetselaar & Lauer, 1991). This is considered the step one diet by experts from the National Cholesterol Education Program (NCEP) and is suggested as the first phase of dietary change for children with an abnormal lipid profile (Nicklas et al., 1991). It should also be noted that these dietary recommendations are the very same as those recommended for the general population by the American Heart Association and are quite similar to those of the American Institute of Cancer Research (Boyle & Zyla, 1992).

If the step one diet does not seem to be working, the NCEP panel recommends the step two diet, with no more than 7% of calories from saturated fat and less than 200 mg of dietary cholesterol per day. This diet requires careful planning and the assistance of a registered dietitian or qualified nutritionist.

Six- to 12-year-old children following a step one diet should obtain most of their calories from breads, cereals, and pasta (preferably whole grain), and fruits and vegetables. If the child participates in vigorous activities and seems to be a voracious eater, let whole grains, cereals, pasta, fruits, and vegetables comprise the bulk of extra food intake, including snacks. Some ideas for low-fat healthy snacks are fruits, raw vegetables with buttermilk dip, low-fat cheese and yogurt, whole-grain crackers, fruit juices, low-fat milk, and plain popcorn (Boyle & Zyla, 1992). Fat and sugar intake should be controlled to counteract obesity. In general, children should not follow a very low-calorie diet. They should be assisted in growing out of excess weight through careful monitoring of the type and quantity of food eaten. When children choose foods without parental control, the food is usually of poor nutritional quality (Klesges et al., 1991).

Behavior Modification

Behavior modification seems to be more useful if the entire family is involved (Epstein et al., 1987; Foreyt et al., 1991), although older children may have greater success if their behavior change sessions are conducted separately from their parents (Blessing, 1986). In school-based programs, a team approach involving the physical education teacher, classroom teacher, school nurse, school counselor, and family is appropriate. The Heart Smart Program, described in chapter VII, is an excellent intervention for obese children (Downey et al., 1987). In addition to behavior change strategies, the family should be taught how to increase physical activity and basic principles of nutrition.

Conclusion

In conclusion, it seems that improper nutrition and low levels of physical activity are major contributors to an increased incidence of childhood obesity. Professionals have a responsibility to educate the child and the family, if possible, about good health habits and to maximize opportunities for enhancing the obese child's self-esteem.

VII

Fitness Education: A Comprehensive Multidisciplinary Approach

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Introduction

Recent studies have indicated a downward trend in mortality rates attributable to cardiovascular disease (CVD) (Kannel, Doyle, & Ostfeld, 1984). This trend has established the concept that heart disease is preventable. According to Stamler and Liu (1983), more than two-thirds of all coronary deaths in the prime of life can be avoided. Despite encouraging reductions, however, heart disease remains the leading cause of death in the United States (Thom, Epstein, & Feldman, 1985).

Biomedical researchers and epidemiologists are in agreement that chronic disease development is not solely an inevitable consequence of aging or genetic makeup. A general consensus exists regarding the importance of life-style alterations in reducing the risk of CVD and other disorders (Pyorala, Epstein, & Kornitzer, 1985). The risk factors associated with CVD are potentially modifiable in that people can stop smoking; lose weight; reduce dietary fat, sodium, and sugar; and participate in regular exercise. In order to establish positive, healthy behaviors, intervention should begin in childhood prior to the development of poor health habits such as smoking, a diet high in fat, and sedentary life-styles.

The Bogalusa Heart Study

The Bogalusa Heart Study is an ongoing epidemiologic investigation of over 8,000 children in the community of Bogalusa, Louisiana. The investigation has compiled the world's largest data bank on risk factors in children during the last 18 years. Observations show the precursors of heart disease begin at a young age with many youngsters already possessing one or more of the known clinical risk factors—hypertension, obesity, and adverse lipoprotein changes (Berenson, 1986). The study also indicates that, in a manner similar to what happens to adults, a clustering of risk factors occurs in children, particularly in later childhood, allowing for the identification of groups of children at relatively high and low risk for heart disease. In light of this evidence, there is a clear need to intervene at an early age in order to facilitate positive, long-term heart healthy habits.

A Comprehensive Multidisciplinary School-based Approach

Since over 95% of children 5-18 years of age attend elementary and secondary schools, cardiovascular (CV) school-based interventions are by far the most efficient means to screen and educate youngsters regarding CV risk factor reduction (DeAngelis, Berman, Oda, & Meeker, 1983).

Heart disease is multifactorial; therefore, the intervention modalities in a school-based program should be broad-based (Berenson, 1986). Although there is strong support for a comprehensive model, most programs tend to be unidimensional in approaching reduction in risk factors (Robinson, 1984). Ten CV youth intervention studies currently being funded through the National Heart, Lung, and Blood Institute (NHLBI) indicate that the projects are typically aimed at one or two grade levels and target one or two intervention areas, such as blood pressure or diet. Walter and Wynder (1989) report there have been favorable yet small effects on CV risk factor reduction after a decade of investigation with the Know Your Body Program, an elementary health education curriculum designed by the American Health Foundation. The authors report, however, that one of the limitations of their research was not having involved the entire school environment in the intervention.

Research on effective schools has indicated the need for a more comprehensive, unified philosophy within the classroom rather than the traditional fragmentation that has existed in the United States for many years. Elementary schools adopting the whole language approach, for example, are reflecting positive gains through the use of subject matter integration, student choice, success-oriented activities, and parental support (Holland & Hall, 1989).

Health and fitness programs that model a similar integrative approach are needed in our schools. Children should receive positive reinforcement about physical activity from the physical educator, classroom teacher, parents, school nurse, principal, etc. This approach will allow children to perceive the benefits of a healthy life-style in a relevant and meaningful manner throughout the total home-school environment.

Recently, the New York State Association for Health, Physical Education, Recreation, and Dance adopted an integrated, multidisciplinary approach to teaching physical education. The model purports a total education theme with wellness as a significant component. In this model, the mental, physical, and emotional aspects of a healthy life-style are the major thrust (Feingold, 1991).

In 1988 the American Heart Association (AHA) adopted the school site as its top priority and, for the first time, noted the area of prevention to be a viable alternative to the risk of heart disease. In 1991, the New York Nassau region of the AHA embraced a more comprehensive approach to the school site, incorporating the entire school population with support from classroom teachers, physical educators, PTA, and family to facilitate a positive change (Virgilio, 1990).

The Heart Smart program will be utilized in this section to describe one prototype of a comprehensive, multidisciplinary school-based model.

The Heart Smart Program

Based on the research findings of the Bogalusa Heart Study, a CV health-fitness intervention model for elementary school children was established, having as its overall aim to develop, implement, and evaluate a school-based heart health promotion program entitled Heart Smart. This was accomplished through the modification of existing school structures such as school lunch, the physical education program, school health services, staff development, school-wide events, and parent-community involvement. Heart Smart is unique in that it is a comprehensive program intervening upon a total school environment (K-6). The theoretical framework is based on the social learning theory that integrates learning through behavioral and cognitive approaches (Bandura, 1977). The model established the elementary school as a positive, supporting environment to develop and acquire knowledge, attitudes, beliefs, and behaviors for the promotion of long-term heart healthy habits.

Collaborative Efforts of Medicine and Education

Historically, the medical model has focused on disease, a doctrine of specific causes, reductionism, dualism (body/mind), paternalism, and passivity of person, whereas health and physical education emphasizes health and wellness, the holistic nature of the person, cooperative interaction with persons, and active self-responsibility for one's health (Bartlett & Windsor, 1985). Marshall and Wuori (1985) indicate that medical and educational domains often have problems communicating and working cooperatively but do emphasize the need and the desirability for such interaction.

The Heart Smart research team is a collaborative, multidisciplinary effort comprised of physicians, nurses, biomedical researchers, sociologists, psychologists, nutritionists, health educators, physical educators, and school teachers (Downey, Cresanta, & Berenson, 1989). Professionals from the Louisiana State University Medical School, the University of New Orleans, and the Jefferson Parish School System teamed up to create the National

Research and Demonstration Center-Arteriosclerosis (NRDC-A), the Bogalusa Heart Study, and the Heart Smart program.

Stuart (1984) stresses the importance of both medical schools and universities accepting responsibility for meeting community health needs, if they are to remain leaders in the health care field. Interaction between medicine and education is essential with a merging of both viewpoints to target health problems for risk factor reduction and to improve the health status of the nation (Downey, Greenberg, Virgilio, & Berenson, 1989).

Intervention Modalities

Staff Development

In order for any change to be successful in a school setting, support is required from all staff members to accomplish implementation, adoption, and diffusion of the program. Additional support is also needed from parents and community members, such as pediatricians and representatives from local health agencies.

Teachers who realize the value of health-enhancing behaviors may serve as excellent role models and potential change agents. The staff development program, or teacher inservice education, is a critical facet of the total Heart Smart program. The major goal is to provide a solid foundation in CV disease prevention and health promotion for the staff, so that teachers understand what they are teaching and why they are teaching it (Downey et al., 1988).

Teachers attend a 21-hour staff development program consisting of inservice workshops, special classes such as aerobic dance, and booster sessions conducted at the school by a multidisciplinary team of subject matter specialists. Regardless of grade level, all teachers (K-6) receive the same content information, materials, and demonstrations in:

- introduction to wellness and heart health education;
- CV disease;
- risk factors for heart disease;
- health behavior—self-concept, coping, stress, and smoking;
- nutrition; and
- exercise concepts and activities.

Subsequent meetings follow to plan specific curricula at the three grade levels: kindergarten, 1-3, and 4-6.

Classroom Curriculum

The classroom serves as the primary vehicle for the core content of Heart Smart. The American Heart Association's Heart Treasure Chest Kit (1983) was modified and adopted for kindergarten. It includes a curriculum guide, background information, parental involvement techniques, an audio tape, and a filmstrip, to help implement key concepts. In grades 1-3 Juno's Journeys

(Lieberman, Parms, & Vogt, 1984) from the American Health Foundation is integrated into the curriculum.

The NRDC-A staff developed curricular materials for grades 4-6. Four modules—CV health, behavior skills, eating behavior, and exercise behavior—were developed and implemented. Activities within each module include those designed for transfer of knowledge, development of cognitive thought processes, skill development, and practice. A total of forty 1-hour lessons were planned each year for grades 4-6.

A teacher's guide was developed for each grade level, with activity books for students. Classroom teachers decided how to use the content lessons in their curriculum. Several teachers integrated the materials with science, math, and language arts through a learning center approach. Others taught the lessons as separate classes. Teachers making decisions on curriculum integration and format is critical to the process, for it places them in a shared ownership position.

Physical Education "Superkids-Superfit" (Virgilio & Berenson, 1988). This component is implemented through the physical education program at each school. The approach centers on activities that are success-oriented, where each student is encouraged to improve his or her own fitness level. Also, the Superkids-Superfit model accentuates that fitness is fun. Students are socialized to appreciate exercise and vigorous play as an expressive part of their daily lives, which can be shared with friends or family or enjoyed on an individual basis (Virgilio & Berenson, 1988).

In grades K-3 a number of creative games were designed that include a high amount of physical activity. Each game has a fitness concept that is reinforced through play. In grades 4-6, the facilitation of exercise concepts is more concrete through 12 specific lesson plans. Concepts such as, "What is Fitness?," "The Components of Fitness," "Stages of a Workout," "Resting and Training Heart Rate," "Weight Control and Exercise," "FIT (Frequency, Intensity, Time)," "Prime Muscle Movers," and others are integrated throughout the school year. Following the 12 lessons, the physical education instructor follows with an individual and team sport curriculum, The major difference between this and other programs is that the first 15 minutes of each class is spent on flexibility, strength, and muscular endurance, and vigorous physical activity, as well as a fitness concept. Furthermore, during the school year, fitness is integrated into sports by modifying traditional sports and skill drills to include a greater amount of physical activity.

Modifications are made for developing fitness programs for students with physical disabilities, especially those who are severely disabled. Goals of the program depend to a great extent on the severity of the handicapping condition. When developing fitness programs for students with disabilities, several guidelines must be considered.

- Determine the purpose of developing fitness. Programming can be thought of as a continuum of performance-related fitness goals ranging from basic stability to competitive sport (Short, 1990).
- Modify the intensity, duration, and frequency of the program. This is important for students with low fitness levels.
- Modify the method of instruction. For example, instruction through pictures instead of words may be employed.
- Modify the activity. For the physically disabled participant, the intensity, duration, and frequency may not change, but the activity itself often needs modification. For information on this particular topic, see chapter V.
- Include functional activities. It is important that activities are taught that can be performed in the community and are not restricted to the school environment.

Children also develop personal exercise plans through an individualized log book. The log includes a contract to exercise, daily diary, profile sheet, fitness score graphs, and long- and short-term plans with schedules (Virgilio, Serpas, Harsha, & Berenson, 1987).

Numerous school-wide strategies were devised to reinforce the Superkids-Superfit model. All students (K-6) were involved in a spring fitness field day and a geography run from Louisiana to Disneyland. Each time the school reached a different state, the school cafeteria would appropriately modify the menu (Texas—barbecued chicken; New Mexico—taco salad). Additional activities included an afternoon perk-up, a voice-cued exercise tape broadcast over the school's public address system; an aerobic dance class for teachers and parents after school; and a 10-minute aerobic tape for each classroom teacher to use during the day, especially when the children were not scheduled for physical education. The Superkids-Superfit model extensively incorporated the support of parents through the family health promotion intervention.

Family Health Promotion

The family unit serves as a focal point from which children's attitudes, beliefs, and behaviors are developed. Family involvement is facilitated through parent education that incorporates a monthly newsletter, weekly seminars, conferences, PTA demonstrations, parent resource rooms, and health fitness fairs. School participation is accomplished by utilizing parents as aides, volunteers, facilities and equipment helpers, school governance committee members, and observers. Finally, home-based activities are encouraged through family games, family contracts, homework helpers, designing neighborhood fitness trails, and wake-up workouts (Virgilio, 1990). This model is coordinated through monthly evening sessions held in the school cafeteria. Professionals work with children and parents in groups as well as individual family-based counseling. Incentives are used as a motivational tool for participation and contract completion (Johnson, Nicklas, Arbeit, Franklin, & Berenson, 1988).

School Lunch Program

Eating behavior is addressed within both the classroom and lunchroom education. The classroom focuses on knowledge transfer and skill development, and the lunchroom serves as an intervention site where sodium, fat, and sugar levels in quantity recipes and commercial products are decreased. The school cafeteria becomes a laboratory within which to experiment and evaluate specific food selections and eating behavior change.

CV healthy choices complement the regular school lunch menu. The USDA Offer vs. Serve program was modified so it allowed children to choose between the regular school lunch—hot dog with chili—or the CV healthy choice—tuna sandwich with carrot sticks, or salad bar—where students designed their own lunch. The director and area cafeteria managers met regularly to plan menu alterations and food service delivery. This process requires institutional changes of food procurement and training of food service workers (Nicklas, Arbeit, Johnson, & Berenson, 1988). The amount and type of snack food sold and distributed on school grounds was monitored. Through communication with the homeroom parents, refreshments served at parties during the school year were modified and CV healthy choices were also available.

Health Services

A comprehensive health screening for children, parents, and the elementary school staff is provided free of charge on a volunteer basis to assess clinical CV risk factors. The CV screening includes measurement of height, weight, triceps and subscapular skinfolds, multiple blood pressure readings, and fasting venipunctures for serum lipid and lipoprotein analysis. Children are also assessed on various fitness components using AAHPERD's Physical Best test (1989). Interpretation of screening results are provided for both children and adults with medical referrals and follow-up offered for those considered high risk.

Conclusions

Cardiovascular (CV) risk-related behavioral patterns are acquired during childhood. Therefore, CV intervention must begin at an early age. The Heart Smart program is a comprehensive CV health-fitness model for school-aged children, which incorporates concepts from social and behavioral learning theories to facilitate long-term commitment to positive CV health habits. This program exemplifies a model in which the total home and school environment has been impacted upon to stimulate behavioral change. Clearly, there is a need throughout the nation to adopt a similar model, in which physical education, health education, health services, and medicine team up to develop a wellness model for our schools. Utilizing a more collaborative approach will enhance efforts to influence positively administrators, classroom teachers, school lunch directors, and parents. In time, we will be able to adopt a total team effort, one that will affect legislation, school policies, television advertisements, and, in turn, a society that is reflective about reducing the risk of heart disease.

VIII

Family and School Partnerships in Fitness

Chris A. Hopper

A major dilemma in children's health promotion is how to involve parents in those efforts. There is growing awareness that physical education has the potential to be an important factor in overall health (Sallis & McKenzie, 1991). However, school programs in physical education can only go so far in promoting physical fitness. Activity levels at home and during vacations will affect children's physical fitness. Therefore parents need to be involved and understand the concepts of physical fitness and be aware of how activity levels will affect their own and their childrens' physical fitness. Joint efforts between parents and schools seem to be an ideal approach to health promotion.

The challenge for program designers is to provide options that include as many families as possible. The traditional nuclear family with two parents is not always representative of home environments, so the single-parent family must also be considered by program planners. Including parents will not be an easy task. Gaining the support of the majority of parents has not been successfully achieved by classroom teachers. In addition, parents will have many different opinions and perspectives on physical education. Their own experiences at school in physical education are likely to influence their willingness to participate. There is much to be done to educate parents.

Sallis and Nader (1990) indicate that the family is a powerful influence on promoting health behaviors, including physical activity. Parents serve important health-related roles for their children, as models of appropriate behavior, as gatekeepers to opportunities and barriers, and as a major source of reinforcement in most children's lives (Perry et al., 1988). Although the influence of parents on children's health behaviors is known, the issues of how to modify that influence to be more health-enhancing has not been adequately established.

The National Children and Youth Fitness Study II (Ross, Pate, Caspersen, Damberg, & Svilar, 1987) provided valuable information on activity levels of parents with children in grades 1-4. Results indicated that 58% of mothers and

62% of fathers said they did not exercise at all with their child in the typical week. Mothers exercised with equal frequency with sons and daughters. However, fathers spent more time exercising with sons. This imbalance was most pronounced in grade 4. In self-reports of activity participation 42% of mothers and 48% of fathers did not participate in any vigorous activity each week. Only 29% of mothers and 30% of fathers reported exercising 3 or more days per week.

Rationale for Parent Involvement

Parents are important targets for physical fitness programs because they act as role models for their children. Also, there is some evidence that interventions that influence family attitudes and habits are likely to promote long-lasting health behavior changes (Crockett, Mullis, & Perry, 1988). In addition, parents are at least approaching an age when cardiovascular disease may begin to manifest; therefore, they can benefit from relevant information regarding exercise.

Virgilio (1990) summarizes the major goals for parent involvement in physical fitness programs for children. These include making parents aware of their responsibilities for the health and fitness of their children, educating parents about the benefits of physical activity, increasing physical activity and skill levels of parents and children, and most importantly having parents become allies with children for supporting healthy life-style changes. Although the benefits of parent involvement are many, the methods to attain extensive family support and involvement have yet to be established. Successful parent programs to date (Epstein, Wing, Koeske, & Valoski, 1987; Taggart, Taggart, & Siedentop, 1986) have been implemented with small selected groups.

Review of Research

Approaches to improving the health behaviors of families have typically targeted parents. In the Oregon Family Heart Project (Hollis, 1984), randomly selected families were recruited to participate at monthly evening sessions in a long-term gradual process of health behavior change. In the Bogalusa Heart Study (Berenson, 1980), an epidemiologic investigation of 8,000 children in Louisiana, parents participated in the school-based Heart Smart component. Heart Smart used family modeling activities and a monthly newsletter, *Heart Smart Gazette*. The newsletter focused on health topics with suggestions for family activities (Downey et al., 1987).

Social learning theory (Bandura, 1977), which emphasizes modeling, rehearsal, practice, goal-setting, cueing, and reinforcement of desirable behaviors by significant others, including family members, has been incorporated in various ways into programs to improve children's fitness. Training parents in behavioral management techniques has been found effective in helping overweight children to maintain improved weight status (Israel, Stolmaker, & Andrian, 1985) and in helping low-fitness children to increase their physical activity levels and fitness scores (Taggart et al., 1986). Behavioral counseling of family groups in evening and weekend sessions has also been reported effective in producing heart healthy dietary changes in children and their family members (Nader et al., 1983; Nicklas, Johnson, Arbeit, Franklin, & Berenson, 1988). In a weight-loss program involving behavioral therapy sessions for children and their parents, obese children showed greater weight reduction and maintenance in a condition targeting both children and their parents than one targeting only children or targeting no one in particular (Epstein et al., 1987). In a program (Epstein, 1984) using behavioral contracts between parents and children, a diet and exercise intervention produced weight losses that were maintained up to 10 years (Epstein, Valoski, Wing, & McCurley, 1990).

Such programs, which work directly with parents and family groups, however, have been found to be complicated and expensive to conduct, and many parents indicated a reluctance to attend a series of evening or weekend sessions (Hollis, 1984; Crockett, Perry, & Pirie, 1989). Hollis reported that of a group of randomly selected families recruited to participate at monthly evening sessions in a gradual process of health behavior change, 53% of the families did not participate. Participants had higher occupational status, more knowledge about cardiovascular diseases and obesity, and a greater feeling of control over their health than nonparticipants. In a marketing survey of parents, Crockett et al. (1989) found that over 50% of the parents rated evening meetings with other parents and university staff to learn more about nutrition "not of interest" to them. The approaches that the parents rated as most interesting were informational sheets, which could be put on the refrigerator, followed by worksheets and activities, which they could do with their children, and homework about health, which they could help their child do.

Petchers, Hirsch, and Bloch (1987) investigated the effects of a within-school heart health curriculum, with and without an added family information component, in which brochures containing information and suggested activities were sent home with the children. They found no significant advantage of the added take-home informational brochure component over the school curriculum in improving children's health knowledge, attitudes, and food choices. Perry et al. (1988) compared a completely school-based nutrition program involving children within the school setting to a completely home-based program involving a correspondence course. In the home-based program, activity sheets were mailed to the parents to complete with the children, and reinforcers were contingent upon family completion of home activities. While the children in the within-school condition gained more knowledge than children in the home-based condition, the children in the home-based correspondence condition showed lower saturated fat intake and more healthy foods in their homes at post-test than within-school and control children.

Attempts to promote childhood physical fitness with family involvement have achieved mixed results. Nader and colleagues (Nader et al., 1983; 1989) completed two studies in which families of 5th- and 6th-grade children were recruited through schools. Both studies included nutrition education and attempted to modify dietary behaviors. No effect was found on physical activity or fitness of children and their parents; however, subjects showed improvement in other targeted health indicators including blood pressure, dietary behavior, and health knowledge. In a study that targeted Black American families with a community center-based project (Baranowski et al., 1990), no increase in physical activity was found. Families participated in a 14-week program that included education and fitness sessions. Participation was low at the end of the program (20%), and no differences were detected between experimental and control groups on indicators of cardiovascular fitness.

Although an increasing amount of research is being conducted on the role of the family in health promotion, a consistent strategy for change has not emerged. Successes have been limited to a few specific groups. In addition, the channels of communication about health behavior and exercise that exist within and between families have not been adequately described or used in programs.

Program Options to Include Parents

Virgilio and Berenson (1988) and Virgilio (1990) provide examples of how parents can be included in physical fitness programs. A variety of options are available to help improve the exchange of information between teachers and parents. Virgilio (1990) suggests newsletters, parent seminars, physical fitness report cards, parent-teacher conferences, PTA physical education evenings, and a health-fitness fair as techniques to communicate with parents regarding the importance of physical fitness and its role in health promotion.

Also, parents may be able to assist the physical education teacher in school-based activities through serving as aides, helping build or repair equipment, and becoming an advocate for physical education with administrators (Virgilio, 1990). Home-based activities offer opportunities to support school learning. Virgilio suggests family games such as Fitness Fortune (parents and children challenge each other in a fitness game using aerobic dollars) and Play Acting (a family writes a script for a short scene around a theme such as fitness), family activity contracts, homework, and summer activity suggestion packets as program options to facilitate family activity. Chapter VII provides additional program ideas.

Physical Fitness Programs with Parental Components

Physical Best. Physical Best (AAHPERD, 1989) is a comprehensive physical fitness assessment and education program. It consists of a health-related fitness assessment, an educational kit, and a set of awards. A letter to parents is included as part of the kit, but only to introduce the program. There is a strong need to include materials in this program so that teachers can work more effectively with parents.

Feelin' Good. The Feelin' Good program is an individualized discovery-oriented cardiovascular health program for children and youth (grades K-9). It includes specific learning activities that parents can complete at home with their children (Knuntzleman, Runyon, & McGlynn, 1982). A variety of fitness discovery learning experiences for specific grade levels are supplemented by questionnaires, family contracts, and special family fitness activities.

Know Your Body. The Know Your Body program (Cross, Cohn, & Resnicow, 1988) is a school-based health promotion curriculum for students in grades K-7. This program includes involvement from parents, community organizations, and school food services. It is designed to provide a basis for lifelong awareness of disease-preventing and health-promoting habits.

Superkids-Superfit. The Superkids-Superfit program (Virgilio & Berenson, 1988), was part of the Bogalusa Heart Study, an epidemiologic investigation of 8,000 children in Bogalusa, Louisiana. The program included an exercise curriculum, community and school-wide intervention strategies, parent education, and evaluation techniques.

Summary

Is it possible that the influence of teachers has been overemphasized? The greater part of a child's life is controlled and influenced by parents, and teachers should realize that parents can be allies in promoting learning (Wilcox, 1988). To date the greatest parental involvement in schools occurs in special education. Indeed, special educators are obligated by law to work closely with parents. Often the results of close teacher-parent collaboration are significant improvements in learning.

Currently, parents are being asked to participate more actively in their children's education; therefore, this is a critical time for physical educators to develop a carefully thought out campaign to secure parent support for physical education and especially physical fitness. Also, the evidence from research suggests that family-based interventions can be successful. An organized approach sponsored by professional organizations seems essential for these reasons.

The trend toward teaching knowledge of lifelong physical fitness concepts in schools is encouraging. However, the lessons learned from health education in the 1970s have important implications. There is a need for exercise programs to interface with other life-style education strands that are present in schools such as nutrition and drug education. Health education before 1980 (Perry et al., 1990) was primarily concerned with increasing knowledge about health. Lack of change in behavior forced health educators to rethink their methods. Guided by behavioral models from social psychology, rather than medical or educational models, programs have de-emphasized knowledge acquisition and instead emphasized social influences, skill building, and behavioral competencies related to particular health behaviors. For cardiovascular health promotion, outcomes were enhanced when curricula were supplemented by parental involvement, school environment changes, and multiple years of education. To expect school programs alone to improve physical fitness levels in children is ignoring other important influences on children.

As Sallis and Nader (1990) indicate, family sponsorship of physical activity has some inherent problems. Finding time with busy family schedules is one difficulty. Different exercise preferences also limit participation. Some family members may like competitive activities, others may not. Walking, swimming, and bike riding permit most family members to participate and are therefore appropriate activities. Family members may pair off for exercise, mother and child or father and child, depending on activity preferences. Although family exercise may not always be feasible it is worth promoting because physical activities at all intensities may promote cardiovascular health.

Fitness Assessment

IX

Physical Fitness Assessment

James R. Whitehead

A Brief History of Fitness Testing

A major milestone on the road leading to the present concerns about childhood fitness was the publication of a study by Kraus and Hirschland in *Research Quarterly* in 1954. That study, which showed that American children had a higher failure rate than European children on tests of minimal muscular strength and flexibility, received widespread media attention, and was even held to be "the report that shocked the President" (Boyle, 1955, p. 30). The study thus became an important impetus that motivated subsequent attempts to improve youth fitness.

Among the first outcomes were the formation of the President's Council on Youth Fitness, and the appointment in 1956 of an American Association of Health, Physical Education and Recreation (AAHPER) task force to study youth fitness. The latter group quickly constructed a fitness test battery (the original AAHPER Youth Fitness Test) and used it to collect data to establish the first national fitness norms (grades 5-12) in 1957 and 1958 (AAHPER, 1962).

The original AAHPER Youth Fitness Test consisted of the following items: pull-ups, sit-ups, shuttle-run, standing long-jump, softball throw, and 600-yard run. The test battery remained essentially unchanged over 2 decades except that the softball throw was dropped in the 1965 revision, and alterations to the sit-ups (which were changed from straight- to bent-knee technique) and the 600-yard run (longer options) were made by the 1976 revision (Hunsicker & Reiff, 1976).

In contrast to the relative stability of the 1960s and 1970s, some radical changes occurred in the following decade. The first of these was the publication in 1980 of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) Health-Related Fitness Test. This battery represented the position of an AAHPERD task force that had been charged with reviewing and revising the existing Youth Fitness Test. The task force decided that a clear differentiation between fitness related to athletic performance and fitness related to functional health was needed. Consequently, the new package consisted of tests of body composition, cardiorespiratory endurance, and abdominal and lower back muscular fitness (AAHPERD, 1980a).

Although the task force had recommended that the Health-Related Physical Fitness Test should replace the Youth Fitness Test, the AAHPERD administration decided to sponsor both tests for a limited evaluation period (AAHPERD, 1984). However, in the mid-1980s, controversy arose when the AAHPERD task force would not compromise with the President's Council on Physical Fitness and Sports on the construction of a new fitness battery. The impasse—which involved argument over philosophy, test items, and award schemes—could not be resolved, thus leading to a split between factions.

Not wanting to abandon their ideas, the AAHPERD task force took their work to the Institute for Aerobics Research in Dallas, Texas, and with sponsorship from Campbell's Soup, published their package as the FITNESSGRAM in 1987. The President's Council also went its separate way and published its President's Challenge test the same year (PCPFS, 1987a). A new fitness task force appointed by AAHPERD followed quickly with the publication and dissemination of the Physical Best program the following year (AAHPERD, 1988). Currently, the latter three test packages are the major options available to practitioners at the national level, although others do exist, and are described in the next section.

Currently Available Test Batteries

Five packages are nationally available and are briefly described below:

FITNESSGRAM (Institute for Aerobics Research, 1987) is a health-related fitness teaching and reporting package that uses professionally determined health standards for score interpretation. A curriculum manual can be purchased separately from the test materials (Corbin & Pangrazi, 1989).

Fit Youth Today (F.Y.T.) has health-related tests as part of a K-12 fitness curriculum. Test scores are interpreted against professionally determined health standards (AHFF, 1986).

Physical Fitness Program (Chrysler Fund-Amateur Athletic Union, 1987) is a battery of four required and six optional tests of health-related and motor-performance-related fitness tests. According to the percentile levels reached, Participation, Attainment, or Outstanding Achievement awards are given.

AAHPERD Physical Best Program (AAHPERD, 1988) is a comprehensive fitness education and testing package for which extensive support materials are available. Scores are interpreted against professionally determined health-criterion standards.

Presidential Fitness Award Program (PCPFS, 1987a) is a battery of one performance-related and four health-related tests. According to the percentile levels reached, participants can win either the National or Presidential Fitness Award.

Which Aspects of Fitness Should Be Tested?

The battery of tests used by Kraus and Hirschland (1954) were measures of minimal muscular strength and flexibility. They were chosen because test failure correlated with orthopedic problems (such as low back pain) and because they were believed to identify "whether or not the individual has sufficient strength and flexibility in the parts of the body upon which demands are made in normal daily living" (p. 178). The tests thus could be said to measure aspects of fitness related to functional health.

In the late 1950s, the AAHPER task force members charged with constructing the first AAHPER Youth Fitness Test battery took a wider perspective. Their aim was to develop tests of different components of fitness, including the abilities that physical education developed. Consequently, the test battery that they designed not only measured aspects of health-related fitness (such as cardiovascular fitness and muscular strength), but it also measured aspects of physical performance related to sports skills or athletic ability (such as speed, power, and throwing ability).

By the mid-1970s a new AAHPER task force was appointed to review the Youth Fitness Test. Probably because of the increasing concern about hypokinetic diseases (such as heart disease, obesity), the task force took a position that fitness testing and fitness development programs should emphasize the functional, health-related aspects of physical fitness (AAHPERD, 1980a). Because of this philosophy, a measure of body composition was included for the first time in the Health-Related Physical Fitness Test battery released by AAHPERD in 1980.

Whether or not to include athletic-performance-related test items in fitness test batteries remains somewhat controversial. However, recent authoritative position stands have called for a health-related focus (American Academy of Physical Education, 1987; American College of Sports Medicine, 1988b), and a strong consensus of opinion that the promotion of health is a major task of physical education is emerging in the literature (e.g., see Pate, 1988; Sallis & McKenzie, 1991). Some test batteries (FITNESSGRAM, Physical Best) have subscribed to that health-related philosophy, and have featured it in their promotion materials.

Fitness Testing Versus Fitness Education

The researchers and practitioners who share concerns about youth fitness have a variety of professional interest areas and academic specialties. Because of the range and breadth of these areas (for example from psychology to physiology, and from measurement to curriculum), it is not surprising that there has been a diversity of opinions regarding the use and suitability of fitness tests.

Measurement issues have been in the forefront. Safrit (1990b) reviewed current test batteries and commented on their validity and reliability. Seefeldt and Vogel (1989) took a similar perspective, but in this case used it as a basis to criticize strongly current tests, and to argue against their continued use until their psychometrics could be improved. Armstrong (1987) echoed those cautions, and also went further by maintaining that changes in children's test scores were as likely to stem from factors such as growth or motivation as from physiological fitness changes.

In contrast, others have argued for the potential health and pedagogical benefits of testing. For example, Pate (1989) made the case for using fitness tests for large-scale health screening and promotion in children. Whitehead, Pemberton, and Corbin (1990) contended that the measurement standards required for laboratory research are unnecessarily rigorous for field use, and outlined the potential cognitive and affective benefits of using tests as educational tools within an overall fitness education curriculum.

Whichever perspective is taken, it is clear that many factors affect a child's fitness test scores in addition to previous physical activity or training. Genetic, maturational, motivational, skill, and other individual differences are also important factors influencing fitness levels (Krahenbuhl, 1980). However, as advocates of fitness education have pointed out, the fitness testing situation is a natural opportunity for teachers to explain to children the influence and implications of all such factors to their fitness programming (Fox & Biddle, 1988b, Whitehead, 1989).

Normative Versus Criterion-standard Interpretation

Fitness testing of children and youth can be done for a variety of reasons. For example, the purpose could be to monitor national fitness trends, to see how a school class matched up to national averages, or to facilitate childrens' motivation toward health-enhancing behaviors.

Logically, the method of interpretation chosen should be the most suitable for achieving the stated purpose of the fitness testing, and the appropriate choice appears relatively clear in most instances. For example, if the goal of fitness testing is to monitor changes in national fitness levels, then a comparison of current population percentiles or norms with those of an earlier period of time is warranted. Similarly, if the goal of fitness testing is to identify and counsel those people at risk of hypokinetic diseases, then it would make sense to evaluate their test scores in relation to the particular fitness levels (health-based criterion standards) that predict a low risk of future hypokinetic problems.

However, when the stated purpose of testing is to motivate children to take an interest in fitness, controversy is more common. Advocates of normative interpretation believe that informing children of the percentile ranking of their test scores will motivate them to improve their standing relative to the fitness of their peers. Conversely, supporters of health-criterion-based interpretation have expressed reservations about the motivational outcomes of normative interpretation for individuals, and have argued that learning the future health implications of a test score provides a more meaningful motivational effect.

Traditionally, normative interpretation has been used in conjunction with award schemes, which ostensibly were designed to increase childrens' fitness motivation, but such schemes have been criticized lately (see the section on awards below).

The most recent packages that use fitness tests as part of an educational plan (FITNESSGRAM, F.Y.T., Physical Best) utilize health-criteria-based interpretations. Their stated purpose has been to increase the relevance of testing by making the results more meaningful to each individual from a health (rather than purely comparative-evaluative) perspective. Although critics have justifiably pointed out that more research data is needed before definitive health-related criterion fitness levels can be stated, a counter argument is that considerable professional and scientific work has gone into setting present standards (Cureton & Warren, 1990; Dotson, 1988; Going & Williams, 1989). It has recently been suggested that more emphasis on the health implications of scoring in different fitness zones, and less on the pass/fail implications of reaching a standard, would further serve the educational rational for criterion-based interpretation (Whitehead, in press).

Awards

The ostensible purpose of using award schemes in conjunction with fitness testing is to boost the fitness-related motivation of participants. Unfortunately, during the 3 decades in which awards have been used, only a few research studies have been conducted to evaluate their effectiveness, and the results of those studies have either been neutral, or have indicated mainly negative effects in terms of motivational outcomes.

Using fitness test data collected from a large sample of children as they underwent their athletic team medical exams, Corbin, Lovejoy, Steingard, and Emerson (1990) questioned the motivational value of percentile-based awards (such as the President's Award) since only a tiny percentage were able to qualify for them. This concern was emphasized by the results of a study by Whitehead and Corbin (1991) showing that receiving a low percentile rating after a fitness test reduced intrinsic motivation.

Proponents of percentile-based awards have tried to answer such criticisms by adding awards for lower percentile attainment, or by giving certificates for participation. While the effectiveness of those strategies does not appear to have been evaluated in the United States, Canadian research found that disappointment and reduced self-esteem was experienced by those who attained only the lower awards of the Canada Fitness Award scheme (Butler Research Associates, 1990). On the basis of that study, a new Canada Fitness Award program is being designed (Kent Consulting, 1991).

A review article (Corbin, Whitehead, & Lovejoy, 1988) reached conclusions congruent with those expressed above. Using mainly logical extrapolation of research on intrinsic motivation and goal-setting theories conducted in other areas, the paper concluded that if awards were to be used, then they should be process rewards for exercise behavior rather than product rewards for high fitness scores. Due to the negative motivational implications of failure and adverse peer comparison noted in that review, it was also recommended that exclusively normative performance awards should not be used.

Skinfold Measures for Body Composition Testing

Of the different assessments included in fitness test batteries, the measurement of body composition by the skinfold technique has been least used, and has met the most resistance from practitioners (Safrit & Wood, 1986). Critics have cited reasons such as violation of privacy, adverse emotional outcomes, and lack of test acceptance by physical education teachers as reasons why skinfold measures are inappropriate or seldom used (Riley, 1990). However, in a response to Riley, Going and Lohman (1990) refuted those criticisms, and suggested positive ways to overcome them.

There are persuasive health-related reasons for suggesting the need for body composition education. Several major research papers have demonstrated that childhood and youth obesity is an indicator of future cardiovascular disease, which, although an independent risk factor, is also associated with physical inactivity (Aristimuno, Foster, Voors, Srinivasan, & Berenson, 1984; Freedman et al., 1987; Kemper, Snel, Vershuur, & Storm-Van Essen, 1990; Shear, Freedman, Burke, Harsha, & Berenson, 1987; Smoak et al., 1987). While body fat measurements tend to be relatively changeable during childhood (Baumgartner & Roche, 1988; Garn & LaVelle, 1985), overfatness becomes more persistent during the teenage years and has a higher probability of tracking into adulthood (Kemper et al., 1990; Shear et al., 1988). The increasing knowledge of the extent of the link between obesity and cardiovascular disease also enables health-related-criterion standards to be set for skinfold measures with greater confidence for use in health screening and fitness testing (Williams et al., 1992).

As evidenced by its inclusion in major fitness test batteries, there appears little doubt that body composition assessment will remain a feature of youth fitness testing in the future. The question is whether the assessments will be made by skinfold measures, or by less reliable and valid methods such as computation of body mass index from height and weight measures.

While some of the complaints about skinfold measurement may have validity, it is probable that the method would become acceptable to practitioners if they had opportunities for training and familiarization with the techniques (Going & Lohman, 1990). It is also likely that some of the problems could be overcome by allowing children to work with partners and measure each other.

For example, it has been shown that most 5th- and 6th-grade children can learn to measure a partner accurately after minimal instruction (Whitehead, Frey, & Corbin, 1989), and also that it is possible to teach important concepts about body fatness and weight management during the time that the children are being taught the skinfold measurement techniques (Whitehead, Parker, & Pemberton, 1992). Whichever method is used, the need for body composition education (as opposed to mere testing) is evidenced by the prevalence of eating disorders and distorted body images that develop as early as the late elementary grades (Czajka-Narins & Parham, 1990; Koff & Rierdan, 1991).

Summary

With regard to the assessment of children's fitness, much has changed over the last 40 years. A major impetus to the development of fitness test batteries was the reaction (in the 1950s) to the results of physical fitness tests on American and European children. The poor comparative showing of Americans led to federal and professional developments in the promotion and evaluation of youth fitness. After 4 decades of development and changes, one result of these developments is that there are currently five major test batteries available for use nationally.

Several issues have arisen during that time, and most of them have still to be resolved. One area of debate has centered on the components of fitness to be tested. Some have argued that because of the widespread health problems related to an inactive life-style the testing emphasis should be on the health-related components (cardiovascular fitness, strength, muscular endurance, flexibility, body fatness). Others have lobbied for evaluation of the fitness components necessary for the performance of physical skills and sports (agility, balance, coordination, reaction time, speed, power).

Another ongoing issue has been psychometric adequacy. While some professionals have strongly criticized the reliability and validity of field tests of physical fitness, others have argued that they are quite adequate when used primarily for educational—rather than purely for measurement and evaluation—purposes.

The ostensible reasons for having children take fitness tests have also been factors in determining the methods used to interpret results, and also in deciding the nature of accompanying motivational schemes. Commonly, test results have been interpreted through comparison to norms, and awards have been given to those who have reached certain percentile standards (e.g., 50th or 85th). Critics have cautioned that negative affective and motivational outcomes may result from these methods, and as alternatives, they have advocated using health-criterion-based standards for test score interpretation, and exercise behavior recognition as a basis for motivational schemes.

Probably one of the most contentious practices in fitness testing has been the use of skinfold calipers for body fatness evaluation. There has been considerable resistance to this test by physical education teachers—despite the recommendations and encouragement of other (primarily university-based) professionals. Although recent research has indicated that teaching situations involving caliper measurement can facilitate important cognitive learning about body composition, debate on the topic is currently far from being resolved.

In conclusion, it seems fair to say that fitness testing occupies an important place in the childhood fitness picture. However, many important issues have yet to be settled; further debate and changes are to be expected in the future.

X

Motor Fitness: A Precursor to Physical Fitness

Dan Mielke

Introduction

The topic of motor fitness has influenced the physical education profession for decades. Recently, however, little has been done to explore updated perspectives of how motor fitness should be viewed or used within the profession.

This chapter explores historical perspectives of what motor fitness has been and proposes new directions of thought and action for the future. The central theme in this chapter reflects the fact that motor fitness development is important to children as a precursor to appropriate physical fitness behaviors.

Definitions of Motor Fitness

Within the literature, the terms motor ability, motor capacity, motor educability, motor fitness, and motor skill have often been used interchangeably. Attempts to define each of these terms has resulted in confusion and inconsistencies.

Traditionally, motor fitness has encompassed a variety of measures that were used to determine the child's level of motor ability. These components included muscular strength, muscular endurance, cardiovascular endurance, power, speed, agility, flexibility, grip strength, and balance (Cobb, 1972; Shore, 1972; Ingersoll, 1976). Most of these measures have now been consolidated into the two most commonly used physical fitness terms: health-related fitness and skill-related fitness. Health-related fitness is comprised of muscular strength and endurance, cardiovascular endurance, body composition, and flexibility. Skill-related fitness includes speed, agility, balance, coordination, reaction time, and power (Casperson, Powell, & Christenson, 1985).

Research evidence has shown that general motor ability may not exist; rather, a number of abilities, each specific to a given task, can be identified

(Safrit, 1990a). When viewed in a historical perspective, motor fitness can be described as an individual's current ability to perform a variety of specific motor skills.

A contemporary perspective demands a shift in our interpretation of what constitutes motor fitness. Since physical fitness is usually defined as a process of acquiring some appropriate level of physical condition and health, it seems consistent to assume that the acquisition of motor fitness must somehow also involve a process that leads to some level of healthy behavior. From a developmental perspective, there is evidence that a progression of sequential motor experiences is necessary for the acquisition of motor fitness (Haywood, 1991).

Clearly then, motor fitness can be described as the process of performing quality fundamental motor skills at a developmentally appropriate level. From a practical perspective, the acquisition of fundamental motor skills (functional movement ability) is a prerequisite to participation in physical activity, which may lead to physical fitness and other healthy behaviors. Seefeldt and Vogel (1987) state that it is the mastery of motor skills and the ability of children to incorporate these skills in the games, dances, and sports of their culture that provides the stimulus for movement and, perhaps concommitantly, the stimulus for a series of mechanical, chemical, psychological, and social events, which in combination contribute to total fitness.

With this new perspective, the assessment of motor fitness would include the evaluation of performance in basic skills such as running, jumping, galloping, skipping, sliding, throwing, striking, catching, kicking, and climbing; and would also demand attention to whether children then incorporate these skills into a wide variety of motor activities. Methods to assess these skills might include skills tests, self-regulation (Sallis, 1987), or systematic objective observational analysis (Dunham, 1989).

The Current Status of Motor Fitness in Children Based upon Recent Research

There have been no national studies to measure motor fitness such as those that have been conducted in physical fitness. Therefore, any claims related to the motor fitness of children must be drawn from the research conducted on specific skills that comprise motor fitness. The majority of motor-fitness-related research has evaluated throwing and balance skills.

In 1982, Gallahue summarized the common measures and components of motor fitness. The following is based on his synthesis of findings of movement control factors (balance and coordination) and movement force factors (speed, agility, and power).

Coordination is the ability to integrate separate motor systems with varying sensory modalities into efficient patterns of movement. Gross body coordination in children shows improvement on a year-by-year basis as the child ages. Boys' performances are superior to girls' from age 6 years in eye-hand and eye-foot coordination. With throwing skills, for example, Roberton, Halvorson, Langendorfer, and Williams (1979) found throwing velocities increased about 3 feet/second/year with girls and 5 feet/second/year for boys. Rippee et al. (1991) also found that boys performed significantly better than girls on both qualitative and quantitative measures of throwing.

Balance is the ability to maintain the equilibrium of one's body when it is placed in various positions. Balance performance improves in children as they age. Girls tend to outperform boys, especially in dynamic balance activities (such as the balance beam) until age 8 years. With respect to balance skills, Gayle and Pohlman (1990) found that overall balance in deaf children was significantly inferior to the balance in hearing children. Butterfield (1990) reported that chronological age and proficiency in balance were related to mature sidearm striking skill.

Speed is the ability to cover short distances in as brief a period of time as possible. Running speed in children improves year by year with age. Branta, Haubenstricker, and Seefeldt (1984) reported a 30% increase in speed between the ages of 5-10 years. Boys and girls are similar until age 6 or 7 years, when boys begin to make more rapid improvements.

Agility is the ability to change the direction of the body, quickly and accurately, while it is moving from one point to another as rapidly as possible. Agility measures for children show improvements each year as they age. Girls tend to level off at age 13, while boys continue to show improvement.

Power is the ability to perform a maximum effort in as short a time period as possible. Children demonstrate a year-by-year improvement as they age. Boys tend to outperform girls at all levels. Baumgartner and Rojeck (1991) found, however, that by using the PQ (pounds pulled/1000 point poundage X 100) equation, boys and girls demonstrated equal ability.

Although Gallahue excludes it from his synthesis of findings, reaction time research continues to be a component of motor fitness. Reaction time is the measure of time from the arrival of a stimulus to the start of a response to it (Schmidt, 1982). The majority of research on reaction time has been conducted with adult populations. However, limited studies with young children indicate that they perform slower on reaction activities than do older children or young adults (Keogh & Sugden, 1985). Studies of gender differences in reaction time also conclude that boys perform about 2 years ahead of girls.

This traditional overview of motor fitness indicates some characteristics of motor skill fitness in children. As children age and develop, skill performance improves. Males and females demonstrate similar motor fitness abilities during early childhood. After age 8, boys tend to demonstrate increased performance curves, while girls improve in a more linear fashion (Campbell, 1987).

The Motor Fitness Expectations for Males and Females Ages 6-8 and 9-12

Going beyond the traditional view of motor fitness, motor fitness expectations are characterized by the demonstration of developmentally appropriate behaviors within fundamental motor skills. Many researchers who have explored the components of success in fundamental movement skills have established numerous lists and diagrams that illustrate what constitutes key elements of successful skill performance (McClenaghan & Gallahue, 1978; Corbin, 1980; Wickstrom, 1983; Logsdon, 1984; Thomas, 1984; Keogh & Sugden, 1985; Ulrich, 1985; Haywood, 1986; Gallahue, 1987; Payne & Isaacs, 1991). Using these varied references, motor fitness expectations can be described in terms of age-appropriate motor skill behaviors that children can be expected to perform.

Motor Fitness Expectations for Children

Ages 6-8	Ages 9-12
Running	
Run while demonstrating variable speeds, directions (i.e., forward and backward), and the ability to change directions quickly.	Run, using the ability to change speeds and directions while manipulating or avoiding an object.
Jumping and Hopping	
Jump and land using a variety of one- and two-footed takeoffs and landings, while showing the ability to jump for height and distance.	Use jumping and hopping skills while manipulating an object (i.e., jump rope or shooting a lay-up) or avoiding an object (i.e., high jump or hurdle).
Skipping, Galloping, and Sliding	
Skip, gallop, and slide using rhythmic patterns and proper body technique, with variable speeds and directions.	Use skipping, galloping, and sliding skills while participating in an applied setting (i.e., sliding while guarding an opponent, or while participating in a Virginia Reel).
Climbing	
Climb across a rope ladder or horizontal ladder.	Climb up a rope using the arms exclusively.

Throwing

Throw an object overhand using a contralateral pattern with trunk rotation and follow-through.	Using a contralateral pattern with trunk rotation and follow-through, throw overhand with force (distance and accuracy) in an applied setting (game).

Kicking

Kick a stationary ball using the instep of the foot as the contact surface.	Kick a moving ball and punt a ball with force and accuracy in an applied setting.

Catching

Catch an object (thrown gently) with the hands while demonstrating ability to absorb force with flexible knees, elbows, etc.	Catch an object with the hands while moving in an applied setting.

Striking

Strike a stationary ball, or self-tossed ball, using various body parts, a bat, and a paddle.	Strike a moving ball with a body part (as in volleyball), a bat, and a paddle/racquet, with force and accuracy.

The preceeding descriptions of motor fitness expectations are not meant to create a definitive model, but rather to provide examples of the direction that this author believes motor fitness should follow. The premise of these examples is that each child should be accountable for achieving certain levels of motor fitness within a physical education program.

The Role of Growth and Development in Achievement of Motor Fitness

The processes of growth and development can have a strong impact upon an individuals's motor fitness. Development includes the progressions and regressions that occur within human beings as they age (Payne & Isaacs, 1991). Development implies a continuous process of change (Haywood, 1986) that is influenced by rates of maturation (qualitative changes) and growth (quantitative changes). Individuals who are to develop good levels of motor fitness must be expected to progress through growth and maturational periods that will affect structure, function, behavior, and ability.

Thus, the development of motor skills can be described as the change in an individual's capacity to exert refined control over motor behaviors. This suggests that the development of motor fitness results from both the maturation of biological systems and the motor experiences the individual encounters (Mielke, 1986). Physiological impairment, behavioral problems, or simply lack of opportunity to participate in movement activities can contribute to low motor fitness and failure to achieve one's potential for motor fitness.

Human development generally is viewed as having three components: motor, cognitive, and affective. The impact of all three areas must be considered when discussing motor fitness. Understanding the way people normally develop movement skills, and how they perfect or improve movement performance, will have an impact on our knowledge of motor fitness.

The performance of motor skills requires the processing of information (Haywood, 1986). As children age, they become more efficient in their ability to identify and process relevant stimuli, and this has a positive effect on their motor fitness.

How children view themselves, and how they think others perceive them (affective domain) will similarly influence motor fitness. Positive motor experiences can enhance a child's self-esteem and affect their performance of motor skills.

Most physical educators advocate an experiential learning environment in which, given proper experience through quality instruction, children will demonstrate improved skill at a level indicative of their personal capabilities. Quality instruction suggests that a teacher knows how children are suppose to develop and translates that knowledge into lessons that afford children the opportunity to master motor skills at their appropriate developmental level.

This perspective requires that teachers help students to achieve competency or reach designated outcome behaviors at their own developmental pace. This doesn't dispute some evidence that males and females perform differently (Nelson, Thomas, Nelson, & Abraham, 1986; Nelson, Thomas, & Nelson, 1991), that children mature at varied rates and potentials, or that there are racial or ethinic differences in motor fitness. But it points out a basic developmental characteristic: that improved motor fitness is dependent on individualized quality instruction for children of all ages, colors, and sexes in combination with growth and maturational characteristics.

Finally, it should be reiterated here that the development of motor fitness will affect an individual's behaviors and attitudes toward improving and maintaining physical fitness. McGinnis, Kanner, and DeGraw (1991) state, "the challenge facing school physical education professionals is to make effective use of a limited class time and teach the knowledge and skills necessary to be successful in a wide variety of physical activities that promote health, fitness, skill building, enjoyment of sport and recreation, general well-being, self-esteem, and confidence."

XI

Fitness Testing for Children with Disabilities

William R. Forbus

Introduction

The Education for All Handicapped Children Act of 1975 (Public Law or P. L. 94-142) (Federal Register, 1977), now amended by P. L. 99-457 and P. L. 101-476, mandates a free, appropriate public education for all children with disabilities; moreover, it specifically mandates physical education. Physical and motor fitness are listed in the definition of physical education in P. L. 94-142. Physical fitness testing is crucial to fitness programming in order that instruction can be individualized. Results of the tests are used to evaluate the individual and are interpreted as bases for decision making relative to program planning and placement.

Assessing Physical Fitness in Children with Disabilities

Disabled individuals have been assessed by a wide array of physical fitness tests. Some of these tests were designed for nondisabled individuals such as the AAHPER Youth Fitness Test (Hunsicker & Reiff, 1976). Other tests such as the AAHPER Special Fitness Test for Mildly Mentally Retarded Persons (AAHPER, 1976), the AAHPER Special Fitness Test for the Moderately Mentally Retarded (Johnson & Londeree, 1976), the Physical Fitness Battery for Mentally Retarded Children (Fait, 1978), the Fleischman Basic Fitness Test (Fleischman, 1964), the Buell Test (Buell, 1973), Project UNIQUE (Winnick & Silva, 1979), and Project UNIQUE II (Winnick & Short, 1986) have been developed and/or modified specifically for certain disabled populations. However, there has been some question as to whether these tests validly measure physical fitness by the contemporary definition (AAHPERD, 1980b, 1989).

Among the many physical education tests available, tests of physical fitness are most numerous and are technically most accurate (Werder & Kalakian, 1985). Physical fitness tests for special populations are by and large modifications of the Youth Fitness Test (Hunsicker & Reiff, 1976) with norms based on the target populations (Baumgartner & Horvat, 1988). However, most of the modifications seem arbitrary and do not appear to improve the test. For many of the original and modified test items, the norms suggest lack of reliability and/or validity (Baumgartner & Horvat, 1988). Further, little research is evident concerning the appropriateness of health-related physical fitness tests for disabled populations.

Based on epidemiological research, it is now accepted that physical fitness should be defined in terms of its components (Caspersen, Powell, & Christenson, 1985). In the past, the definition has been nebulous and tests have measured either some aspect of physiological function or certain aspects of motor performance. These tests have been coined motor fitness tests and are more indicative of potential for athletic excellence than potential for a high level of health (Baumgartner & Jackson, 1987). The AAHPER Youth Fitness Test (Hunsicker & Reiff, 1976) is an example of a motor fitness test that included items related to both health and motor ability. Clarke (1971a) identified these components of motor fitness as muscular strength, muscular endurance, respiratory endurance, muscular power, agility, speed, and flexibility.

However, as the scope of physical fitness became more definitive, other tests were developed in response to growing dissatisfaction with traditional motor fitness batteries. Further, the definition of physical fitness has shifted to health promotion and thus the components of physical fitness have changed. This new philosophical viewpoint focuses on traits that medical and exercise scientists have purported promote health and reduce the risk of disease. Components of health-related fitness in the more recent tests include the following: cardiorespiratory endurance, body composition, muscular strength, muscular endurance, and lower back flexibility. Although speed, agility, and power are not considered to be health-related, as they do not contribute to lifelong health, their importance as motor fitness attributes is recognized.

In 1977, the AAHPER Presidential Task Force implemented recommendations from the Joint Committee on Physical Fitness. The task force recommended that tests of motor performance not be included in a fitness battery and that tests measuring physical and motor fitness be differentiated. Differentiation resulted in two categories of test items: (a) motor fitness/performance items (Clarke, 1980) and (b) health-related items.

The Youth Fitness Test (Hunsicker & Reiff, 1976) is comprised of items that are motor fitness/performance in nature. The Health-Related Physical Fitness Test (AAHPERD, 1980a) is comprised of items that reflect health promotion and reduction of risk for disease.

In 1987, a new AAHPERD Youth Fitness Task Force was created. This task force developed the Physical Best program. The purpose of this program was not only to redefine physical fitness in terms of health-relatedness, but to provide opportunities for lifetime participation and benefit (AAHPERD, 1987). Many items are now specific and options are limited.

Considerations in Testing

Whatever the fitness test used, assessment should be used to provide information to the practitioner and disabled individual so that informed decisions can be made regarding positive life-style changes. This information should also be reflected in program planning. Due to the nature of physical fitness tests, it is clear that there is no one test that can be used for all populations. In recent years, AAHPERD's Health-Related Physical Fitness Test and the new Physical Best program have been used to measure fitness of disabled individuals. Johnson and Lavay (1988) developed the Kansas Adapted/Special Physical Education Test to measure fitness of students with various disabilities. A discussion of these and other tests follow as well as suggestions for testing modifications.

Kansas Adapted/Special Physical Education Test

This test battery was developed by Johnson and Lavay (1988) to address some of the evaluation concerns regarding students with various disabilities. A primary difference between this test and others is that modifications and adaptations allow all students to be tested, regardless of their disability. The test provides four measures: sit-ups (abdominal strength and endurance), sit & reach (lower back and leg flexibility), isometric push-up or bench press (upper body strength and endurance), and aerobic movement (cardiovascular endurance).

The test manual implies that the test battery can be used with all students but lists no specific ages. Using a group of approximately 205 students (aged 5-17 years) with varying disabilities, predictive validity and reliability were determined for each item but were not reported by the authors (Johnson & Lavay, 1988, 1989). However, test-retest reliability coefficients were obtained from one of the authors (R. E. Johnson, personal communication, September 15, 1989). The reliability coefficient for sit-ups ranged from 0.90 to 0.97, sit & reach ranged from 0.86 to 0.98, isometric push-up ranged from 0.71 to 0.93, aerobic movement ranged from 0.37 to 0.85, and bench press was reported at 0.94. These reliability coefficients seem satisfactory and validity may be based on logic. The Kansas Adapted/Special Physical Education Test can be a viable alternative in physical fitness testing of disabled individuals.

AAHPERD Health-Related Physical Fitness Test

The Health-Related Physical Fitness Test (AAHPERD, 1980a) shifted emphasis away from sport and motor fitness performance to a focus on the health aspects of fitness. Four measures are included to assess three components of physical fitness: mile run and mile and one-half run or 9- and 12-minute run (cardiorespiratory function); skinfolds (body composition); modified timed sit-ups and sit & reach (abdominal and lower back-hamstring musculoskeletal function). The test manual provides national norms for students in grades 1-12.

It is important that each item on a physical fitness test be discussed in terms of rationale for its inclusion and research support for reliability and validity (AAHPERD, 1984). Distance running tests are considered to be valid tests of cardiorespiratory endurance (AAHPERD, 1984). Reliability coefficients have ranged from 0.75 to 0.90 (Askew, 1966; Burris, 1970; Doolittle, Dominic, & Doolittle, 1969). The validity coefficients of triceps and subscapular skinfolds and body fatness range from 0.78 to 0.95 (Boileau, Wilmore, Lohman, Slaughter, & Riner, 1981; Parizkova, 1961; Parizkova & Rath, 1972). Test-retest reliability estimates tend to exceed 0.95 (Pollock, 1975, 1976). The validity of the sit-up and sit & reach tests seem to be acceptable on the basis of content validity (AAHPERD, 1984). This conclusion has been supported primarily by clinical observations and logic. Reliability estimates for the sit-up and sit & reach tests range from 0.68 to 0.94 and 0.84 to 0.98, respectively.

National norms for the Health-Related Physical Fitness Test were revised after two national surveys on youth fitness. Norms were established based on the results on the National Children and Youth Fitness Study I (Ross & Gilbert, 1985) and the National Children and Youth Fitness Study II (Ross & Pate, 1987).

Although the norms reported for grades 1-12 were based on data collected on able-bodied students Pizzaro (1990) conducted a study to determine the reliability and suitability of the Health-Related Physical Fitness Test with mainstreamed educable (EMR) and trainable mentally retarded adolescents (TMR). A total of 126 nonhandicapped, EMR, and TMR students were tested on four items: modified sit-ups, sit & reach, 880-yard run, and skinfold fat measure (tricep only). Test-retest reliability coefficients were calculated and testing deviations were noted. Pizzaro (1990) determined that the modified sit-ups, sit & reach, and skinfold fat measurement were suitable and reliable to use with mainstreamed EMR and TMR students. The reliability scores on the 880-yard run were fair, good, and excellent for the nonhandicapped, EMR, and TMR students, respectively. The deviations in procedure when testing TMR students raised questions as to the suitability of this item for use with this population.

Physical Best Fitness Test

Physical Best is comprised of five items: the one-mile run/walk (aerobic endurance), tricep and calf skinfolds (body composition), sit & reach (flexibility), modified sit-ups (abdominal muscular strength and endurance), and pull-ups (upper body strength and endurance). The program has an awards system based on individualized goal setting.

Criterion-referenced standards are provided for each test. In contrast to norm-referenced tests, in which the goal is to point out individual differences and compare the performance of one student to the performance of others, performance on a criterion-referenced test is judged relative to a preset standard that reflects a satisfactory level of the attribute being measured (AAHPERD, 1989). The criteria set in Physical Best are based on levels of physical fitness thought to be associated with minimal health risk.

Since the Physical Best has only recently been used in the schools, there is a lack of research with its applicability to special populations. Forbus (1990) conducted a study to determine the suitability and reliability of Physical Best with mildly mentally handicapped (MiMH), moderately mentally handicapped (MoMH), learning disabled (LD), and nonhandicapped (NH) students. He tested 200 subjects, with equal numbers of males and females. Subjects were evaluated subjectively for testing procedural deviations using a modified checklist developed earlier by Pizzaro (1990).

Utilizing the subjective performance checklist, more deviations were reported for the mentally handicapped groups than the LD or NH groups. A low number of deviations were reported for the LD group on all items.

It was concluded that the Physical Best is a reliable instrument to use with MiMH, MoMH, LD, and nonhandicapped students. However, it was also found that the test was not suitable for all groups and that there were differences in performance on the test. Overall, the Physical Best test should not be used with mentally handicapped populations. Modifications and/or alternative tests should be considered when assessing health-related physical fitness of these populations.

Project UNIQUE

Winnick and Short (1982, 1985) developed a physical fitness test battery (Project UNIQUE) for orthopedically impaired, auditory impaired, and visually impaired students. The test was developed based on factor analytic techniques. Items included skinfold measurements, hand grip strength, arm hang, pull-ups, shuttle run, 50-yard dash, softball throw, and a distance run. Although the norms were sometimes based on small sample sizes, a visual comparison of the norms does not suggest many places where scores are so poor as to suggest a lack of test item validity (Baumgartner & Horvat, 1988).

Suggestions & Modifications in Testing

Baumgartner and Horvat (1988) have published an excellent article on the problems of measuring physical and motor performance of disabled individuals. One problem is the lack of addressing disabled populations in measurement texts. Another problem is the heterogeneity of the various populations. Each disability may have characteristics that limit the effectiveness of measurement procedures.

Prior to P. L. 94-142, a majority of disabled students were educated in special classes or special facilities. This allowed teachers to utilize individual testing procedures, trained personnel, and special equipment (Baumgartner, 1986). However, now that approximately 80% of all disabled students are in mainstreamed physical education classes, the students are being tested by teachers who know little about measurement of fitness of disabled students.

Baumgartner (1986) points out that although individual testing can sometimes be used, some valid and reliable group tests, which anyone can give with minimal equipment, must be available. However, the problem is that very few of these group tests exist. Therefore, educational decisions are being made on unreliable and invalid data gathered in mass testing situations.

Specific Fitness Test Items

Cardiorespiratory Endurance

Distance runs are probably the most common and feasible method of assessing cardiorespiratory endurance. Based on earlier research, the one-mile run/walk should not be used generically with disabled populations. A lack of motivation in these subjects is probably the key factor in the suitability of this item. It should also be noted that questions have arisen as to the validity and reliability of the shorter distances that have been used such as the 300- and 600-yard runs. Since the larger correlation coefficients between distance runs and directly measured maximal oxygen uptake have been observed for distances of 800-1,000 meters (Shephard, 1987), a practical alternative could be the 880-yard run (Forbus, 1990; Pizzaro, 1990). Johnson and Lavay's (1988, 1989) use of generic aerobic movement may also be an alternative for various populations. The student may run, jog, march, walk with vigorous arm movement, propel a wheelchair, use a walker, or move in any fashion to elevate the heart rate above the resting heart rate. The aim of the item is to reach and maintain a heart rate between 140-180 beats per minute for 12 minutes (after a 6-minute warm-up). This alternative eliminates motor efficiency bias by using time and pulse rate, rather than time and distance covered.

Flexibility

The sit & reach test (Wells & Dillon, 1952) is a simple field test that gives a fairly accurate assessment of lower back and hamstring flexibility. The sit & reach test is a suitable and reliable item to use with disabled populations, and reliability estimates have been found to range from good to excellent (AAHPERD, 1980b; Forbus, 1990; Johnson & Lavay, 1988, 1989; Pizzaro, 1990). The test is considered to be valid on the basis of content validity. This conclusion has been supported by clinical observations and logic.

Muscular Strength and Endurance

The pull-up is the most common measure of arm and girdle (upper body) strength and endurance. However, many students have difficulty moving their body weight against gravity; therefore, the pull-up test has a tendency to yield scores of zero (Baumgartner, 1978). It is not recommended that the pull-up test be used with disabled populations. Although reliability estimates have been acceptable, the large percentage of zero scores does not allow a discriminating assessment of upper body strength and endurance. As the pull-up gives an accurate depiction of the work done, it has been suggested that this test might not be an adequate measure of arm strength and endurance (Bolonchuk, 1971). Therefore, some alternatives might be the Baumgartner Modified Pull-Up test (Baumgartner, 1978), isometric push-ups, and the bench press (Johnson & Lavay, 1988).

The sit-up test in one form or another has been used as a measure of abdominal strength and endurance. The controversy of administration procedures has been evident and has centered around proper lower-limb position and test duration. The modified sit-up test (as used in the Health-Related Physical Fitness Test and Physical Best) is recommended: the number of correctly performed sit-ups in 60 seconds. Reliability coefficients range from fair to excellent and validity seems acceptable on the basis of content validity. However, this test should not be used with moderately mentally handicapped students. The question of suitability is influenced by factors of poor motivation, performance deviations, and poor abdominal strength and endurance (Forbus, 1990). As no other practical field tests have been used, it is not possible to suggest an alternative test.

Body Composition

The use of measuring skinfold thicknesses to estimate body fatness has been used with success in field tests, but is not without controversy. Individuals have taken measurements at anywhere from 1-10 skinfold sites (Shephard, 1987). However, the precision of body fat estimation is not increased by using more than 3-4 skinfolds, although information on fat distribution is obtained (Kirkendall, Gruber, & Johnson, 1987). Reliability estimates are excellent when properly trained testers are used. Parizkova (1961) found two measures, the subscapular and tricep, to be highly correlated ($r = 0.82$-0.95) with body fat. These two sites were adopted for use in the Health-Related Physical Fitness Test (AAHPERD, 1980b); however, accessibility of the subscapular site has been of concern. Physical Best utilizes the tricep and calf as sites. The measurement of skinfold thickness to estimate body fat is considered a suitable, reliable, and valid test to use with most disabled populations. However, care must be taken when taking measurements. The small discomfort associated with lifting a skinfold can be startling for the unsuspecting student. Time should be taken to orient the student on what will occur.

Conclusions

It is evident that reliable, valid, and practical tests need to be developed/ identified to measure the factors associated with physical fitness. Specific administration procedures should accompany every test. Disabled students need to be given specific instructions on the desired task as well as opportunities for orientation and practice. More trials may be necessary to obtain reliable and valid data (Baumgartner & Horvat, 1988). In addition, teachers need more training in test construction, administration, and interpretation.

It is important to note that Physical Best has utilized criterion-referenced standards rather than norms. Are the same levels of cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition required for disabled populations as their able-bodied peers? Or, due to the innate characteristics of certain conditions and the idea that disabled students may need a higher level of fitness, do different criterion-referenced standards need to be developed? These are questions that researchers and educators must seek to answer in the future.

XII

The Evaluation of Children's Growth and Its Impact upon Health-related Fitness

Robert W. Grueninger

The most valuable, in fact, the only general, as well as exact conclusions as to normal growth which have been thoroughly worked out are with reference to height and weight. (Hastings, 1902).

Introduction

Physicians and physical educators alike, as well as school nurses and other health professionals, routinely measure the height and weight of schoolchildren. Yet, this information often is not used to its full advantage in plotting the growth records of children. Regular recordings of height and weight allow comparisons to others of the same chronological age and sex, as well as to the child's own standard. Conclusions may then be made regarding the quality of growth. Frequently a child is found to have an underlying health problem that prevents achievement of full potential for growth.

The Extent of the Problem

Since physical and motor fitness are influenced by growth and maturation (Bouchard, Shephard, Stephens, Sutton, & McPherson, 1988), it is unrealistic to expect children to perform to their potential in any one of these areas if their underlying growth and nutrition have been adversely affected by poverty or disease. Brown (1987) estimated that 9% of the American population was hungry or chronically short of the nutrients needed for good health and optimal growth. The Physician's Task Force on Hunger (Brown, 1987) estimated that 500,000 children were undernourished. With reduced nutrients, a child's metabolism may decrease, leading to slower physical growth. Furthermore, malnutrition weakens resistance to infection and is associated with more colds and other illnesses. Increased absences from school contribute, in turn, toward poorer physical and academic performance.

Since the 1960s, the number of children who are over nourished through eating too much and expending too little energy also has increased. A larger percentage of children above the 95th percentile of weight for height suggests a rise in childhood obesity (Pate, Ross, Dotson, & Gilbert, 1985; Unger, Kreeger, & Cristoffel, 1990). Of 175 obese children studied in a nutrition clinic, many were found to have associated medical problems such as asthma (30%), elevated blood pressure (25%), and hyperlipidemia (28%), and consequently were at a greater risk of developing heart disease in later life (Unger et al., 1990).

Evaluation of Physical Growth

Several growth charts were introduced in the 1940s as methods of studying and evaluating child growth. Most notable among these were the Harvard Charts developed by Stuart, the Iowa Charts of Meredith, and the Wetzel Grid (Behrman, Vaughan, & Nelson, 1987). The Harvard Charts for body weight, length, and height from ages 2 through 13 years were "based upon repeated measurements of 100 White boys of North European ancestry living under normal conditions of health and home life in Boston, Massachusetts," (Behrman et al., 1987, p. 27) and were furnished by Mead Johnson Laboratories for use at the Children's Hospital in Boston. The Meredith Weight-Age and Height-Age percentile charts were compiled from data collected by the Iowa Child Welfare Research Station in 1943 and have been used for nearly half a century. Most sophisticated was the Wetzel Grid, which employs serial plottings of height and weight and provides added advantages of:

- allowing an evaluator to see size and shape changes together rather than as separate plots in which one parameter must be kept in mind while looking at the other;
- determining nutritional grade and schedule;
- estimating caloric needs (BMR) as size increases; and
- being independent of population norms, providing reasonable tolerance limits for individual growth, and allowing each child to be his/her own standard of comparison.

The physical growth percentile charts of the National Center for Health Statistics (NCHS) (Hamill et al., 1979) are currently seeing the widest use. These are provided as a public service by two corporations: Genentech and Ross Laboratories. Four NCHS charts are available: birth-36 months and 2-18 years, one each for boys and for girls. The sample of 6-11-year-olds comprised over 7,000 children, and the data for this age span were collected as part of the National Health Examination Survey, 1963-1965. The percentile curves are for stature-age and weight-age on one side of the graph (see Figure 1a), and for weight-stature on the other side (see Figure 1b).

Figure 1a: Boys: 2 to 18 Years Physical Growth. NCHS Percentiles. (Percentile Curves Are for Stature-Age & Weight-Age)

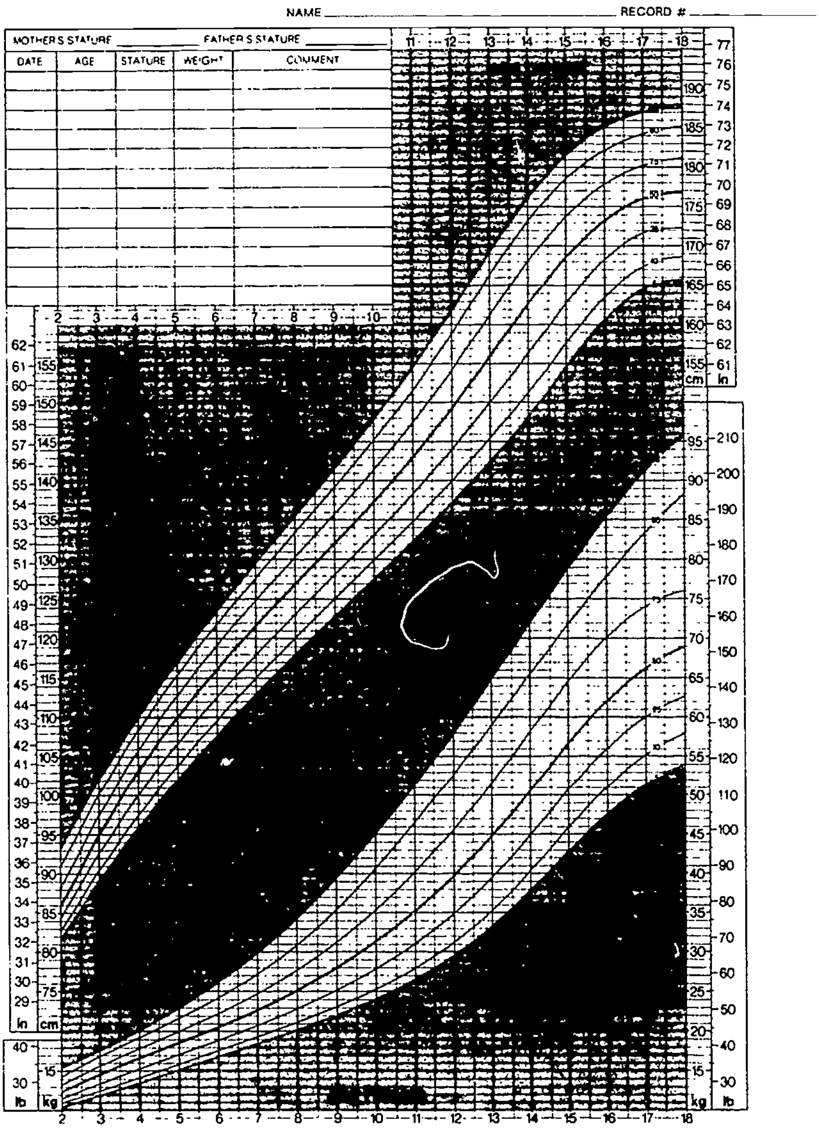

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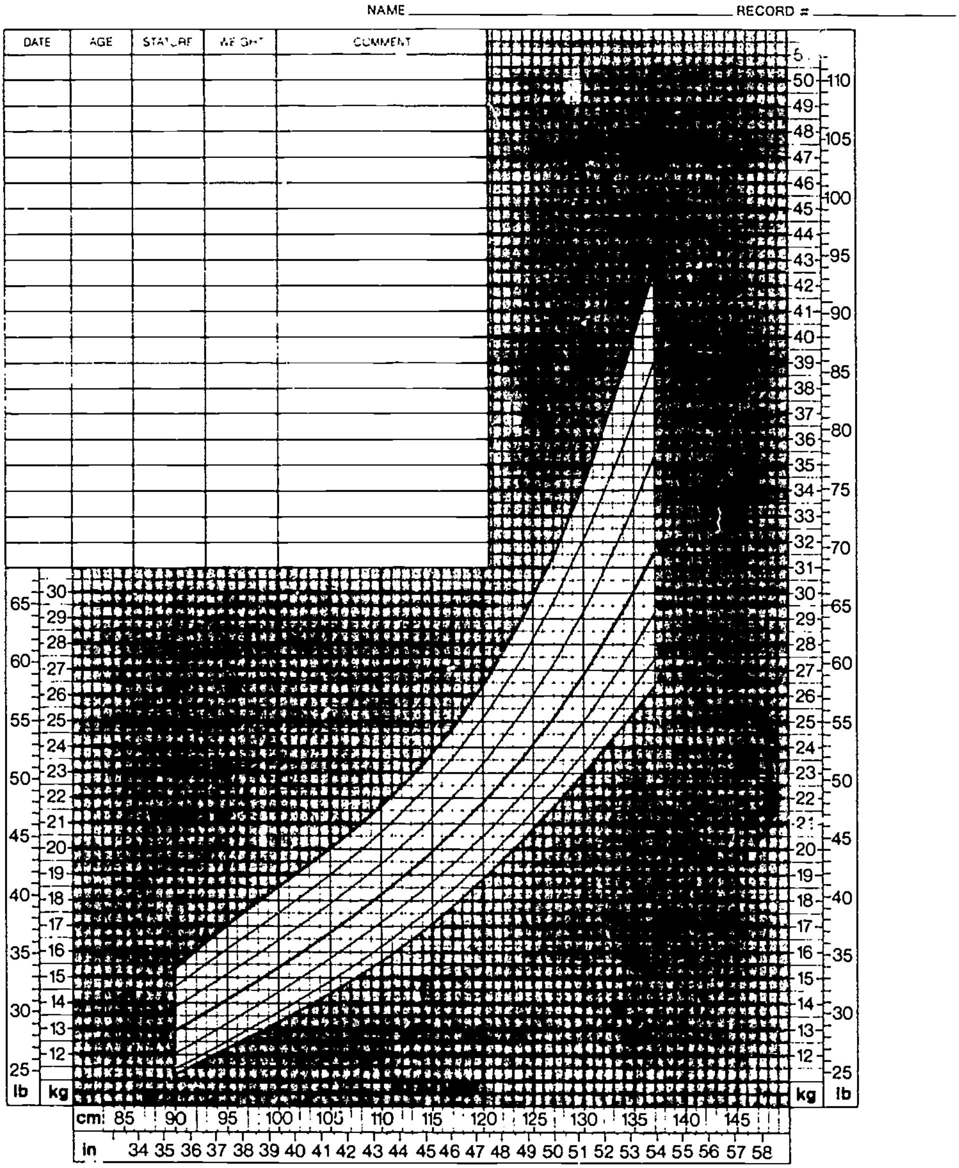
Figure 1b: Girls: Prepubescent Physical Growth. NCHS Percentiles. (Percentile Curves Are for Weight-Stature)



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Major Aspects of Growth in Children (MAGIC) is one organization employing the NCHS charts. MAGIC was formed in 1989 by the parents of several children who had experienced growth-related disorders. Mary Andrews, the executive director of MAGIC, advocates checking growth every 3-6 months for infants and annually after age 2 years. Then, she recommends plotting the measurements against age. With due consideration to a child's following a familial trend, i.e., to be small or large, mature or slow-to-mature as mother and/or father were, children who are above the 95th percentile or below the 5th percentile for stature-age or weight-age should be referred to a physician for an examination to discover an underlying cause. A medical cause might be a hormone deficiency, a tumor, or heart disease (M. Andrews, personal communication, October 19, 1991) Equally important are marked fluctuations in direction of growth that could reveal a medical, psychological, or nutritional problem. Rapid gains and losses of weight also would become apparent in examining the graphs.

Hebert and Waternaux (1983) observed that a comparatively small number of obese children could negatively skew mean weight, and, in fact, maintained that the NCHS reference population is skewed. Earlier reference in this chapter to an increase in childhood obesity (Pate et al., 1985) lends credence to this observation. Although Hebert's interest was in group comparisons, the suggestion of dividing a child's weight by the median weight for the same age could be considered as a more conservative method of screening for underweight or overweight. A similar approach could be used for height. Waterlow et al. (1977) suggest that a child whose height is 90% of the reference median is moderately stunted, and 85% or less is severely stunted. For example, if median height for a child of a certain age is 48 inches, a 43-inch-tall child would be 90% of median height and identified as moderately stunted, i.e., he or she is 5 inches shorter than 50% of his/her age peers.

Growth Quality and Performance

Over the past 50 years, there appear to have been few studies in which growth was monitored longitudinally to discover the relationship between growth quality and performance. Using the Wetzel Grid to evaluate growth, Rousey (1949) found that the growth success group was superior to the growth failure group in performance on the Indiana Physical Fitness Test. Hopwood and Van Iden (1965) showed a relationship between poor growth and academic achievement, which grew worse as poor growth continued. Their 10-year analysis of the Wetzel Grid growth records of 134 boys showed that boys with top quality growth declined only 3.5% in mean grade point average (GPA) from elementary through high school, whereas those with unsatisfactory growth declined by 33% over the same 10-year period. An analysis of physical growth and academic achievement in the Medford Boys Growth

Study (Grueninger, 1970) did not permit a comparable conclusion regarding academic performance. Differences in mean trends of GPA between the growth quality groups were not statistically significant, perhaps because the Medford group was homogeneous socioeconomically and because those with chronic disease—and henceforth, more severe growth failure—were screened from the study. However, physical performance was affected in that excellent and satisfactory growth groups were superior to the poor-quality group in Rogers' Physical Fitness Index (PFI), at the .05 level of significance.

Size and Performance

Older, taller, and heavier children are more capable of good physical performances than are their younger and smaller siblings (Clarke, 1971b; Espenschade, 1960; Jones, 1949; Updyke & Willett, 1989). Espenschade (1960) showed in her work on adolescents that improvement in gross motor performance is closely related to physical growth, and that marked changes in rate occur near puberty. (For an excellent review of age changes in motor skill performance during childhood, see Branta, Haubenstricker, & Seefeldt, 1984).

Indeed, a cursory examination of the norms for any fitness or skill tests will reveal a progressive improvement as age and size advance (Updyke & Willett, 1989), although with varying rates, particularly variable for tests of strength. Strength increases with size and maturity. Jones (1949) showed in the well-known longitudinal Berkeley Growth Study that there is a close relationship between gain in standing height and increase in strength. In both sexes at the same chronological age, postpubescents are stronger than prepubescents.

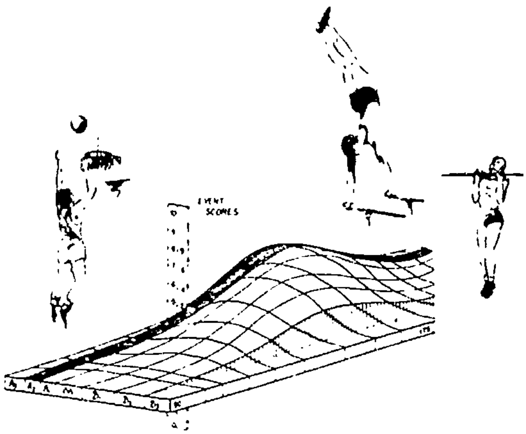
Performance increases with size up to that achieved by the average girl at about age 14 years and the average boy at 18-20 years. The pattern of growth is not the same for all structures, fitness attributes, or events. Strength grows in different proportion to structures. Vertical jump increased with body height in the same way for both sexes, but running speed did not.

Body Shape and Performance

Discussions of body shape and performance commonly make reference to the somatotyping system developed by Sheldon in 1940 (Sheldon, 1954). The three components of physique were referred to as endomorphy, in which fat tissue predominates; mesomorphy, the medium physique type characterized by stockiness and muscular development; and ectomorphy, or linearity of physique (Carter & Heath, 1990). In boys, strength is most closely related to the mesomorphic component. Mesomorphy is associated with early maturity. Endomorphs are strongest in gross strength, but ectomorphs are superior in agility, speed, and endurance, the qualities, incidentally, which are favored in the present physical fitness tests. According to Espenschade (1960), "certain individuals are literally built for action, and, furthermore, built for certain types of action." Yet, she goes on to say that physique is not the most important determinant of performance, and with respect to size, "a good big man may be better than a good little man in many sports," but "being big is less significant than being good."

Size and physique are associated jointly in their effect on performance, as indicated by the mound diagram in Figure 2 (Grueninger, 1961). Performance improves with shape toward the A1 physique channel, which characterizes a mesomorph in Sheldon's somatotyping system.

Figure 2: Mound Diagram Showing the Relationship Between Size, Shape, and Performance



From Grueninger (1961).

Body Composition and Performance

Clarke (1971b) showed significant negative correlations between body weight and adipose tissue and performance. Percent body fat generally is accepted as having an inverse relationship with physical fitness, as fitness is commonly defined through performance on tests. A small increase in skinfold thicknesses has been noted with increasing age (Saris, Elwers, Van T Hoff, & Binkhorst, 1986).

Maturation and Performance

Maturation is indicated by peak height velocity, skeletal age, dental age, or sexual maturity ratings (SMR) from the time of the appearance of secondary sex characteristics. Maturity exists on a continuum, as does growth and development. Still, it is useful to compare extreme types, classified as early and late maturers. Early maturing boys and girls are advanced in skeletal age and skeletal maturity for chronological age, are heavier and taller for their age, have more weight for height, and a higher percent of fat mass than is true for their slower maturing age peers. Extreme mesomorphy is related to early maturation in boys, and endomorphy, in girls. Linearity is associated with lateness of maturity; early maturity means more fat, muscle, bone, and lean body mass, that is, greater size (Kemper et al., 1983; Malina, 1988). Late maturers, both boys and girls, also have higher maximal oxygen uptake values for body weight.

Boys who are early maturers have a size, and consequently a strength, advantage, leading to success in sports, when compared to late maturers. In contrast, girls who are late maturers are more often successful in sports. Linearity of physique, also commonly associated with females' success in sports, is a characteristic of late maturing girls, who have long legs relative to their height, narrower hips, and less weight and less percent fat. Early maturing girls tend to be fatter, shorter, and with broader hips, which are disadvantageous to performance in most girls' sports (Malina, 1988).

The consequence of delayed development for boys often means that they are denied opportunities to participate in sports. Boys who are small for their age are most often cut during team tryouts, even though they eventually may be of average or above average height or size (Bailey & Martin, 1988). It is important to remember that exercise testing during childhood may not be predictive of a child's ultimate performance capabilities (Rowland, 1990).

Age Comparisons and Indexes

Although children are unique, they still are expected to achieve performance standards for age and sex, irrespective of their growth, maturity, size, shape, or body composition. Chronological age is not a good reference point for analyzing biological data (Astrand & Rodahl, 1986). Differences in maturity, as indicated by skeletal age, can be as much as 4 years from chronological age. For example, one girl may attain peak height velocity (PHV) at the age of 9.5 years, but another not until age 15. Age norms may be an improvement over school grade norms, but they still ignore obvious differences in children by size, physique, and maturity, differences that affect motor test performance.

Perhaps reliance on age standards persists because a satisfactory index based on other variables has not yet been devised. Recognition of the importance of size and shape in performance led to several indexes to classify performance according to these factors. McCloy proposed a height-weight classification, as did Cozens (McCloy & Young, 1954). The Neilson-Cozens Classification Index was used as an alternative to age and grade classifications in the first American Association for Health, Physical Education and Recreation (AAHPER) Youth Fitness norms. The index was dropped in 1976 (Hunsicker & Reiff, 1976).

Wetzel has pointed out that the Neilson-Cozens Index did not really control for physique, in that the Cozens classifications cut across Wetzel Grid physique channels and spanned a number of Wetzel developmental levels (size). The grid itself was proposed as a classifier for interpreting physical fitness test scores, and a substantial relationship was shown with performance on the Indiana Physical Fitness Test (Bookwalter, 1952). But such standards were not adopted, perhaps because of their apparent complexity.

Simplicity, what the child and the parent would understand, often appears to have been the guide for fitness practices. Even such a simple allowance as the Amateur Athletic Union (AAU) provided in their fitness test for a child's being over or under Wetzel Grid-based maximum and minimum weights for age, has been dropped in the current AAU revision (Amateur Athletic Union, 1992). The AAU formerly recommended a 10% allowance on scores for children who were outside the normal weight range, thus allowing more children to qualify (Amateur Athletic Union, 1978). Now reports are made and awards are presented on the basis of standards by age and sex, with no consideration to height, weight, size, or physique.

The Texas Physical Fitness-Motor Ability (TPFMA) Test provides performance norms by weight for girls on the flexed-arm strength test and for girls 11.6 years of age and older on the sit-up tests. Regarding the TPFMA, J. R. Morrow (personal communication, October 13, 1991) commented that the "concept is a good one," there being little doubt that "performance on . . . upper body strength tests is [inversely] related to body weight." Indeed, inspection of the norms for girls show that as weight increases, flexed-arm time and number of sit-ups each decrease, proportionately.

The TPFMA includes age-related percentiles and T-scores for all tests except the distance run items, namely the 12-minute run, and the 1.5-mile run/walk for boys, and the 9-minute, 12-minute, and 1.5-mile run/walk scores for girls. "Research," it is stated, "indicates that age is not a factor on these" items (Texas Governor's Commission on Physical Fitness, 1983). This is an interesting departure from tradition, corroborating the research of Palgi and Gutin (1984) who correlated running events from 40m to 2000m with aerobic capacity, anaerobic capacity, percent fat, and anaerobic threshold. The Wingate Anaerobic Test correlated highest with each running event, suggesting that running performance is not well differentiated among 10-14-year-old children; those who scored well in short running events did well in long events.

Summary and Recommendations

Health-related fitness is considered to include muscle strength, muscle endurance, flexibility, and a lack of adiposity (Bar-Or, 1988). Aerobic endurance is added in Physical Best (AAHPERD, 1989), the AAU (1992), and other fitness tests. Height and weight data often are collected, e.g., for the optional body mass index component of Physical Best. But in no test are height and weight data used for their greatest potential application: evaluating the physical growth and nutrition of individual children.

Measure and record the height, weight, and age of children during the fall and spring of each year.

Height and weight should be measured and recorded at least as often as physical fitness tests are given in the schools. Whether this is the role of the physical education teacher, a parent, or school nurse is a local decision, as long as care is taken in measurement and that the process is not neglected—only to become a sin of omission, egregious for those children experiencing growth failure that goes undetected and therefore untreated.

Dress should be standardized for the weighing, and consist of shorts, T-shirts, and socks; ideally the clothing worn should weigh no more than 11 ounces (Hamill et al., 1979). Height should be recorded against a wall with a square placed flat against the wall and slid down until it touches the crown of the child's head. The child should be standing tall, feet together, heels flat and against the wall, eyes looking straight forward so that the head is in the "Frankfort plane."* Stadiometers found on physicians' balances tend to be more difficult to use in that they often do not slide easily and bend too easily; consequently, they are suspected of less accuracy than the against-the-wall method.

Plot each child's height, weight, and age on a growth chart.

Age data also must be accurate. Evaluate the children's growth records and schedule follow-up visitations for those whose individual growth curves show placement above the 95th or below the 5th percentile, or which reveal rapid gains or losses.

Hammer, Kraemer, Wilson, Ritter, & Dornbusch (1991) recommend using the Body Mass Index (BMI = weight/height^2) as an indicator of obesity, and state that the 95th percentile is a conservative cut-off for obesity (see Table 1). R. A. Wetzel (personal communication, May 11, 1992) believes that boys and girls at or above the 75th percentile are gaining weight at a rate significantly above the Wetzel Grid's tolerance limits and are at increased risk of long-term obesity.

*The Frankfort plane refers to the position of the head in which the lower edge of the eye socket (inferior orbital margin) is in line with the top of the external ear canal, more technically, with the tragion, a notch above the tragus of the auricle (Lohman, Rolche, & Martorell, 1991).

Table 1
Body Mass Index (Weight in kilograms/Height^2 in meters)
NHES Survey, 1971-1974
Selected Percentiles for Boys and Girls Aged 6 through 12 Years

	Boys' Percentiles			Girls' Percentiles		
Age, Yrs.	25	50	75	25	50	75
6	14.7	15.4	16.3	14.6	15.3	16.4
7	14.7	15.5	16.5	14.7	15.5	16.7
8	14.9	15.7	17.0	15.0	16.0	17.2
9	15.1	16.0	17.6	15.5	16.6	18.0
10	15.5	16.6	18.4	15.9	17.1	19.0
11	16.0	17.2	19.2	16.2	17.8	19.8
12	16.5	17.8	20.0	16.7	18.3	20.4

From Hammer, Kraemer, Wilson, Ritter, & Dornbusch (1991).

In interpreting results of physical fitness and motor ability tests, be aware of the influences of growth quality, size, shape, maturity, and body composition, if only to be more compassionate.

The child who is below par in physical growth may need medical intervention or improved nutrition before being able to compete with age peers, much less to earn a fitness award. A child's natural body type may be thin, medial, stocky, or obese, leading to certain advantages or disadvantages in performance. Children need physical fitness guidance and counseling to accept and maximize the health and performance outcomes that are attainable. The child who is obese may be embarrassed by not being able to do a pull-up or flexed-arm-hang, but might do well in a test calling for gross strength or power. Embarrassing moments in physical education may turn off children to the benefits of a more active life-style for a long time. Counsel the overweight child into activities where he or she may succeed, and, if indicated, into a weight-loss program combining moderate exercise with moderate dietary restriction, particularly high-fat, low-nutrition foods (see chapter VI).

Certain tests favor specific combinations of size and shape for superior performance. There is less variability in many motor performance tests when scores are compared by body size rather than chronological age. This tends to be true for tests of leg power and for arm endurance. Such tests also favor ectomorphs and mesomorphs, where strength is greater relative to body weight. For measures of isometric strength, stocky and obese boys may be slightly superior to the slender and medium in physique unless equation is made on the basis of body size. With equal body surface area or isodevelopmental level, the favoritism shifts toward medium physique (Grueninger, 1970).

Report and interpret results of health-related fitness tests to the children, their families, and to school administrators.

Scores, growth curves, and reports are of no value if filed away and not used.

Fitness Applications for the Practitioner

XIII

Energizing Strategies for Motivating Children Toward Fitness

Kathryn D. Hilgenkamp

The Need for Motivational Strategies in Fitness

Elementary school children come to physical education classes with a variety of needs: some students have social needs, others simply need to be active, some need to improve self-esteem, and still others need to overcome growth and development obstacles. Students are frequently asked to follow directions when they would rather play freely, to pair up with an unacceptable peer, to endure some type of physical discomfort, or to risk ridicule by other children if they cannot perform as expected.

Physical educators today are taking responsibility for motivating their students inside and outside of class and beyond the school years. They know that student experiences affect future choices concerning participation in physical activity and that physical education teachers have a strong leadership role for young citizens. In order to help young people to integrate physical activity into their adult life-styles, the many motivational forces crucial to the desired outcomes must be considered.

One of the most important issues concerning sustained exercise behaviors in children is that negative experiences with exercise can create long-term aversion to physical activity. Stephens, Jacobs, and White (1985) reviewed physical activity patterns in North America and found a remarkable decrease in participation during late adolescence. The school environment is partially to blame for this, as many schools do not require physical education classes past the 10th grade. Other contributing factors are activity habits and experiences from previous years. Exercise and training programs should be introduced in an enjoyable and satisfying manner.

Exercise program interventions in the school can be effective in increasing fitness and leisure activity even with curriculum restraints such as sporadic classes, a curriculum that encompasses more than fitness, and short class periods (Gilliam, Freedson, Geener, & Shabraray, 1981; MacConnie, Gilliam, Geener, & Pels, 1982). The key to overcoming these problems is to encourage children to exercise outside of the school environment, in their natural setting. The National Children and Youth Fitness Study (NCYFS) conducted by the U.S. Department of Health and Human Services (1985) found that the typical student reports over 80% of his or her physical activity is outside the physical education class through community programs. Although studies of self-selected leisure activity in children have been reported, very few indicate the reasons why the children chose the activities in which they engaged (Dishman & Dunn, 1988).

The Role of the Physical Educator

Corbin (1987b) advocated that if physical educators want children to take fitness seriously and make it a habitual part of their life-style , they should:

- expand fitness concepts outside the classroom
- educate parents and the community as well as the children,
- teach higher order objectives such as self-evaluation of one's own fitness and planning one's own exercise programs,
- unlock the key to intrinsic motivation in children, and
- teach students how to set reasonable and attainable goals.

This author suggests that physical educators consider the stages of exercise involvement and learning processes of children so that motivation toward fitness is an achievable outcome:

Stage 1: Anticipatory Stage of Exercise Involvement

During this stage children are curious, drawn to activity, excited to learn, and are very impressionable. Factors important to motivation are: acceptance, activities that are fun and enjoyable, and self-efficacy.

Stage 2: Initial Stage of Exercise Involvement

During this stage, children are most influenced by their dependency; fears; and need for understanding, approval, acceptance, and recognition. The teacher's role is crucial. At this stage of learning, many mistakes are made requiring significant amounts of teacher feedback. Factors most crucial to motivation are: tasks of interest with an acceptable level of challenge, perceptions of performance control, perceptions of success, feedback from significant others, perceptions of ability, and self-efficacy. Teachers should also structure developmentally appropriate activity in order to teach students new skills and improve other skills. The term developmentally appropriate indicates that activities are selected with the aim that students succeed as quickly as possible. Teachers should also attend to giving immediate feedback concerning both performance and outcome successes.

Stage 3: Compliance Stage of Exercise Involvement

As children progress through the learning process, they should be taught to spot their own mistakes and correct them, which decreases dependency on the teacher for feedback about success/failure. Performance increases as long as motivation is sustained. Motivation will be sustained as long as the teacher realizes that students' need change. During previous stages of exercise involvement, children are most influenced by the need for conformity, peer acceptance, belonging, recognition, and achievement. Factors most influencing motivation at this stage include social rewards, feedback from peers, perceptions of control, self-efficacy, and self-confidence. It is a wise teacher who recognizes the need for students to develop a concept of competence and control as well as mastery. These needs transfer into teaching strategies that transform extrinsic motivation to intrinsic motivation. Intrinsic motivation is absolutely necessary to sustain exercise behaviors for extended periods of time. Intrinsic motivation can be developed when social opportunities such as individual achievement, peer acceptance, and selection as part of a team are provided. Whitehead and Corbin (1991) found that external events that increase or decrease perceived competence will increase or decrease intrinsic motivation. They found that positive feedback enhanced all aspects of intrinsic motivation, whereas negative feedback decreased them. Fox and Biddle (1988a) concluded through their research that the two main intrinsic elements that are most potent for children are inherent joy of the activity and feelings of mastery and competence.

Stage 4: Adherence Stage of Exercise Involvement

If learning opportunities have been successful in the previous learning stages, the student should be able to progress to a stage of mastery dominance, self-realization, and independence.

Factors most important to continued performance without teacher feedback include: perceptions of ability, perceptions of physical competence, perceived control, self-efficacy, self-confidence, attitudes, beliefs, and values. It is important to remember that attitudes, beliefs, and values are developed as a result of experiences with physical activity and are crucial to sustained physical activity several years after physical education experiences. Most often, physical educators are not present to observe whether or not their proteges have adopted an active life-style as a result of physical education experiences. Efforts to track childhood exercise patterns into adulthood find only a weak connection (Powell & Dysinger, 1987).

It may be discouraging to think that long-term educationa[illegible]ls such as exercise adherence into adulthood may not always be a dir[illegible]ome from positive experiences in physical education classes, but we cannot ignore the fact that short-term benefits enhance long-term behaviors. Ferguson, Yesalis, Pomrehn, and Kirkpatrick (1989) suggested that teachers should pay attention to short-term as well as long-term benefits of exercise programs. Teachers of 603 middle-school students reported that students responded well to positive short-term benefits, such as improved appearance. Providing students with feedback on progress helps convince them of the benefits of exercise.

Motivational Strategies for Physical Educators

Motivational strategies include energizing techniques such as selecting developmentally appropriate activities, creating a need to know, making activities fun and enjoyable, offering students choices, and altering the environment to make the activity more interesting. Several strategies for motivation are discussed in this section.

Goal Setting

Locke and Latham (1990) have discussed the implications of goal setting on self-efficacy, expectancy, and performance. They conclude that assigned goals not only affect personal goals, but self-efficacy as well. Assigned goals give the child some direction and can make fitness activities more challenging, yet attainable. Assigned goals appear to convey normative information to the student by suggesting or specifying what level of performance the individual could be expected to attain. Physical educators must be careful not to give children the impression that they must attain a fitness norm to be successful. The emphasis in fitness education is not on comparing oneself to another, but on individual successes. A better approach would be to use fitness measures to determine the baseline level of fitness and use a 20% improvement for a goal standard. Once this goal has been reached, another goal can be set, unless the student has reached a high level of fitness, then the goal should be to maintain fitness.

Although it is important that someday students are able to set their own goals, at the elementary level, it is not recommended. Children with low self-efficacy tend to set goals too low. Goals that are too low can be demotivators. Even if success is achieved, it is not attributed to effort and persistence and does not have a reinforcing effect. Goals should therefore be challenging yet attainable, no matter at what level the student functions. Specific goals lead to higher levels of task performance than vague goals, easy goals, or no goals. Erbaugh and Barnett (1986) found that children performed significantly better when given a specific goal than when just told to do their best on a jumping task.

Bandura (1986) suggested that short-term goals were more important in improving performance because of the immediate feedback concerning progress. Bandura and Schunk (1981) found that short-term goals resulted in more effective weight loss than long-term goals. Bandura does not take an either/or stand between the two types of goals. He advocates that long-term goals are an important part of the goal-setting hierarchy because an individual may not become self-motivated unless there is a long-term goal in sight. Weinberg, Bruya, Longino, and Jackson (1988) found among 4th, 5th, and 6th graders that those with long-term, short-term, and long-term/short-term goals performed significantly better on an endurance task (sit-ups) at the end of a 10-week training period than those with "do your best" goals.

Modeling

Goal-setting can also be paired with other motivational strategies such as modeling. Erbaugh and Barnett (1986) also found from their study that children in goal-setting or modeling plus goal-setting conditions learned more than children in either the control or modeling conditions. The teacher should be a good role model for fitness. Show enthusiasm by actively participating in fitness activities during class and in the community. Lirgg and Feltz (1991) found that the effects of modeling on self-efficacy vary depending on competence of the model. Those who observed a skilled model reported higher efficacy beliefs than those who had no model or an unskilled model.

Other Techniques

Other positive motivational techniques used by physical educators include giving children choices of activities, self-assessments, and progress evaluations. Some physical educators may consider fitness tests to be motivating, but there is no indication that this is true. Generally, any changes in attitude toward fitness derived from a fitness program are not a result of fitness testing, but from the program itself. In situations involving a physically awkward or obese child, fitness testing can be a demotivator.

Motivational techniques should be energizing strategies. Situations must be created so that each child may be intrinsically motivated to participate, enjoy, and retain the fitness skill or concept. The learning environment, the fitness curriculum, and the methods by which we assess success can be adjusted. The following are additional suggestions:

The Learning Environment

- Allow children to learn about fitness in places other than the school gymnasium. Move the class outdoors, take them to a park or fitness trail, walk about the neighborhood, conduct a biking tour, or visit a nearby fitness club.
- Allow opportunities for children to perform fitness activities during the school lunch hour with an area set up for a mini-fitness circuit.
- Give students opportunities to earn points for fitness-related activities at home, after school, or on weekends.

The Fitness Curriculum

- Present fitness activities in the early elementary grades in an informal manner.
- Make sure that large group activities encourage maximum participation from everyone in the class. If someone is tagged in an elimination game, assign a physically active task instead of telling the student to sit still.
- Provide students with a variety of activities to choose from to accommodate likes and dislikes.
- Pair students up according to size and fitness level.
- Set student goals that are challenging yet attainable so each child can experience early success.
- Make sure students understand instructional goals and are interested in attaining them.
- Begin with a small number of repetitions and add to that number every 3rd day. When 20 repetitions can be completed efficiently, try a different physically challenging activity.
- Create new ways to perform traditional fitness activities to prevent boredom.
- Invite parents to participate in a fitness unit.
- Create obstacle courses for a fitness challenge activity.
- Organize intramural activities outside of normal school hours.
- Encourage students to participate in fundraisers (such as Jump Rope for Heart), fun runs, intramurals, and youth sports.
- Praise physically challenged students who try hard, daily.
- Post achievement charts and awards for improvement for groups or individuals.
- Do not use normative fitness scores as criteria for grading.
- Score performance based on improvement.
- Recognize the entire class for their fitness achievements.
- Provide feedback to parents about student progress and urge them to encourage continued activity.

Summary and Conclusions

Physical educators should remember that children are constantly changing physically, mentally, and socially. Acceptable psychological approaches must be considered before attempting to shape attitudes, beliefs, values, and behaviors. Motivational assessment instruments that are based on theory and supported by empirical research can be applied. Physical educators can accept the responsibility to acquire knowledge about motivation by conducting research that is theoretically based. Role model examples must be set to show the types of behaviors we wish to elicit in others. Physical educators must be careful not to judge or label students for problems in complying with desired behaviors lest we set the stage for self-determinism with a negative behavior pattern, which remains with them for a lifetime. We must accept the challenge motivational issues present in encouraging lifetime fitness among children. Dare to try innovative approaches, which students will remember for a long time, by creating a positive learning environment, creating enjoyable activities, and enhancing the potential for success!

XIV

Academic and Physical: A Model for Integration of Fitness Concepts

Sandra A. Stroot
Shan Bumgarner

Introduction

Academic scores for reading and mathematics have declined over the past decade throughout the United States, as illustrated by test scores reported for the 1989-1990 school year in Columbus, Ohio (Bell, 1990). The National Commission on Excellence in Education brought this concern to the forefront as "the rising tide of mediocrity" was addressed (Sims, 1984). Calfee and Drum (1986) suggested multiple reasons for the decline in the quality of public education, including loss of authority by teachers and principals, lack of respect for traditional structures, open education concepts, inadequacy of literary instruction, and lowered standards. In the field of mathematics, one concern was the predominant teaching style, which was described as "extensive teacher-directed explanation and questioning followed by student seatwork on paper-and-pencil assignments" (Fey, 1979, p. 494).

Inadequate fitness levels of children and youth in the United States is another area that was brought to national attention through the National Children and Youth Fitness Studies (NCYFS). Information from the NCYFS I for young people ages 10-17 (Ross & Gilbert, 1985), suggested that one third of high school juniors and seniors were not physically active enough for aerobic benefit. The NCYFS II study examined fitness levels of children ages 6-9 and found that, although children ranked physical education as their favorite subject, programs may be inadequate to promote lifetime fitness (Ross & Pate, 1987). One reason mentioned by teachers for low fitness levels was lack of time available for physical education. Another may be lack of incentive and motivation for children as they attempt to become more fit. In the past, only elite performers were rewarded for their strides to increase fitness levels, and, although this is beginning to change, more programs must address needs and reward the accomplishments of all children.

Lack of success in teaching academic subjects and improving fitness levels in children has been a perennial problem for several decades. Calfee and Drum (1986) described efforts to respond to these challenges by spending more time in reading and mathematics instruction during the school day. Time in physical education classes is also limited, and, although this is an important issue in overall program implementation, results of the NCYFS II study show no significant relationship between minutes of physical education per week and results on the mile walk/run test or the sum of skinfolds test (Pate & Ross, 1987).

Perhaps the solution is not the quantity of time spent in instruction, but rather the quality of instructional time. One suggested approach would be the Integrative Education Model described by Clark (1986), which claims to address the whole child through integration of cognitive, emotional, physical, and intuitive thinking and provides for optimal learning in the classroom.

The idea that children learn through multiple modes is not a new one. Carl Jung (1933) revealed that human learning included multiple sensory processes: thinking, feeling, physical sensing, and intuitive processes. More recently, Levy (1980) suggested that motivation for learning is a highly integrated brain action. He found that the brain operated best when both cognitive and emotional systems were challenged, resulting in motivation toward learning and encouraging physical involvement. Within the integrative concept, the student is an active learner. Clark (1986) reported,

> Cognitive, affective, physical, and intuitive activities are all valued parts of the classroom experience. . . . The student is an active participant in the learning process. Movement, decision making, self-directed learning, invention, and inquiry are encouraged both inside and outside the classroom. (p. 33)

A significant problem in teaching academic subjects to students seems to be lack of motivation. Gentile (1983) suggested that many children see reading and writing as a chore or a duty rather than as an exciting challenge. Young children are under pressure to read, which can induce a great deal of stress, and eventually avoidance. In order to provide exciting, motivating challenges to children to encourage participation in reading and writing skills, sport and activity have been integrated into the reading and mathematics curriculum (Clark, 1986; Gentile, 1980, 1983; Thomas, 1983; Turner & Turner, 1989).

Alternative schools in the Columbus, Ohio, Public School District have had integrated programs for several years, with four elementary schools integrating a physical component into the school's academic curriculum. For the past four years, the Westgate School of Academic and Physical Excellence has integrated physical activity into the elementary curriculum, and initial data has shown potential for improving math and reading scores (Stroot, Carpenter, & Eisnaugle, 1991). The success of Westgate Alternative School was reflected in the reading and math test results from the California Achievement Test (1986) shown in Table 1.

Table 1
Results of the California Achievement Test (1986)
Westgate Elementary School

Grade	Subject	Number Tested WG	Number Tested DIST	Average Percentile WG	Average Percentile DIST
2	Math	97	5351	70	59
2	Read	97	5325	41	42
3	Math	67	4996	74	58
3	Read	67	5000	61	49
4	Math	76	4540	73	66
4	Read	76	4586	63	54
5	Math	61	4301	77	60
5	Read	61	4305	58	48

From Stroot, Carpenter, & Eisnaugle (1991).

Average scores for each grade level in both reading and math were higher for Westgate (WG) than for the district (DIST) except for the 2nd-grade reading scores. An explanation for this may be that the 2nd-grade teacher was replaced during this year, and continuity was disrupted.

Success of Westgate Alternative School of Academic and Physical Excellence was also demonstrated by high attendance during the 1989-1990 school year, indicating that students enjoyed the positive atmosphere demonstrated throughout the building and wanted to be in school.

Integration of sport and physical activity seems to be an ideal medium to motivate children. Physical activities can be used to enhance interest levels of children as they are learning academic skills. Physical activities can also allow children to take a more active role in learning, thus increasing potential for success and retention. In addition to the academic benefit, physical fitness levels could be increased by designing physical activities with fitness components in mind. Integrating the physical activity and/or the cognitive concepts of fitness into the classroom lesson gives students the opportunity to work toward some measure of fitness and see and feel ideas physically represented.

Suggested Integrative Activities

The following provide examples of activities that can be used in the classroom or gymnasium. The lessons address many curricular areas, such as reading, mathematics, health/science, geography, and computer skills.

Reading

Race for Space
Grades: 1-2

Equipment needed:	Arrange chairs in circle facing outward, with one less chair than the number of children
Cognitive and psychomotor objectives:	Listening skills; locomotor movements

Directions:As one child reads aloud, the other children circle the chairs using designated locomotor movements until a predetermined noun, verb, or adjective is read. At that point all children find a chair; whoever is left without a chair becomes the new reader. The previous reader writes the word on the blackboard and continues in the activity. This list could become the spelling list for the week.

Source: Sweeney (personal communication, September 11, 1991)

Body Spelling
Grades: 1-2

Equipment needed:	Storybook; arrange for open space
Cognitive and psychomotor objectives:	Listening, comprehending; nonlocomotor movements, flexibility

Directions: After reading a new story, the children practice spelling new words by bending their bodies into letters that form the words. Letters can be combined into words and sentences.

Source: Modified by the authors from Dauer & Pangrazi (1989, p. 267)

Dash for Cash
Grades: 2-6

Equipment needed:	Play money, story book

Cognitive and psychomotor objectives:	Reading, comprehending, arithmetic; flexibility, strength movements

Directions: Work in partners or groups of four to rotate through 5-10 activity stations per session. Stations can incorporate fitness activities focusing on strength, flexibility, and endurance. Students are challenged for 30-second intervals. Body Bucks are awarded for each successful repetition per 30-second cycle. At the completion of the stations, scores are tallied and totals placed in a deposit box. (Reading skills could be incorporated by providing written instructions using new fitness vocabulary words.) Play money can be distributed based on total score.

Source: Turner & Turner (1989, p. 41)

Mathematics

The Beat Goes On

Grades: 2-6

Equipment needed:	Clock, record sheet, record player, music
Cognitive and psychomotor objectives:	Counting, calculating, graphing; aerobic activity

Directions: Count resting pulse for 6 sec. x 10 = ____ beats/min. Complete aerobic dance routine starting at 5 minutes building to 20 minutes. Stop, take pulse, find beats/min. Graph results (all grades). Variations can include calculation of target heart rate for older students.

Source: Modified by the authors from Dauer & Pangrazi (1989, p. 250)

Up, Up, and Away

Grades: 1-6

Equipment needed:	Balloons, magic marker
Cognitive and psychomotor objectives:	Math computation; application of force

Directions: Each child has a balloon with a math problem printed on it. The balloon can be kept in the air by requesting students to use designated body parts to strike the balloon. On the signal the student can catch a balloon and solve the math problem. Repeat.

Source: Modified by the authors from Dauer & Pangrazi (1989, p. 358)

Buddy Pushes
Grades: K-6

Equipment needed:	Record sheet
Cognitive and psychomotor objectives:	Counting, graphing; maximal muscle contractions

Directions: Students work as partners, with student A sitting on a chair or bench and student B standing. Student A attempts to raise a leg or arm while student B creates resistance by pushing down against the limb. The maximum muscle contractions should be held for 2-5 seconds. Number of repetitions are counted, recorded, and graphed. Students then switch places and repeat the activity.

Source: Modified by the authors from Kneer (1981, p. 2)

Health/Science

What's the Matter of Molecules
Grades: 2-3

Equipment needed:	Container of ice, water, steam
Cognitive and psychomotor objectives:	Understanding movements of molecules; locomotor/nonlocomotor movements

Directions: From a science unit on molecules of solids, liquids, and gas, identify each. Divide students into three groups assigning solid, liquid, or gas to each group. Create movements that reflect how the molecules would act under various environmental conditions.

Source: Modified by the authors from Dauer & Pangrazi (1989, p. 267)

Solar System
Grades: K-6

Equipment needed:	Bean bags, hula hoops, stop watch
Cognitive and psychomotor objectives:	Knowledge of planets and solar system; locomotor movements

Directions: Line the hoops according to their distance from the sun (can be measured to scale). Working in small groups and using a cooperative relay format, children will calculate time to get from beginning to the end of the solar system or selected planets in between. During each trial the students will work to improve their time and knowledge of planets.

Source: Sweeney (personal communication, September 11, 1991)

Step Up to Fitness

Grades: K-6

Equipment needed:	Step-boxes, recorded music
Cognitive and psychomotor objectives:	Physiological components of aerobic performance; step-up and step-down

Directions: Each student has a box or space on a step to step up and down in time to the music. The amount of continuous time stepping is recorded. Class discussion of aerobic conditioning concepts. Repeat this activity every other day for a minimum of 20 minutes for 8 weeks to effect change.

Source: Modified by the authors from Kneer (1981, pp. 22-25)

Geography

Tour de France

Grades: 3-6

Equipment needed:	Two desks per student, map of France
Cognitive and psychomotor objectives:	Mapping skills, knowledge of France; strength and endurance of arms and legs

Directions: Students stand between two desks and place one hand on each desk, lift legs and support body weight. Begin moving legs as though bicycling for a designated time period. Set goal for each trial, and correlate time to distance traveled on map following the route of "Tour de France."

Source: Modified by authors from Dauer & Pangrazi (1989, p. 664)

Geography Jump

Grades: 1-4

Equipment needed:	Yardstick/tape measure, map of United States, encyclopedias; landing mats
Cognitive and psychomotor objectives:	Measuring skills, calculations, scale of feet to inches, knowledge of geography; standing long-jump

Directions: Students work in pairs with one performing a standing long-jump, the other measuring the distance of the jump. Measurements must be converted to scale appropriate for size of map. Transfer distance jumped to appropriate distance on map, choosing to travel N, S, E, or W from the starting point. Conversions from inches to feet or to metric systems can be used.

Source: Sweeney (personal communication, September 11, 1991)

Softball Tossing

Grades: 3-6

Equipment needed:	Herculon target, strips of Velcro glued to plastic balls
Cognitive and psychomotor objectives:	Mapping skills; strength of arms, accuracy of throwing skills

Directions: Stand a predetermined distance from a wall map of the United States of America, throwing balls, which will attach to the target. Count the number of successful contacts; identify states hit, capital cities, regions, major cities, major rivers and lakes, mountain ranges, famous landmarks. Point values can be determined for each successful identification.

Source: Turner & Turner (1989, p. 115)

Computers

Physical Best or FITNESSGRAM

Grades: 3-6

Equipment needed:	Personal computer, AAHPERD Physical Best software,
Cognitive and psychomotor objectives:	Basic computer skills; knowledge of fitness standards, ability to perform fitness components

Directions: Students will set goals for various fitness components; be provided multiple opportunities to work toward achieving goals; monitor progress through self-testing; and input results into the computer. Sorting and listing fitness scores provide opportunities for students to monitor the extent of improvement over time.

Source: Stroot & Bumgarner (1989)

Discussion

Inadequate achievement in academics and fitness levels have been reported throughout the literature. Integration of physical activity and academics could only benefit and enhance childrens' opportunities in both arenas. Through the incorporating of physical activity into the academic focus, children would be motivated by their natural desire for movement, and opportunities for improving fitness levels would be increased. Use of academic goals in the physical environment would motivate children to learn, and would also ensure presentation of consistent materials throughout the school curriculum. As learning is reinforced when children receive similar information from multiple sensory processes, integration of materials would provide opportunities for optimal achievement. Instruction could be individualized based upon physical and academic achievements of each child, and could occur in a gymnasium setting or in the classroom as a group or individual activity. Children are active learners, and physical activity is an ideal medium to increase motivation for learning in all subject areas. The potential is limited only by our imagination.

XV

Teaching Fitness Concepts

Laurie Priest
Cindy Gregory

Introduction

From a practitioner's point of view, research needs to be applicable to the classroom/gymnasium environment. It is the purpose of this chapter to present a beginning compilation of hands-on activities whereby students engage in fitness experiences to gain cognitive, affective, and psychomotor information.

The teaching activities that follow have been adapted from *Teach for Fitness: A Manual for Teaching Fitness Concepts in K-12 Physical Education* (Priest, 1981). These activities are designed to aid and encourage physical education teachers to incorporate the teaching of physical fitness concepts into the physical education curriculum.

Each activity is presented in outline format, providing the following information:

- *Concept* being introduced by the lesson, such as physical fitness, the human heart, breath rates, nutrition, bones, skeletal muscles, warm-up/cool-down, principles of exercise, fitness guidelines, strength, flexibility, heart rate, cardiovascular endurance, body composition.
- *Level of the lesson.* The aim of lower-level activities is to introduce the concepts of physical fitness. Middle- and upper-level activities introduce a more advanced activity level. The level of activity taught will depend upon the student's present knowledge in the area of physical fitness. Since all activities can be modified to meet individual and class needs, specific grade levels have not been assigned.
- *Time* required for the lesson.
- *Objective* of the lesson.
- *Materials* needed.
- *Definition of terms* used in the lesson, if appropriate.
- *Description of the activity.* Some activities require a lecture format, but whenever possible exercise and activity should be included as an integral part of a lesson plan.

- *Authors' notes*, if appropriate, to offer additional resources.
- *Expansion ideas*, which include suggestions for building on a particular activity.

Readers should keep in mind that these activities provide only a starting point for the teaching of physical fitness concepts and for the opportunity to encourage students to incorporate physical fitness activities into their daily lives.

Concept: Physical Fitness

Level: Lower **Time:** 20 minutes

Objective: Students will define the term physical fitness.

Materials: None

Terms: *Physical fitness*—the ability to carry out daily tasks with vigor and to engage in leisure-time pursuits and to meet the above average physical stresses encountered in emergency situations (Corbin & Lindsay, 1979); the ability to carry out daily tasks with vigor and to demonstrate low risk of diseases associated with a sedentary life-style (Pate, 1988).

Activity:

1. Discuss with students the definition of physical fitness and what physical fitness means to them.
2. Ask students why they think it is important to keep physically fit.
3. Discuss with students the health-related components of physical fitness:
   strength—how strong muscles are
   muscular endurance—how long muscles will work
   flexibility—how far muscles will stretch
   cardiovascular endurance—how much oxygen the body can supply to working muscles
   body composition—how much fat, muscle, bone, etc. the body has
4. Have students discuss what these components mean to them.
5. Have students list animals that have the different components of physical fitness, e.g., bears are strong, pigs are fat, snakes are flexible.
6. Have students do an exercise to illustrate each component of physical fitness, e.g., push-ups (arm strength), arm circles (muscular endurance), toe touches (flexibility), run in place (cardiovascular endurance).

Expansion: (a) During classroom activities/exercises, help make students aware of components of physical fitness, and have them perform appropriate exercises. Students can test their levels of physical fitness, including the health-related components by using the AAHPERD Health-Related Physical Fitness Test (AAHPERD, 1980a) or the Physical Best program (AAHPERD, 1988). (b) For a fun activity, add some movement education using animals and have students move like their animals. Using different types of animals and different components, have students not only move like their animals, but if one is a predator to another, have them chase one another appropriately.

Concept: Physical Fitness

Level: Lower **Time:** 20 minutes

Objective: The students will identify daily activities that require physical fitness.

Materials: None

Activity:

1. Review with students the components of physical fitness: strength, muscular endurance, flexibility, cardiovascular endurance, and body composition.
2. Have students select daily tasks and activities that require physical fitness, i.e., carrying logs into the house for a fire, helping move furniture, chopping wood, carrying groceries, running to catch the bus.
3. Have students talk with family members to find out what types of activities they do to stay physically fit.
4. Have students discuss exercises/activities they can do to improve their fitness levels to meet the needs of daily activities (i.e., push-ups to assist with carrying tasks).

Authors' Notes: This activity could be combined with an English class assignment and students could write a report on their findings.

Expansion: Students could write papers describing their favorite sports, including the components of physical fitness needed and how one becomes physically fit for each.

Concept: Physical Fitness

Level: Lower **Time:** 10 minutes

Objective: Students will demonstrate understanding of the importance of physical fitness throughout their lives.

Materials: Notebooks

Activity:

1. Discuss with students the concept and purpose of a savings account, i.e., working today to save for future needs.
2. Explain to students that developing and maintaining their physical fitness level is equally important. The physical effort that they expend today will improve their fitness levels and in turn, will help them throughout their lives. Physical activity is an investment in their future.
3. Have students keep a fitness account in individual notebooks. Students should record their participation in physical activities/exercise in and out of school on a daily basis. Stress to students that this is a personal account that will serve to monitor their fitness development.

Authors' Notes: (a) The physical education teacher could design notebooks that resemble savings account passbooks for the students. (b) The teacher could also encourage students to invest in their futures by being active outside of class.

Concept: Physical Fitness

Level: Middle **Time**: 30 minutes

Objective: Students will each make a notebook of activities concerning physical fitness.

Materials: Old newspapers, magazines, glue, scissors

Activity:

1. Have students cut articles that relate to physical fitness from newspapers and magazines.
2. Have students report to the class on two of the most interesting articles included in their notebooks.

Authors' Notes: (a) This activity could be combined with a writing assignment for an English class. (b) It is important that students realize that many articles on physical fitness can be found in a variety of newspapers and magazines.

Concept: Physical Fitness

Level: Middle/Upper **Time:** 10 minutes

Objective: Students will define physical fitness.

Materials: None

Activity:

1. Ask students what they think the term physical fitness means.
2. Discuss with students the definitions of physical fitness: The ability to carry out daily tasks with vigor and to engage in leisure-time pursuits and to meet the above average physical stresses encountered in emergency situations (Corbin & Lindsay, 1979); the ability to perform daily activities with vigor, and demonstration of traits and capacities that are associated with low risk of premature development of the hypokinetic diseases, i.e., those associated with physical inactivity (Pate, 1988).
3. Ask students to list daily activities that require some level of physical fitness (i.e., running to catch a bus, moving furniture, etc.).
4. Explain to students that there are two types of physical fitness. One is performance-related, which helps students to perform motor skills (enhancing athletic ability). The other is health-related, which helps students to remain healthy and active.

Expansion: Students could write a one-page paper on why it is important to be physically fit. Papers could be shared with the class.

Concept: Physical Fitness

Level: Middle/Upper **Time:** 25 minutes

Objective: Students will list the different components of fitness and differentiate between performance-related fitness and health-related fitness.

Materials: None

Activity:

1. Discuss with students the performance-related components of fitness:

   agility—the ability of a person to change direction or body position quickly and control the movement of the entire body

   balance—the ability to maintain a desired position of the body, both in movement and in stationary positions *coordination*—the ability to integrate muscle motions into an efficient pattern of movement

power—the ability to release maximum force or to contract the muscles in the shortest possible time

speed—the distance covered/time taken; rate of performance or action

reaction time—the time it takes to perceive a stimulus and begin movement

2. Have students list different sports and activities that require the performance-related components of fitness.

3. Discuss with students the health-related components of fitness:

strength—the amount of force a muscle or muscle group can exert

muscular endurance—the ability to perform repeated muscle movements for a given period of time.

flexibility—the ability to move a joint through a full range of motion

cardiovascular endurance—the body's ability to provide oxygen continuously to the body as it performs work over an extended period of time

body composition—the relative percentages of fat and fat-free body mass

4. Have students list different sports and activities that require the health-related components of fitness

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Concept: Physical Fitness

Level: All **Time:** 2-3 class periods

Objective: Students will measure their levels of physical fitness based on the AAHPERD Physical Best program.

Materials: Track area measured off, skinfold caliper, mats, stop watch, specially constructed box with measuring scale

Activity:

1. Discuss with students the purpose of the AAHPERD Physical Best program. Describe each of the five test items and what each one measures:

aerobic endurance—to measure cardiovascular efficiency

skinfold—to measure body composition

flexibility—to evaluate the flexibility of the lower back and hamstring muscles

muscular strength and endurance—to evaluate abdominal muscle strength and endurance *upper body strength and endurance*—to measure arm and shoulder girdle strength/endurance

2. Have students take the tests and help them to assess their performances.

Authors' Notes: Students can help set up test stations, administer tests, keep their own records, and make an assessment chart or performance profile.

Expansion: (a) Using their performance profiles, students could design programs to help them improve their physical fitness and periodically take the Physical Best program tests to assess their progress. (b) Help students learn to set and achieve realistic goals. (c) Develop an incentive program, i.e., use a map or atlas and set a course to walk (e.g., who can be the first person or the first team to reach New York City).

Concept: Physical Fitness and Work

Level: Lower **Time:** 20 minutes

Objective: Students will identify the components of physical fitness required by different jobs.

Materials: None

Activity:

1. Review with students the health-related components of fitness: strength, muscular endurance, flexibility, cardiovascular fitness, body composition.
2. Have students identify different jobs that require different components of physical fitness, i.e., police officer, firefighter, dancer, mother, office worker, construction worker, nurse, teacher.
3. Discuss with students how physical fitness relates to the jobs they identified. For example, what happens if a nurse does not have enough strength for the job? Or if a firefighter does not have enough muscular endurance for that job?
4. Have students select jobs they might want to pursue when they grow up. Have them determine what components of physical fitness are required for their future jobs and share this information with the class. Students who select jobs that do not require a high degree of physical fitness should discuss exercise programs that can be incorporated into their future life-styles.

Expansion: The teacher could arrange for students to visit a local fire department to observe job fitness demands and ways firefighters maintain their physical fitness. Students could also visit other job sites or have classroom visits from individuals in various occupations to discuss on-the-job fitness demands.

Concept: Human Heart

Level: Lower **Time:** 10 minutes

Objective: Students will identify the size and location of the human heart.

Materials: Poster or picture of the human heart

Activity:

1. Have students make fists with their hands. Explain that the heart is as big as a person's fist.
2. By opening and closing your fist, demonstrate to students how the heart beats to pump blood to the body.
3. Discuss with students where the heart is in the chest. Use posters or books to illustrate.

Authors' Notes: (a) The teacher can contact local or state affiliates of the American Heart Association for further information. (b) For student observation, the teacher might want to obtain an animal heart (cow, pig) from the local butcher or grocery store. (c) Anatomy or science textbook illustrations of the heart can be used.

Expansion: (a) Students can further their understanding of how the heart pumps blood by clasping their hands together in a bucket of water and forming a spout with the thumbs and first finger. Squeeze hands together to force water through the spout. Students should understand that the heart pumps blood in a similar fashion. (b) Students could lie down and trace their bodies on large pieces of paper and draw the heart in its proper location. (c) Have students bring paper towel rolls. Use the paper towel rolls like a stethoscope to listen to the heart. Students should do this at rest and during exercise.

Concept: Breath Rates

Level: Lower **Time:** 10 minutes

Objective: Students will demonstrate that they breathe more rapidly when exercising.

Materials: Balloons, picture or poster of the lungs

Activity:

1. Discuss with students the body's need for increased oxygen during exercise.
2. Have students sit quietly with their hands on their chests and feel them move as air is inhaled and exhaled through the lungs.
3. Have students run in place for 2 minutes and then stop. Have students immediately put their hands on their chests and feel them move.
4. Discuss the difference in the rate of breathing at rest and after activity.

Authors' Notes: (a) Balloons can be used to illustrate how lungs expand as one inhales. (b) A picture or poster of the lungs should be available for student examination. (c) Additional information and materials can be obtained from the American Lung Association. (d) Students should understand that the lungs supply oxygen to the blood.

Expansion: (a) As students engage in different activities, the teacher can have them stop and feel their chests as they breathe. What activities will make them breathe heavier than others? (b) As students engage in different activities/ exercises students should, at varying speeds (i.e., walking, skipping, jogging, running): (1) breathe only through a regular straw that is about 3 inches long (pinch nose closed), (2) breathe through a coffee stirrer straw (same as above), and (3) breathe normally. (c) Then discuss the differences. Include in your discussion cigarette smoking and asthma and how each affects our breathing.

Concept: Bones

Level: Middle/Upper **Time**: 10 minutes

Objective: Students will locate the major bones of the human body.

Materials: Skeleton or a poster of the skeletal system

Activity:

1. Discuss with students the following bones and where they are located: clavicle, scapula, vertebrae, sternum, ribs, humerus, ulna, radius, femur, tibia, fibula, patella.
2. Review with students the relationship between bones and muscles. Their major cooperative function is to produce movement.
3. Discuss with students the idea that a joint is formed where two bones meet. The bones are held together by ligaments. Joints are where flexibility is measured.

Authors' Notes: (a) Have either a skeleton or a poster of the skeletal system for students to examine. (b) Have students locate the bones on their own bodies. (c) The muscles and bones are referred to as the musculoskeletal system.

Expansion: During class activities use the names of bones to help reinforce knowledge of the bones; this can easily be done in skill development activities.

Concept: Skeletal Muscles

Level: Middle/Upper **Time:** 10 minutes

Objective: Students will locate the major skeletal muscles of the human body.

Materials: Poster illustrating skeletal muscles

Terms: *Skeletal muscles*—bands of contractile fibers that attach to bones and produce movement

Activity:

1. Discuss with students the following muscles and where they are located: deltoid, trapezius, pectorals latissimus dorsi, biceps, triceps, brachioradialis, abdominals, gluteals, quadriceps, hamstrings, gastrocnemius, soleus.
2. Discuss with students that muscles are attached to bones by tendons. As muscles contract and expand, bones are moved.

Authors' Notes: (a) Have a poster available to show students the muscles. (b) Have students also feel these muscles on their own bodies. (c) Skeletal muscle accounts for approximately 40% of total body weight. (d) There are about 600 muscles in the human body. (e) Tendons are much tougher than muscles and are composed of nonliving fibers. (f) The muscles enable people to move, stand erect, and carry out activities.

Expansion: During class activities use the names of the muscles to help students learn them.

Concept: Warm-up/ Cool-down

Level: Middle/Upper **Time:** 2 class periods

Objective: Students will describe the importance of warming up before physical activity and cooling down after.

Materials: Stopwatch or clock with second hand

Terms: *Warm-up*—a brief period of mild exercise/activity prior to vigorous exercise.
Cool-down—a brief period of mild exercise/activity immediately following vigorous exercise.

Activity:

1. Discuss with students reasons why warming up is important, i.e., stimulates blood flow, helps to loosen muscles, increases body temperature, awakens nerves.
2. Discuss with students why cooling down is important, i.e., slows body functions down gradually, muscles continue to contract to aid venous blood return to the heart.
3. Discuss with students different warm-up and cool-down activities, such as slow jogging, walking, stretching, calisthenics.
4. Have students warm-up slowly and run approximately 200 meters or for 2 minutes, then stop and sit down, and take their pulses after 1 minute. Have them record heart rate. On another class day, have students run 200 meters once again and then stop. This time instead of sitting down have them walk for 1 minute, and then take the pulse after that minute. Discuss with students how walking and cooling down aids body recovery.

Expansion: The teacher should always include warm-up and cool-down when activities include vigorous exercise.

Concept: Principles of Exercise

Level: Middle/Upper **Time:** 20 minutes

Objective: Students will describe and demonstrate the three general principles of exercise.

Materials: None

Activity:

1. Discuss with students the following principles of exercise:
   overload—a person needs to do more than would normally be done to improve fitness. For example, muscles will not become stronger unless they are exercised at higher than normal levels.
   specificity—a person needs to do specific exercises to improve specific components of physical fitness and specific body parts. In other words, specific exercises are needed for specific results. For

example, lifting weights will improve the strength of muscles involved in the exercise, but may not affect other muscles or flexibility.
progression—a person needs to start exercising slowly and to increase the amount of exercise done over a period of time. For example, at the beginning of a running program, a person runs short distances and gradually increases these distances.

2. Explain to students that these three principles apply to strength, muscular endurance, flexibility, and cardiovascular fitness.
3. Have students give examples of how these principles apply to strength, muscular endurance, flexibility, and cardiovascular fitness.
4. Have students do activities/exercises that reinforce the principles of exercise.

Expansion: During class activities/exercises, include the principles of exercise whenever appropriate.

Concept: Fitness Guidelines

Level: Middle/Upper **Time**: 30 minutes

Objective: Students will define intensity, frequency, and duration and apply the three factors to fitness development.

Materials: None

Terms: *Intensity, frequency, duration* (defined below)
Repetition—the number of times an exercise is performed
Set—a given number of repetitions
1RM — maximum weight lifted in one repetition of the exercise

Activity:
1. Discuss and define:
intensity—how hard one exercises
frequency—how often one exercises
duration—how long one exercises
2. Discuss with students how these three factors apply to strength, muscular endurance, flexibility, and cardiorespiratory fitness (see the following Guidelines for Physical Fitness chart.

Authors' Notes: (a) The intensity at which a person exercises is related to the duration of the exercise, with more intense exercises usually performed for a shorter duration. (b) To increase physical fitness, most exercises should be performed 3-4 times a week. (c) Duration is usually expressed in sets and repetitions for all activities except for cardiovascular fitness, when it is expressed in time or distance.

Guidelines for Physical Fitness

Component	Intensity	Frequency	Duration
Strength: Isotonic Exercises	Body wt or a portion of the body wt	3-4 days/wk	3 sets 5-7 reps
Strength: Isometric Exercises	Contract muscles as tightly as possible	3-4 days/wk	3 sets Hold for 5-7 sec
Strength: Weight Training	80-90% of 1RM*	3-4 days/wk	3 sets 5 reps
Muscular Endurance: Isotonic Exercises	Body wt or a portion of the body wt	3-4 days/wk	3 sets 15-25 reps
Muscular Endurance: Weight Training	30-50% of 1RM*	3-4 days/wk	3 sets 15-25 reps
Flexibility	Muscle is stretched beyond normal length to reach stretching point	3-4 days/wk	3 sets Hold stretch for 10-15 sec
Cardio-vascular Fitness	70-80% of max heart rate	3-4 days/wk	Activity with large muscle groups must last at least 20 min

*Maximum weight lifted in one repetition of the exercise.

Concept: Strength

Level: Middle/Upper **Time:** 30 minutes

Objective: Students will apply the general principles of exercise and guidelines for physical fitness to strength.

Materials: None

Terms: *Strength*—the amount of force a muscle or muscle group can exert
Isotonic or dynamic contractions—a muscle contraction with movement (isotonic exercises or weight training)
Isometric or static contractions—a muscle contraction with little or no movement (pushing against a wall)
Isokinetic contraction—a muscle contraction with equal resistance through a full range of motion (accommodating resistance exercise machines are needed for isokinetic training)
Hypertrophy—an increase in muscle size

Activity:

1. Discuss with students how overload, specificity, and progression relate to strength training.
2. Discuss with students the guidelines for physical fitness and how they apply to strength training:
   - *intensity*—how hard an activity is conducted
     - isotonic exercises—body weight or a portion of body weight is moved
     - isometric exercises—contract muscles as tightly as possible
     - weight training—80-90% of 1RM (repetition maximum)
   - *frequency*—how often an activity is conducted (3-4 days a week)
   - *duration*—how long an activity is conducted
     - three sets of 5-7 repetitions of isotonic exercises
     - three sets of 5-7 seconds for isometric exercises
3. Discuss with students the advantages and disadvantages of isotonic and isometric exercises (see chart that follows).

Authors' Notes: (a) For strength to increase, a very heavy weight is lifted for a small number of repetitions. (b) Students should understand that weight training is an isotonic exercise because weights are moved by the muscles (here isotonic exercises are used to differentiate them from isometric exercises). (c) The teacher should explain that girls will not develop bulky muscles from weight training because they lack the necessary male hormone, testosterone, that plays a major role in increasing muscle bulk; however, they can still increase strength through adaptations in the nerves that stimulate muscles to contract maximally.

Isotonic Exercise vs. Isometric Exercise

	Isotonic	Isometric
Advantages	• gains in strength can be measured • greater muscle hypertrophy is developed • strength is developed through full range of motion	• can be done with no equipment in a small area • causes little muscle soreness
Disadvantages	• special equipment is needed in weight training	• restricts blood to muscles • difficult to measure strength gains • strength is not developed through full range of motion

Concept: Strength

Level: Middle/Upper **Time:** 2-3 class periods

Objective: Students will develop a personal strength training program using weights.

Materials: Barbells, weight training equipment (such as Universal Gym)

Activity:

1. Review with students the principles of exercise and the guidelines for physical fitness (intensity, frequency, duration) as they apply to isotonic weight training. Review rules for 5 minutes (see following chart).
2. Have students do warm-up activities for 5 minutes.
3. Have students select partners and split into groups at each weight station.
4. To determine the amount of weight to be lifted, the student should estimate the maximum amount of weight that can be lifted in one repetition

of exercise (1RM). Write this amount on the weight training worksheet. Because isotonic exercise for strength should be done at 80-90% of 1RM, students should use these numbers to determine their weight training resistance. Try this resistance for the exercise for 5 repetitions and 3 sets. The student should barely be able to complete the fifth repetition. If the weight is too heavy or too light, adjust it so the student can barely lift the weight on the fifth repetition. Once a student is able to lift 7 repetitions for 3 sets, the student should increase the resistance.

5. Have students fill out worksheet.

Authors' Notes: See Appendix for examples of weight training exercises.

Expansion: (a) Periodically let students test themselves in class to determine their progress. (b) It is important that the exercises selected by students provide for strength training in all major areas and muscles of the body.

Rules for Weight Training

1. Warm-up before lifting weights.

2. Always lift weights with a partner, who acts as a safety spotter.

3. Breathe when lifting weights. Do not hold your breath.

4. Never attempt to perform maximal lifts (1 RM or 2RM lifts).

5. Always have control when lifting weights.

6. Lift weight through a full range of motion.

7. Lift, rather than swing, weights. Make each lift in a slow, smooth, continuous manner.

8. Execute the return portion of the lift slowly.

9. Allow enough time between workouts for adequate recovery, or muscle tissue will be torn down rather than built up.

10. Always be alert when lifting weights. No horseplay should be allowed.

11. Always cool-down after lifting weights.

Sample Weight Training Worksheet

Exercise	Major Muscles Exercised	DATE			DATE			DATE		
		WT	REPS	SETS	WT	REPS	SETS	WT	REPS	SETS

Concept: Flexibility

Level: Middle/Upper **Time:** 1 class period

Objective: Students will demonstrate stretching exercises that increase flexibility.

Materials: None

Terms: *Passive stretching*—stretching the joints and muscles slowly and holding the stretch for a given amount of time

Active stretching (ballistic stretching)—bouncing a given number of times rapidly to stretch a muscle

Activity:

1. Review with students the principles of exercise and the guidelines for physical fitness (intensity, frequency, duration) and how they apply to stretching exercises.
2. Discuss with students the two ways to stretch the joints and muscles: passive stretching and active stretching.
3. Have students perform a stretching exercise actively and then do the same exercise passively.

4. Discuss with the students some basic stretching exercises, emphasizing the passive method of stretching. Also discuss with students the body areas and muscles each exercise stretches.

5. Have students perform warm-up activities for 5 minutes.

6. Have students perform the stretching exercises using the passive method.

Authors' Notes: (a) Flexibility differs with individuals. (b) Both types of stretching improve flexibility, but with passive stretching there is less chance to injure a muscle and there is less muscle soreness.

Concept: Heart Rate

Level: Middle/Upper **Time:** 20 minutes

Objective: Students will measure the increase in heart rate that occurs during exercise.

Materials: Clock or watch with second hand; refer to breath rates exercise for lower level, found earlier in lessons

Activity:

1. Have students check their heart rates while sitting quietly. Students should count the pulse for 10 seconds and then multiply by 6 to get heart rate per minute.
2. Have students engage in vigorous exercises (i.e., run in place, jump rope) for 2 minutes and then take their pulses.
3. Discuss the differences in heart rate while sitting and after activity.
4. Have students discuss what other activities/exercises will make the heart rate increase.

Authors' Notes: Pulse can be taken at the brachial artery on the wrist or at the carotid artery on the neck. The carotid artery lies between the Adam's apple and the sternocleidomastoid muscle.

Concept: Cardiovascular Endurance

Level: Middle/Upper **Time:** 20 minutes

Objective: Students will apply the general principles of exercise and the guidelines for physical fitness to cardiovascular endurance and calculate target heart rate.

Terms: *Cardiovascular endurance* (cardiorespiratory endurance)—the body's ability to continuously provide oxygen to the body as it performs work over an extended period of time

Activity:

1. Discuss witn students how overload, progression, and specificity relate to cardiovascular endurance.
2. Discuss with students the guidelines for physical fitness and how they apply to cardiovascular endurance exercises:

    intensity—70-80% of maximum heart rate, which is also known as th target heart rate
    frequency—3-4 times per week
    duration—at least 20 minutes of large muscle group activity

3. Have students list different activities in work and leisure where cardiovascular endurance is needed (running to catch a bus, playing soccer). Why is cardiovascular endurance important?
4. Use this formula to calculate intensity:

    220 minus age = maximum heart rate (MHR)

    (MHR x 70%) to (MHR x 80%) = target heart rate (THR)

THR is calculated according to the initial fitness level of the individual. For a well-conditioned student, 70-80% of maximum heart rate would be an appropriate THR; for a sedentary or obese student, 60-75% might be more appropriate. Exercise is then to be controlled and maintained within the THR for maximum benefits from the exercise.*

Authors' Notes: Duration is dependent on the intensity of the activity; therefore, lower intensity activities should be conducted over longer periods of time.

*Encourage students to check pulse regularly throughout exercise.

Concept: Body Composition

Level: Middle/Upper **Time:** 15 minutes

Objective: Students relate the concept of body composition to physical fitness.

Terms: *Body composition*—the relative percentages of fat and fat-free body mass that comprise a person's weight

Overweight—body weight in excess of average for person of a given height; excess weight may be in the form of fat or fat-free tissue
Obese—body fat percentage in excess of the level recommended for optimal health

Activity:

1. Discuss with students the differences between overweight and obesity.
2. Discuss the negative effects of obesity on posture, lower back, feet, and appearance. Also, explain that the heart must work harder in the obese person.
3. Explain to students that a healthy male has 12-16% body fat and a healthy female has 19-24% body fat; discuss the reasons why females have more body fat than males.

Authors' Notes: (a) It is possible for a muscular person to be overweight according to standard height and weight tables and still have a relatively small percentage of body fat. (b) Students should understand that obese teenagers are more likely than nonobese teenagers to become obese adults. (c) Teachers can discuss different ways of measuring percent body fat (skinfold calipers, underwater weighing). (d) Teachers could perform skinfold test on students (make sure that you explain the variance in measurements that may occur from tester to tester).

Concept: Nutrition

Level: Lower **Time:** 30 minutes

Objective: Students will identify the foods they eat and compare their foods to a nutritious diet.

Materials: Old magazines or newspapers, scissors, glue, six to eight poster boards or brown paper

Activity:

1. Have students split into groups of 4-6.
2. Have students cut pictures from magazines that show the kinds of foods they usually eat.
3. Have students glue pictures on the poster board. The teacher should help students put the poster board on the wall.
4. Have entire class discuss the kinds of food they eat and have students determine which foods are nutritious and good and which are not. What foods may cause a person to gain weight? Which foods should be eaten?

Authors' Notes: Physical education and health teachers might coordinate this activity with a unit on nutrition.

Expansion: Students should keep daily logs of the foods they eat.

Concept: Nutrition

Level: Middle/Upper **Time**: 15 minutes

Objective: Students will identify their eating patterns.

Materials: Composition of foods tables

Activity:

1. Have students record the following for 1 week: when they eat, what they eat, how much they eat, and how long it takes to eat.
2. Have students record their daily caloric intake. Students can establish a program to follow for maintenance as well as weight loss or gain.
3. Have each student evaluate personal eating patterns. If changes in eating patterns should be made, students should explain what these are and why these are needed. What insights did the student gain into personal eating patterns? Does the student eat foods that contain the proper nutrients? Does the student always, even when full, clean his or her plate? How many snack-type foods does the student consume each day?

Authors' Notes: (a) Students should be advised to get a medical checkup before beginning a diet. (b) The physical education teacher should cooperate with the health teacher to coordinate this activity with a unit on nutrition.

Appendix

Weight Training Exercises

Exercise	Directions for Exercise	Body Areas	Major Muscles Strengthened	Precautions
Bench press	Lie back on bench with feet flat on floor on either side of bench. Bar should be held with palms down grip, shoulder-width apart. Rest barbell on chest. Raise bar upward until arms lock. Return to starting position to complete exercise.	Chest, shoulders, upper arms	Deltoids, triceps, pectorals	Have at least one spotter (preferably two) to assist with bar. Do not arch back.
Half squats	Place barbells on shoulders. Keep back flat and lower body until thighs are parallel with floor (not quite 90 degrees). Raise to starting position to complete exercise.	Legs, lower back	Quadriceps, gluteals, hamstrings, gastrocnemius, soleus	Have at least one spotter (preferably two) to assist with bar. Keep back straight (do not round shoulders). Do not bounce. As a safety device, a bench can be placed behind the person lifting in case balance is lost.
Standing arm curl	Standing, grasp barbell palms up with hands shoulder-width apart. Rest barbells on thighs. Curl barbell up to shoulders and return to starting position to complete exercise.	Arms	Biceps, brachioradialis	Keep body erect. Do not bend back. Keep elbows close to body.
Toe raise	Place barbell on shoulders, with feet 8-10 inches apart. Rise up on toes as far as possible and return to starting position to complete exercise.	Lower legs	Gastrocnemius, soleus	Keep body straight and do not bend knees.
Seated overhead press	Sit on bench with barbell held palms down at midline of chest. Push bar upwards until arms lock. Lower barbell to chest position to complete exercise.	Shoulders, back, chest, upper arms	Triceps, deltoids, pectorals, trapezius	Keep head and back straight.

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Exercise	Directions for Exercise	Body Areas	Major Muscles Strengthed	Precautions
Lat pulldown (machine)	Kneeling, grasp bar palms down at widest points with arms fully extended. Pull bar down behind neck and return to starting position to complete exercise. For variety, this exercise may also be done by pulling the bar down in front.	Forearms, back, upper chest	Latissimus dorsi, trapezius, pectorals, brachioradialis	Keep body straight and do not let body rise off ground to assist in pulling weight.
Leg extension (machine)	Sit with fronts of ankles against the bar. Extend the knee until leg is parallel to floor. Return to starting position to complete exercise.	Thigh, knee joint	Quadriceps	Keep back straight. Do not bounce weight. Make sure leg is fully extended during exercise.
Bent arm pullover	Lie on back on bench with feet flat on floor on either side of bench. Hang head over edge of bench. Using palms-down grip with hands 12 inches apart, rest bar on chest. Lower bar back over head as far as possible with elbows bent. Pull the bar back to the starting position to complete the exercise.	Chest, shoulders	Deltoids, pectorals, latissimus dorsi	Keep hips on bench and avoid unnecessary arching of back. Keep elbows close to head and pointing toward ceiling during the exercise. Keep bar close to face during exercise.
Leg curl	Lie face down with knees just over edge of bench and backs of heels against bar. Curl feet upward until they are over or touching buttocks. Return to starting position to complete the exercise.	Upper legs, buttocks	Hamstrings, gluteals	Keep body from moving on bench. Do not swing or bounce weight.
Upright rowing	Standing, grasp bar palms down with ha' ds 4-6 inches apart. Rest barbell on thighs. Raise barbell to touch chin. Elbows should be pointed outward. Lower barbell to starting position to complete exercise.	Shoulders, front of upper arms, back	Biceps, deltoids, trapezius	Keep body erect and barbell close to body with elbows above hands.

XVI

Game Boards that Promote Participation in Fitness Activities and the Learning of Basic Fitness Concepts

Patricia A. Wallace

Introduction

Cooperatively structured games have been shown to promote prosocial behaviors in young children and are perceived by children as fun (Grineski, 1989; Glakas, 1991). A physical education game board is a unique motivational and learning tool that promotes cooperative behavior. Points are earned toward space moves on a game board by displaying appropriate behavior during class, by answering questions related to basic knowledge of physical education concepts, or by completing activity or fitness assignments; this makes daily physical education classes exciting and stimulating for both the teacher and the student.

It has been suggested that quality physical education programs must not only keep students active but focus activity on tasks that improve motor skill and enhance student learning (Beauchamp, Darst, & Thompson, 1990). A game board can meet behavior management and cognitive learning objectives with minimal use of activity time.

What Is a Physical Education Game Board?

A physical education game board is similar to many board-type games. Students may advance along the board in various ways, depending on the objective to be met. For example, students can advance along the board by (a) rolling a die, (b) behaving appropriately, (c) answering knowledge questions, or (d) completing an activity or fitness assignment.

Game boards may be knowledge-, activity-, or behavior-based, or a combination of all three. Knowledge-based boards enhance the learning of basic concepts of fitness, nutrition, health, and the human body. These concepts may initially be introduced to the class through fact sheets, gym bulletin boards, station work, or during breaks in activity periods. Behavior-based boards motivate appropriate behavior. Activity-based boards motivate participation in fitness activities outside of class.

Construction of a Physical Education Game Board

Game boards can be easily constructed using readily available materials:

- Tag board or heavy paper
- Markers
- Stickers to use as symbols for the game board key
- Glue
- Clear contact paper or laminating machine

Steps in construction of the game board:

1. Decide on the purpose or type of board (one example is given in this chapter).
2. Decide on the background or shape of the board (purpose of the board may dictate, i.e., a board about the muscles and bones might be shaped like a human body).
3. Design and draw the background/shape on the tag board using brightly colored markers.
4. Mark off spaces and numbers, following the shape of the board.
5. Decide how spaces will be earned to meet goals and objectives of the game.
6. Design a key for the game board. Extra spaces can be earned if the class lands on a keyed space. Picture symbols or stickers can be used. For example:

 =Health question. Advance one space if answered correctly.
 =Heart question. Advance one space if answered correctly.
 =Strength question. Advance two spaces after completing a fitness assignment.

7. Place key symbols on spaces (see sample board at end of chapter).
8. Laminate game board or cover with clear contact paper.
9. Prepare a class evaluation sheet if using behavioral objectives to earn spaces (see sample sheet at end of chapter).
10. If desired, prepare a number sheet, which should contain the same number of spaces as the game board. The teacher can use this to keep track of each class' positions on the game board.

Examples of Game Boards

Go for the Gold Game Board (pictured at end of chapter)

Objectives

1. Promote positive class behavior, including sportsmanship and cooperation.
2. Assist students in development of listening skills and following directions.
3. Improve basic knowledge of fitness, nutrition, health, and the body, without losing class activity time.

Equipment Needed

1. Game board consisting of 100 spaces
2. Jogger stamp and stamp pad
3. Class evaluation sheet
4. Class number sheet to keep track of each class' position in the game

Rules of Play

1. The teacher should leave 3-4 minutes at the end of class to evaluate the class on behavior. Moves along the game board are earned for the following:
   - a good start of the class (getting into squads, ready for class, quickly and quietly) = advance 1 space;
   - all wearing tennis shoes (we have spare tennis shoes at our school) = advance 1 space;
   - teamwork and sportsmanship (effort, encouraging classmates, courtesy) = advance 1 space;
   - following rules and directions (listening, playing safely) = advance 1 space;
   - a good ending for the class (walk, remain in line) = advance 1 space.
2. The class is asked a bonus question pertaining to the class unit; correct response = advance 1 space.
3. Count out the number of spaces earned by the class that day. Do what is directed on the space landed upon. It may be one of the following:
   - a "safe" space with no instructions;
   - a question on health, nutrition, the heart, muscles, endurance, flexibility, strength, sports trivia, or sports news. If answered correctly, move ahead the number of spaces directed (1 or 2);
   - all wearing tennis shoes, advance 1 space;
   - good sportsmanship for the day, advance 1 space;
   - cooperation, advance 1 space;

- junk food junkie, 1 move back;
- Big Mac Attack, 1 move back;
- Muscle Up!, 1 move ahead if the class completes an out-of-class exercise assignment.

4. Use the jogger stamp to indicate progress on the class number sheet.
5. The class at each grade level that crosses the finish line first may earn a reward. For example, each class earns a choice day (students choose the activity) when they finish a game board.

Follow the Heart Beat Trail (this game board is not pictured)

Objectives

1. Promote positive class behavior, including sportsmanship and cooperation.
2. Assist students in development of listening skills and following directions.
3. Improve knowledge about the heart, its major parts, and the circulation of blood through the heart.

Equipment Needed

1. Game board designed to show the inside of the human heart and its major parts
2. Heart stamp and stamp pad
3. Class evaluation sheet
4. Class number sheet to keep track of each class' position in the game
5. Fitness equipment, such as a sit & reach box and exercise bicycle

Rules of Play

See rules for Go for the Gold

Introducing Basic Knowledge

A series of stations can be used to introduce basic knowledge. Each station gives students the opportunity to learn more about fitness and their bodies. They are able to work on heart-healthy exercises to improve fitness levels. By increasing their knowledge of the heart and what it takes to keep it healthy, some students learn that they already lead healthy life-styles, while others learn that life-style adjustments may be needed.

Students work in groups of three on fitness, academics, and self-esteem by rotating to each station. Fitness stations are intended to make the heart strong and the body fit; academic stations provide students with basic concepts about the heart and circulatory system; and the self-esteem station provides students with the opportunity to express good feelings about themselves and their participation in physical education.

Station 1. Fitness: Super Rubberband Activities

Grades 1-2: Practice reaching down the sit & reach box to improve bendability.

Grades 3-5: Test your flexibility on the sit & reach box. Do each flexibility exercise 10 times and retest.
Answer the question: What happened to your sit & reach score after exercise?

Station 2. Self-Esteem: Heart-to-Heart

Grades 1-2: Make a valentine for yourself. Draw a picture of something you do well in physical education.

Grades 3-5: Make a valentine for yourself. Write one or more totally awesome facts about yourself in physical education.

Station 3. Fitness and Academic: Exercise and Heart Rate

Grades 1-2: Put your hand over your heart. Feel your heart beat. Ride the exercise bicycle. Put your hand over your heart. Is it beating faster or slower?

Grades 3-5: Sit on the bicycle. Put pulse clip (if available) on your earlobe. Find your sitting pulse. Ride the exercise bicycle for 30 seconds. Find your exercise pulse. What happens to your pulse after exercise?

Station 4. Fitness: Abdominal Strength Activities

Grades 1-2: Do as many sit-ups as you can. Try the V-sit. What muscles can you feel getting stronger.

Grades 3-5: Do as many sit-ups as you can in 1 minute. Have your partner time and count for you.

Station 5. Fitness and Academic: Rope Jumping and Heart Model

Grades 1-5: Jump rope to make your heart stronger. Look at the model of the heart. Trace blood flow through the heart following the arrows.

Station 6. Academic: My Pulse and the Stethoscope

Grades 1-2: Find your pulse at the wrist. What is your pulse? Listen to your heart with the stethoscope. What do you hear? (Teacher must work with 1st and 2nd graders at this station.)

Grades 3-5: Read the charts on finding your pulse and using the stethoscope. Find out what the "lub" and the "dub" are that you hear when listening to your heart.

Station 7. Fitness: Arm Strength

Grades 1-5: Do the arm strength exercises on the chart. Find one other exercise to do on the parallel bars to make your arms stronger.

Station 8. Fitness: Arm Strength

Grades 1-2: Hang from the chinning bar. Have your partner count how many seconds you can hang by saying "1 Mississippi, 2 Mississippi," etc., until your feet touch.

Grades 3-5: Do as many chin-ups as you can in 1 minute.

Station 9. Fitness: Jogging

Grades 1-5: Do a slow jog around the gym. Walk if you need to. What kind of fitness activity is this?

Station 10. Academic: Heart Knowledge

Grades 1-2: Read the five Heart Helpers and do the activities (Play Hard; Eat Good Food; Say No To Smoking; Be Thin; and Live Happy). Heart Helpers were taken from *Color Me Red*, from *The Feelin' Good Series*, published by Fitness Finders, Spring Arbor, Michigan.

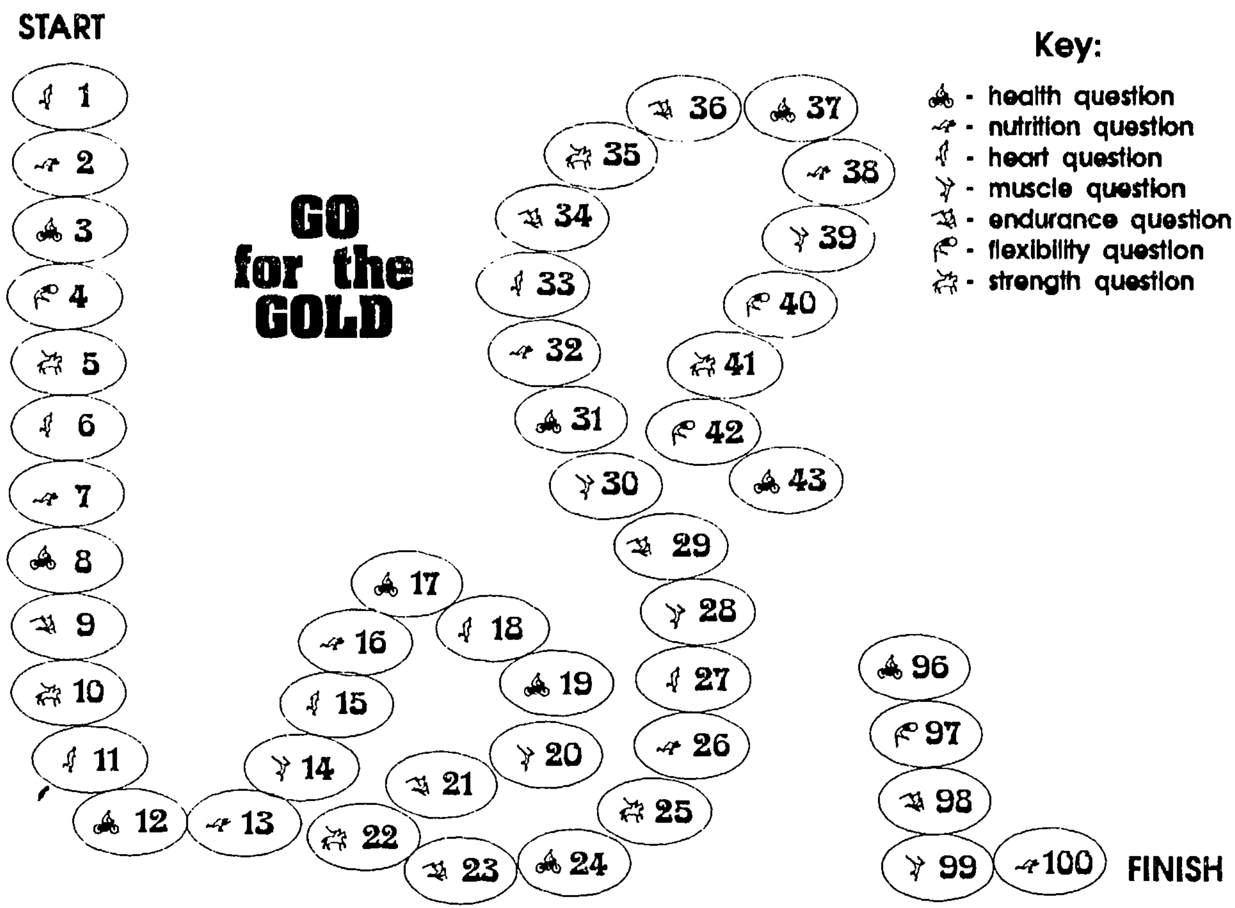
Grades 3-5: Provide activity sheet that will help children learn about their hearts. Activity sheet may be taken from duplication master books on the human body. These can be purchased from any school supply store or catalog.

Station 11. Fitness: Long Jump Rope

Grades 1-5: Jump using a long jump rope. Students may take turns turning the rope after their second miss or 15 jumps in a row. How can rope jumping help make your heart stronger?

Other Game Boards

Using the principles and ideas above, teachers might also make game boards for Bone Bonanza and Muscle Mania (to learn bone and muscle facts) and Build a Better Body (to give classes extra exercise and activity assignments at home and during recess).


GO
for the
GOLD
START
FINISH
Key:
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- nutrition question
- heart question
- muscle question
- endurance question
- flexibility question
- strength question
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Go for the Gold Class Tally Sheet

The teacher may use a tally sheet to record spaces earned on the game board for specific class behaviors.

Class	Spaces Earned (maximum of 1 space per category)				
	Good Start	Tennis Shoes	Teamwork	Following Directions	Good Ending

XVII

A Practitioner's Guide for Marketing Children's Fitness Programs

Richard L. Irwin

Introduction

While it has been reported that noncompetitive activities are in demand among children (American Sports Data, 1989; Bezilla, 1988; Huffman, 1988; Seibert, 1990), a major portion of the elementary physical education curriculum has been found to be comprised of competitive team sports (Ross, Pate, Casperson, Damberg, & Svilar, 1987). Human growth and development specialists state that this age group does not have the cognitive ability to grasp fully the strategies of team sports (Coakley, 1978). The above data suggest that much current fitness programming for children fails to address the most significant function of a successfully marketed product, the needs and wants of the consumer.

Furthermore, the lack of sufficient informational exchanges with administrators, parents, and civic leaders has created a lack of awareness as to the educational value of physical education among these publics, which has resulted in an image concern cited by Stewart and Green (1987). Public school physical educators need to recognize that this poor image has resulted from an uninformed or misinformed public, which in turn has led to significant program reductions, depriving masses of children of physical activity opportunities as well as jeopardizing the employment of many physical education instructors. To avoid these problems, an understanding of basic market and communication principles may be extremely helpful to administrators, physical education teachers, and children's fitness instructors, in both public and commercial settings.

The Marketing Process

Marketing, frequently perceived to be limited to promoting and selling, is a more comprehensive process that relies heavily on analyzing a particular market's needs and desires; providing programs to fulfill these demands; and using effective communication, pricing, and distribution channels to inform, motivate, and service the interested markets (Kotler, 1975).

Fundamental to the marketing process is the development of a strategic marketing plan. A marketing plan serves essentially as a lesson plan, entailing tasks such as preparation, planning, coordination, and execution, familiar to most sport and fitness professionals. The proposed marketing plan for children's fitness programs consists of the following components: (a) a set of marketing campaign objectives, (b) a market analysis of consumers and the competition, (c) marketing strategies designed to enhance the product's appeal and communication channels, (d) an action plan for the schedule of strategies, (e) a budget for marketing resources, and (f) a program evaluation.

Marketing Objectives

The market plan should be initiated by identifying a set of marketing objectives (Mize, 1990; Ensor, 1988). While the specific objectives may vary, all marketing-related objectives should possess similar characteristics, such as clarity, measurability, and outcome-orientation. Objectives may be directed toward enrollment or attendance figures; amount of program publicity in school, local, and/or professional media sources; evaluation scores; or revenues generated. For instance, specific examples may include increasing course enrollment by 10% or having an annual story about the program in the local newspaper.

Market Analysis

Basic to any planning process is the collection of decision-making information that should include (a) developing a profile of the existing target market, (b) conducting a needs analysis of this population(s), and (c) making a comparative analysis with competitive agencies.

Target Market Profile and Needs Analysis

The children's fitness market actually consists of two submarkets including parents, the purchasers of the product in terms of direct fees or as taxpayers, and children, the users of the product (Moler, 1990). Therefore, it is important to become familiar with the characteristics and demands of both groups.

The consumer profile should consist of demographic (age group distributions, geographical distributions, income, spending behavior, etc.) and psychographic information (attitude, opinion, and life-style), which should address such issues as: Where do the consumers live? Are they aware of our product or service? What is their opinion of our product or service? How much are they willing to spend? How large is the current as well as projected market population? In what physical activities do they like to participate? How frequently do they participate?

The needs analysis enables the marketer to identify a key marketing element: current as well as future consumer interests. This information may be compiled through the distribution of surveys, telephone or personal interviews, and focus group discussions with students and parents. More generalized questions may be sufficiently answered through secondary sources such as census reports and trade association or professional research services, which are generally available in most public or university libraries.

Analysis of Competitors

Studying the competition is a key component to improving internal operations and identifying unfilled needs of the consumer. The community-based organizations that may offer physical activity programs for children include school physical education programs, clubs and spas, community sports leagues, park and recreation programs, YWCAs, YMCAs, churches, scouting organizations, and farm clubs.

A comparative evaluation of program strengths and weaknesses, as well as threats and opportunities, should be conducted. For instance, municipal recreation officials and commercial fitness directors have identified the public school "fitness negligence" as an opportunity to provide children adequate programs (Martinsons, 1991; Huffman, 1988). However, the for-profit fitness centers view the development of not-for-profit fitness programs at YWCAs, YMCAs, Jewish Community Centers, and municipal park and recreation centers as a serious threat to their existence and unfair competition (Graham, 1991). The active interest of this collective group of fitness programs in the children's market, where 85% of children seek physical activity (Ross et al., 1987), can be viewed as a threat to the maintenance of public school physical education.

Marketing Strategies

Based on the findings of the market analysis, the children's fitness specialist should now be prepared to develop strategically the components of the marketing mix: product, place, price, and promotions. A brief introduction to these concepts is presented here.

Product Strategies

Fitness-related activities have been more appropriately labeled as "product offerings" by Stotlar (1989). Strategies that can be implemented to enhance the appeal of the product offerings include a fitness product line, which is the diversification of fitness-oriented activities within the curriculum; product development, the design of new and improved products; or, the use of product extensions, which may include equipment, field trips to activity centers, audio-visual aids, and learning activity packets.

Place/Environmental Strategies

According to Kotler (1975) the design of a product's distribution environment must be calculated to produce specific cognitive and emotional effects on the consumer. This is accentuated in the sport and fitness setting where the environment generally serves as the point of distribution as well as consumption.

The physical environment can have a significant impact on the attitude of the participant. Therefore, specific sensory elements such as the color, size, shape, and temperature should be selected that convey the desired image. Greengard (1990) described one exemplary children's fitness center as having walls decorated with colorful posters and signs, ceilings adorned with flags and banners, carpeted floor covered with wooden platforms, ladders, bars, kid-cycles, and giant vinyl rings to crawl through. The environmental theme changed daily, from a jungle, to the Wild West, to a space mission, which inspired the children to anticipate the unknown.

Pricing Strategies

In commercial and some public settings where price setting is necessary, the most common strategies include determining a financial break-even point and charging just enough to cover total expenses; pricing competitively; profit-margin orientation; and, demand pricing. For an extensive review of these pricing strategies the reader is referred to Stotlar (1989), Mullin (1983), or Kotler (1975). Peterson and Colacino (1990) introduced time and energy as consumer expenditures to be considered in the price paid for activity programs, which is relevant for the public school fitness program where a direct expenditure is usually not incurred.

Promotional Strategies

Promotion, often erroneously considered synonymous with marketing, is in fact, a compilation of activities designed to stimulate consumer awareness, interest, and usage of the product or service. The appropriate promotional mix for children's fitness programs, from Kotler (1975), includes incentives, personal contact, advertising, and publicity.

Incentives. Incentive programs are designed to elicit behaviors from individuals or groups, such as the incorporation of an active life-style. Children may be encouraged by such incentives as a student Fitness Honor Roll or the awarding of prizes. To enhance the effectiveness a theme such as The Fit Fest or Exercise with Class should be developed.

Personal Contact. Bronzan and Stotlar (1987) have categorized the individuals with whom physical educators commonly have personal contact as (a) an immediate public of participants, fellow staff, administrators, parents, and governing boards, (b) an associated public of prospective participants and parents, civic and youth service groups, and professional associations; and, (c) a disassociated public of political, taxpayer, and special interest groups.

Activities to facilitate and maintain positive public relations with the immediate public should include sound instructional and leadership behaviors; assembling an advisory committee of students, parents or interested citizens (Stewart & Green, 1987); seeking special project assistance (East, Frazier, & Matney, 1989); developing parental orientation sessions (Moler, 1990); and scheduling a family sports day. Furthermore, Mize (1990) has recommended that the public school instructor become actively involved in school functions and strive to integrate other subject areas into the curriculum, similar to the Kinesiological Studies Model (Jewett & Bain, 1985).

Activities designed to reach the associated and disassociated publics may include exhibitions held at local malls, community centers, or during special community events and athletic events (Mize, 1990). Invitations may be sent to members of the chamber of commerce, service clubs, senior citizens groups, or other prominent civic leaders for special event assistance or as an honorary guest leader.

Advertising. Advertising, usually considered any form of nonpersonal presentation and promotion, includes the production and distribution cost for all publications, mailings, paid-for media space, and audio-visuals.

A brochure that describes the curriculum content, student experiences, special activities, and fitness testing results should be designed (Mize, 1990). The brochure should be attractive, informative, and timely (Moler, 1990) with exciting photographs, easy to read text, quotes from happy participants, full-color printing, and quality paper. Offering a prominent civic leader, recognized athlete or fellow faculty an opportunity to write a guest column on their fitness program would integrate individuals from a variety of publics. Brochures may be mailed or distributed along life-path points, which include physicians' offices, libraries, and shopping locations (King, 1991). Utility bill stuffers or supermarket fillers could be used to reduce the mailing costs.

If funds are available, an action videotape may be produced reflecting an exciting activity setting. The tape can serve as an instructional tool, professional presentation, audio-visual aid, or display during parent conferences.

Publicity. Publicity can be defined as unpaid exposure. The most common method of obtaining media publicity is by submitting a press release. While a press release should be brief, it should include all essential facts about the program, arranged in descending order of importance, and including a photo if possible.

Print media publicity may also be obtained by planting an article or volunteering to write a column. An appearance or guest instruction from a prominent local figure can make a great story. Contributing articles and information to state, regional, and national publications promotes program familiarity among other professionals and should go over well with administration.

A common technique for obtaining publicity through the broadcast media is the submission of a public service announcement. Most broadcast operators are interested in community-related events that benefit fitness providers. An example of a 10-second announcement might be:

> Keep moving America. *Name of club/school* reminds you this is Physical Education and Sport Week. Actively support children's fitness programs to assure a healthier America.

Securing an event sponsor might assist in obtaining program publicity. Community involvement is a primary sponsorship objective of banks, utilities, and supermarkets, according to Jackson and Schmader (1990). Therefore, these organizations as well as the local media should be approached regarding the sponsorship of a children's fitness event. The sponsor can be requested to pay for the media space, awards, and other items related to the administration of the event.

Action Plan

Once the objectives and strategies have been set, a sequence should be established in an action schedule. The schedule should be put in writing and include specific areas of staff responsibility, an organizational timetable of events and production deadlines, performance indicators to track progress, and other related activities that need to be assigned a time slot.

Budget Development

The identification of the marketing budget as a component of the marketing plan is often overlooked. The budget should consist of all resources allocated to the marketing process. This generally includes copying, mailing, and printing, in addition to advertising and promotional materials. Mize (1990) reported that the cost for an elementary physical education marketing plan will be minimal through the use of readily available facilities and supplies. These include such internal communication resources as the telephone, copying machines, bulletin boards, public address systems, as well as the local media. Marketing programs within commercial fitness clubs will require a budgetary line item, generally 5-10% of the operating budget (Patton, Grantham, Gerson, & Gettman, 1989).

Evaluation

A thorough marketing plan evaluation should include the review of marketing objectives as well as the solicitation of feedback from participants, parents, and associated publics, using survey methods similar to the market analysis. Items should address the benefits of the activities, a rating of the marketing mix elements, and suggestions for improvement. The evaluative process should provide insight as to the success of the marketing campaign and items for future consideration.

Conclusion

While the application may vary among organizations, the essential point of this chapter is that the design and implementation of a formalized marketing plan is a critical ingredient in achieving and maintaining fitness program effectiveness. Numerous strategies presented are spontaneously employed by seasoned veterans of the profession but frequently without long-term planning. More importantly, the evaluative process is often absent from the marketing scheme, which to the pedagogist will resemble the failure to provide knowledge of results (KR) to participants, often leading to misconceptions of success or failure for the tasks and activities.

Ascribing to a marketing mind-set, the children's fitness provider can develop exciting programs, fulfill the interests of the consumer, and establish positive relations with a variety of valuable publics. This can only lead to better children's fitness programs and a better image for the profession.

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Ronald Feingold, Ph.D., is chair of the Department of Physical Education and Human Performance Science at Adelphi University, Garden City, New York. He is former chair of the board of the American Heart Association, Nassau County, former president of the New York State Association for Health, Physical Education, Recreation, and Dance, and is currently president-elect of the Eastern DistrictAssociation ofAAHPERD. He has served on the board of the New York State Heart Association and was chair of the Education Outcomes Project for New York.

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William R. Forbus, Ed.D., is an assistant professor in the Department of Physical Education at California State University, Chico. He teaches in the undergraduate and graduate physical education programs and the adapted physical education credentialing program, as well as coordinates a federal teacher training grant in early childhood adapted physical education. He has several publications and presentations that address physical fitness and disabled populations. Before his arrival at California State University, Dr. Forbus taught at the University of Georgia and Georgia College. His research interests include measurement of physical fitness of disabled populations, physiological variables in wheelchair ergometry, and the responses of asthmatics to physical activity.

Cindy Gregory

Cindy Gregory is an ir[illegible]uctor in physical education and the men's and women's volleyball coach at the Massachusetts Institute of Technology in Boston. She has taught elementary and secondary physical education and science in South Carolina, Virginia, and Massachusetts. Her B.A. is from Southwest Missouri State University and her M.A. from the Texas Woman's University.

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Robert Grueninger, Ph.D., is professor and chair of the Department of Health, Physical Education, and Recreation at Morehead (Kentucky) State University. Prior to that, Dr. Grueninger was chair of the Division of Health, Physical Education, and Recreation at Eastern Montana College. Dr. Grueninger's undergraduate degree is from Springfield College and his master's is from the University of Illinois. He received his doctorate from the University of Oregon, where his dissertation advisor was H. Harrison Clarke. His dissertation was one of the last in the Medford Boys' Growth project.

Kathryn D. Hilgenkamp

Kathryn Hilgenkamp is assistant professor in the Department of Physical Education and Exercise Sciences at Creighton University in Omaha, Nebraska. Her areas of expertise include psychological aspects of behavior and teacher preparation. She received her doctorate from the University of Nebraska-Lincoln and a master's degree from Southern Illinois University in Carbondale. A former manager of a community gymnastics program, she continues to coach youth soccer in her spare time.

Chris A. Hopper

Chris Hopper is a professor of health and physical education at Humboldt State University in Arcata, California. He has a Ph.D. in physical education from the University of Oregon. Dr. Hopper has written two books, *Coaching Soccer Effectively* and *The Sports Confident Child*. He teaches adapted physical education and social psychology of physical activity. Most recently, Dr. Hopper has been organizing family fitness programs for elementary schools.

Richard L. Irwin

Richard L. Irwin, Ed.D., is an assistant professor in sport administration within the School of Physical Education, Recreation, and Dance at Kent State University, Kent, Ohio. His areas of concentration are sport marketing, promotions, and fund raising, topics about which he has presented and lectured nationally and internationally.

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Jay Kimiecik is an assistant professor in the Department of Physical Education, Health, and Sport Studies at Miami University, Oxford, Ohio. Dr. Kimiecik's primary professional interests are in adult exercise motivation and family influences on children's physical activity participation.

Ellen Kowalski

Ellen Kowalski, Ph.D., is an assistant professor in the Department of Physical Education and Human Performance Science at Adelphi University, Garden City, New York. Her area of interest and expertise is adapted physical education. She is involved with the American Heart Association in extending its Jump Rope for Heart Program to include differently abled children.

Marjorie L. Leppo

Marjorie L. Leppo is an associate professor in the Department of Physical Education and Recreation at Howard University in Washington, D.C., where she is a member of the undergraduate and graduate faculties. Dr. Leppo received her Ph.D. from the University of Maryland and her B.S. and M.Ed. from Towson (Maryland) State University. Her areas of expertise include elementary/secondary curriculum and sport/fitness psychophysiology. Besides writing numerous articles and conducting research projects, she has authored a book on bowling and coauthored the book, *Fitness for You Now*. In addition to her higher education teaching and administrative experiences, Dr. Leppo's professional experiences include teaching grades K-12.

Dan Mielke

Dan Mielke, Ed.D., CHES, is an associate professor and coordinator of physical education at Eastern Oregon State College, where he teaches motor development, measurement and evaluation, alcohol and drug prevention, games and activities, and pedagogy. He also teaches K-6 physical education at the Ackerman Laboratory School, a model program for eastern Oregon. He is active in the American Alliance for Health, Physical Education, Recreation and Dance and curently is president of the Oregon Alliance for Health, Physical Education, Recreation and Dance. He has published in a variety of state, regional, and national journals including *Perceptual and Motor Skills* and *Journal of Physical Education, Recreation and Dance.*

Russell R. Pate

Russell Pate, Ph.D., was educated at Springfield College (B.S.) and the University of Oregon (M.S. and Ph.D.). He is professor and chair of the Department of Exercise Science at the University of South Carolina. Pate is an exercise physiologist with interests in the physiological basis of endurance performance, physical activity and fitness in children, hematological effects of exercise training, and the health implications of physical activity. He has published over 70 scholarly papers and has authored or edited four books. Pate is currently president of the American College of Sports Medicine and has served as president of the South Carolina Association for HPRD and chaired the Physical Fitness Council of AAHPERD. A lifelong distance runner, Pate competed in three U.S. Olympic Trials marathons and twice placed among the top 10 finishers in the Boston Marathon.

Laurie Priest

Laurie Priest is currently chair of physical education and director of athletics at Mount Holyoke College in South Hadley, Massachusetts. Prior to that, Priest was assistant professor, athletic director, and swim coach at Marymount University, Arlington, Virginia. She has been active professionally on the state, regional, and national levels and served as President of the National Association for Girls and Women in Sport in 1989-1990. She has published numerous articles, is a frequent presenter at conferences, and in the spring of 1991, was awarded the Mabel Lee Award from the American Alliance for Health, Physical Education, Recreation and Dance. She is active on NCA committees and currently serves as president of the New England Women's Eighth Athletic Conference.

Scott O. Roberts

Scott O. Roberts received his B.S. degree in Physical Education from California State University, Chico, and his M.S. degree in exercise physiology from California State University, Sacramento. He is currently a research and teaching assistant at the University of New Mexico, where he is pursuing a Ph.D. in exercise physiology and health promotion. He is the author of *Developing Strength in Children: A Comprehensive Approach*, scheduled to be published by the National Association for Sport and Physical Education, Reston, Virginia, in 1993.

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Gary Stein is an assistant professor in the Department of Exercise and Movement Science at the University of Oregon, Eugene. Dr. Stein's research focus is in the area of parent-child relationships pertaining to children's sport and exercise participation.

Sandra A. Stroot

Sandra Stroot is an assistant professor in teacher education in the School of Health, Physical Education, and Recreation at the Ohio State University; a position she has held for the past 5 years. Prior to receiving her Ph.D. from the University of Northern Colorado in 1987, she taught elementary physical education for 8 years. Recently, she has developed a professional development system with the public schools.

Stephen J. Virgilio

Stephen J. Virgilio, Ph.D., is an associate professor of physical education and human performance science at Adelphi University, Garden City, New York. His area of expertise is fitness pedagogy and elementary physical education. He spent 11 years at the University of New Orleans and the Louisiana State University Medical School, where he served as coprincipal investigator of the National Research and Demonstration Center-Arteriosclerosis. The grant resulted in the development of a comprehensive school-based cardiovascular health/fitness program entitled The Heart Smart Program. Dr. Virgilio has published over 40 manuscripts and made over 85 professional presentations. Currently, he is on the Board of Directors of the American Heart Association-Long Island and chair of the School Site Committee.

Patricia A. Wallace

Pat Wallace has taught physical education in Hartford County, Maryland, for 25 years. She received her B.S. from Towson State (Maryland) College and her M.Ed. from the Johns Hopkins University. She is currently working on 30 credits beyond the master's.

James R. Whitehead

James R. Whitehead is originally from England where he accrued 13 years of teaching experience in public schools after completing his undergraduate work in physical education at Loughborough University. During his M.S. and Ed.D. courses at Arizona State University, he specialized in fitness education and exercise physiology and is now active in publishing papers, giving professional presentations, and teaching in those subject areas. Dr. Whitehead is currently an associate professor in the Department of Health, Physical Education, and Recreation at the University of North Dakota.

Linda D. Zwiren

Linda D. Zwiren, Ed.D., FACSM, is an exercise physiologist at Hofstra University, Hempstead, New York, where she serves as professor in the Department of Health and Physical Education and in the Department of Biology. She coordinates the exercise specialist major. In the past few years, Dr. Zwiren has written several book chapters on children and exercise, including guidelines for exercise prescription and the effects of regular physical activity on children's present and future health. Dr. Zwiren was a member of the task force that developed the Physical Best program. Dr. Zwiren is a fellow and recent Board of Trustees member of the American College of Sports Medicine. Her research has focused on fitness and cardiovascular responses to exercise of adults, children, and the physically challenged.

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