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Health-Related Fitness Knowledge and Physical Activity of High School Students

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Abstract

The purpose of this study was to determine if health-related fitness (HRF) knowledge is related to self-reported physical activity (PA) of high school students. Students (N=165) enrolled in physical education from two schools in the Southwestern U.S participated. A 100-point HRF knowledge test was assembled, focusing on the HRF concepts of cardiovascular endurance, muscular-fitness, body-composition, and flexibility, using the question bank from the Fitness-for-Life Teachers CD-ROM. Physical activity was assessed using the Physical Activity Questionnaire for Adolescents (PAQ-A). The PAQ-A includes eight items scored on a five-point scale. The total activity score is the calculated mean of the eight items. One-way ANOVAs reported no significant difference by gender on HRF tests and PAQ-A scores. A Pearson correlation coefficient was generated to examine the strength of relationship between HRF test and PAQ-A scores. There was a moderate positive correlation between HRF test and PAQ-A scores ($r(168) = .438$, $p < .001$) This means that those who scored higher on the HRF test also tended to report being more physically active. As a secondary analysis students who reported scores rounding to 1-2 on the PAQ-A were categorized as low active ($n = 50$), scores rounding to 3 as moderately active ($n = 73$), and

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scores rounding to 4-5 as high active (n = 44). One-way ANOVA reported significant between group differences (F(2, 166) = 23.36, p < .001). Tukey's post-hoc revealed significant HRF test score differences between the low active and moderately active groups, and low active and high active groups (p's < .001), but not between the moderately active and high active groups (p = .352). Students who scored higher on the HRF test also reported higher levels of PA. These findings support the implementation and requirement of conceptually based fitness-for-life courses which may improve HRF knowledge and PA behavior.

There is a major concern regarding the prevalence of young people who are at risk for overweight or overweight in the U.S. Data in the United States indicate that 17.1% of children and adolescents were considered overweight in 2003-04 (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). The increasing trend of at risk for overweight and overweight is highlighted by the fact that from 1999-2000 to 2003-04, the prevalence of overweight among female youth rose from 13.8 to 16.6%, and from 14.0 to 18.2% in male youth (Hedley, Ogden, Johnson, Carroll, Curtin, & Flegal, 2004; Ogden et al., 2006). A major factor associated with at risk for overweight and overweight in youth is reduced physical activity (Dencker et al., 2006; Thomas, 2006).

The current United States Department of Health and Human Services (USDHHS) physical activity recommendations for children and adolescents are to participate in at least 60 minutes of moderate intensity physical activity most days of the week, preferably daily (USDHHS, 2005). Regular and adequate physical activity in childhood improves strength, endurance, and also helps build healthy bones and muscles (Bailey & Martin, 1994; Twisk, 2001). In addition, physical activity aids in the social, emotional, and psychological aspects of health (Biddle, Goreley, & Stensel, 2004; Paluska & Schwenk, 2000). For people of all ages, those who are overweight are at higher risk for depression, eating disorders, distorted body image, and low self-esteem (USDHHS, 1996; USDHHS, 2007).

Despite the fact that these benefits seem to be widely known, only 35.8% of youth participate regularly in moderate to vigorous physical activity (MVPA) (Centers for Disease Control and Prevention [CDC], 2005). In addition, research has found that low levels of MVPA are

most prevalent among adolescent girls (Sallis, Prochaska, & Taylor, 2000). Although physical education seems to be the ideal place to counter the trend of overweight youth, the percentage of students who attended daily physical education dropped from 42% in 1991 to 28% in 2003 (American Heart Association/National Association for Sport and Physical Education [AHA/NASPE], 2006). Further, research has shown that participation in both physical activity and physical education declines dramatically as teens age (CDC, 2005).

It is also concerning that AHA/NASPE (2006) reports there is no federal law that requires physical education in American education. It is up to the individual states to set minimum requirements, but many delegate this responsibility to the local school districts. This results in varying levels of physical education throughout the country. In addition, only 36 states require some form of physical education starting in elementary and continuing through high school (AHA/NASPE, 2006). With the different mandates and lack of unified direction from the state or federal level, the overweight and physical activity statistics do not seem likely to improve. However, there is hope that physical education classes at the high school level which focus on concepts-based physical education may be the key to turning the tide of teens' inactivity.

Historically, physical education has lacked an emphasis on cognitive learning, especially related to health-related fitness (HRF) knowledge (Stewart & Mitchell, 2003). Physical education classes have traditionally focused on skill acquisition and sport performance (Hannon, Holt, & Hatten, 2008). However, over the past decade there has been a shift in focus toward concepts-based lifetime fitness courses (Hannon et al., 2008). The nature of this type of class includes a classroom/lecture component of fitness concepts and then time to apply those concepts in an activity/lab setting (Dale, Corbin, & Cuddihy, 1998). Past research investigating the effects of conceptually based physical education courses, although positive, was based on perceptions and attitudes and did not measure HRF knowledge and how it relates to physical activity (Adams, Graves, & Adams, 2006). However, recent studies have shown that fitness knowledge can help young people regularly engage in more physical activity (Keating, 2007).

At the time of the 2006 Shape of the Nation report, nine states required a concepts-based lifetime fitness course to graduate and 41 states offered this kind of course but not as a graduation requirement

(AHA/NASPE, 2006; Hannon et al., 2008). There are many different titles for the course but they usually include the terms fitness for life, or lifetime fitness. No matter what it is labeled, it is assumed that these types of physical education classes will increase the student's chances of achieving and maintaining certain levels of physical fitness over the course of their lifetime (Ermler & Kovar, 1993). The fundamental theory for these classes is that if students have the necessary foundational knowledge they will adopt positive attitudes about physical activity that will lead to more active lifestyles (Adams et al., 2006). Based on the five components of health-related fitness (NASPE, 2005), lifetime fitness classes should be ideal to increase student's HRF knowledge, and to counter many of the negative lifestyle behaviors associated with adolescence, including poor nutrition, limited physical activity, and stress (Adams et al., 2006).

These types of conceptual physical education classes may have a positive long-term effect on knowledge, attitude, and activity (Ermler & Kovar, 1993; Slava, Laurie, & Corbin, 1984). Experiences that have long-term value (such as health-related fitness knowledge) can create a foundation for an active lifestyle. However, limited research is available identifying the effects of these curricula on student health-related fitness knowledge, and physical activity. Do conceptually based physical education classes increase students HRF knowledge, and/or physical activity behavior? The purpose of this study was to examine students' health-related fitness knowledge and relate it to their self-reported physical activity level.

Method

Participants

Participants were recruited from two high schools in a predominantly (93%) white suburban area of the southwestern United States. All the potential participants were enrolled in a sophomore "Fitness-for-Life" class required by the school district; as a result, 98.6% of the potential participants were in the 10th grade. Over 300 parental consent documents were initially dispensed. Only those students who returned a form signed by a parent were allowed to participate in the study. Those students who returned a parental permission form were also required to sign a participation assent form. Two students were 18 years old and therefore classified as adults and signed an informed consent document. The final sample consisted of 167 participants (88 males, 77 females, two unidentified).

The study protocol and procedures were examined and approved by the University Internal Review Board and the school district prior to recruitment and data collection.

Instrumentation

A 100-item, multiple-choice HRF knowledge test (see Figure 1) was administered along with a physical activity survey (see Figure 2). The knowledge test was assembled from the "Fitness-for-Life" Teacher Resources and Materials CD-ROM, 5th Ed. (McConnell, Corbin, & Dale, 2004). The test was designed to cover the HRF concepts of cardiovascular endurance, muscular fitness, body composition, and flexibility. This served as a comprehensive exam to assess the participants HRF knowledge. The test is considered a valid instrument for measuring HRF knowledge because it was developed by the creators of the Fitness-for-Life curriculum and thus had high content and face validity.

The physical activity survey used in this study was the Physical Activity Questionnaire for Adolescents (PAQ-A). The PAQ-A has been used in previous research with adolescents and has demonstrated good internal consistency and acceptable validity (Janz, Lutuchy, Wenthe, & Levy, 2008; Kowalski, Crocker, & Kowalski, 1997). The PAQ-A includes eight items, each scored on a 5-point scale (1's being the least active behavior to 5's being the most active). The total activity score of the PAQ-A is the calculated mean of the eight items.

Data-Collection Procedures

All data were collected at the end of a semester, presumably after students had been exposed to lifetime fitness concepts. Additionally data were collected during regular class time in two sessions in each participating class. During the first session, the participants were informed of the purpose of the research, as well as benefits, risks, and their rights as a participant and were given a parental permission form to take home.

During the second session, the students who had parental permission were informed about voluntary participation, confidentiality and withdrawal from the research, and then given a participation assent form. Once the assent form was signed and collected, the HRF knowledge test with accompanying scantron form and survey packet was dispersed. The procedure for filling out the packet was explained orally as well as in written format in the

HEALTH-RELATED FITNESS KNOWLEDGE TEST Page 1 of 7

Choose the letter of the *best* answer for each question.

1. The ability of your body systems to work together with the least effort is
   a. wellness.
   b. physical fitness.
   c. health.
   d. exercise.

2. Two important benefits of a regular program of physical activity are feeling good and
   a. increased energy.
   b. proper nutrition.
   c. speed.
   d. good grades.

3. Physical, intellectual, social, emotional, and spiritual fitness are included in
   a. health-related fitness.
   b. health and wellness.
   c. skill-related fitness.
   d. recreational fitness.

4. Which is a part of skill-related fitness?
   a. height
   b. strength
   c. flexibility
   d. balance

5. One hypokinetic condition is
   a. good flexibility.
   b. low blood pressure.
   c. heart disease.
   d. low body fat level.

6. Power is the ability to
   a. use strength quickly.
   b. change body fat range.
   c. maintain good posture while standing still or moving.
   d. use muscles repeatedly without tiring.

7. Which is TRUE about health-related fitness?
   a. It includes speed, agility, and coordination.
   b. Good health-related fitness results in good skill-related fitness.
   c. It includes cardiovascular fitness and muscular endurance.
   d. Only athletes can achieve health-related fitness.

8. Doing more exercise than the body can handle may result in
   a. cardiovascular fitness.
   b. overuse injury.
   c. biochemical principles.
   d. hypothermia.

9. Unnoticed injuries with effects that may be delayed for months or years are
   a. microtraumas.
   b. sprains.
   c. strains.
   d. dislocations.

10. The BEST clothing for exercising in cold weather includes
    a. a nylon jacket, several lightweight layers, knit hat, and mittens.
    b. a shirt, heavy coat, and heavy gloves.
    c. a rubberized jacket and ski mask.
    d. two sweatshirts, heavy jacket, knit hat, and gloves.

11. Who would probably have the most trouble exercising comfortably?
    a. a person living in a high-altitude location
    b. a person from a high-altitude location visiting a low-altitude location
    c. a person living in a low-altitude location
    d. a person from a low-altitude location visiting a high-altitude location

12. Clothes for hot weather should be
    a. nonporous and dark-colored.
    b. porous and dark-colored.
    c. nonporous and light-colored.
    d. porous and light-colored.

13. Cold, clammy skin and symptoms of shock are signs of
    a. heatstroke.
    b. heat exhaustion.
    c. frostbite.
    d. overuse injury.

14. Hypothermia can result from
    a. exercising in cold weather.
    b. exercising in hot weather.
    c. losing fluids through perspiration.
    d. drinking too much water in hot weather.

15. To help prevent heat exhaustion or heatstroke when exercising in hot weather,
    a. omit a warm-up.
    b. start quickly.
    c. drink more water.
    d. increase your pulse.

From *Fitness for Life Teacher Resources and Materials, Fifth Edition* by Karen McConnell, Charles B. Corbin, and Darren Dale, 2005, Champaign, IL: Human Kinetics.

Figure 1. Sample Health-Related Fitness Knowledge Test Questions

HEALTH-RELATED FITNESS KNOWLEDGE TEST

Choose the letter of the *best* answer for each question.

16. Hypertension is a primary risk factor in heart attack, kidney damage, and
    a. influenza.
    b. colon cancer.
    c. arthritis.
    d. stroke.

17. Since 1926, the leading cause of death in this country has been
    a. cancer.
    b. cardiovascular disease.
    c. diabetes.
    d. lower back problems.

18. Too much physical exercise is the cause of
    a. a hyperkinetic condition.
    b. a hypokinetic condition.
    c. anorexia nervosa.
    d. infections.

19. Running 5 miles despite having painful shinsplints is an example of
    a. atherosclerosis.
    b. activity neurosis.
    c. osteoporosis.
    d. hypertension.

20. A condition in which bones become porous and start to lose their strength is
    a. body mechanics.
    b. obesity.
    c. atherosclerosis.
    d. osteoporosis.

21. A build-up of substances on the inner walls of arteries is
    a. lordosis.
    b. atherosclerosis.
    c. cardiovascular resuscitation.
    d. blood clotting.

22. A stroke causes damage to the
    a. heart.
    b. brain.
    c. heart and brain.
    d. kidneys.

23. Which of the following is MOST likely to result in back injury?
    a. Avoid twisting while lifting.
    b. Avoid a bent position while sitting.
    c. When lifting, keep hips high.
    d. Pull or push rather than lift a load.

24. The principle of overload states that
    a. it is foolish to exercise too much or too often.
    b. exercising more than you normally do improves fitness.
    c. decreasing regular exercise improves fitness.
    d. lifting too much weight is harmful.

25. Your correct range of physical activity is your
    a. target ceiling.
    b. threshold of training.
    c. target fitness zone.
    d. *FITNESSGRAM* zone.

26. The minimum amount of overload needed to build physical fitness is the
    a. threshold of training.
    b. target fitness zone.
    c. principle of specificity.
    d. principle of overload.

27. Of the following, the factor that contributes LEAST to physical fitness is
    a. maturation.
    b. age.
    c. heredity.
    d. height.

28. Intensity means how
    a. often a person exercises.
    b. long a person exercises.
    c. much a person enjoys exercising.
    d. hard a person exercises.

29. Which part of the FITT formula relates to how often a person exercises?
    a. type
    b. intensity
    c. frequency
    d. time

30. When your body adapts to your exercise load, you should
    a. decrease the load slightly.
    b. increase the load slightly.
    c. change the kind of exercise you are doing.
    d. stop exercising.

31. Agility exercise might not have an effect on muscle strength according the principle of
    a. Progression.
    b. Overloading.
    c. Specificity.
    d. Fitness.

From *Fitness for Life Teacher Resources and Materials, Fifth Edition* by Karen McConnell, Charles B. Corbin, and Darren Dale, 2005, Champaign, IL: Human Kinetics.

Figure 1. Sample Health-Related Fitness Knowledge Test Questions *(cont.)*

Choose the letter of the *best* answer for each question.

32. Girls score lower than boys in all types of physical fitness except
    a. flexibility
    b. muscular endurance
    c. muscular strength
    d. cardiovascular endurance

33. People who are active and stay active have been shown to use
    a. sport skills
    b. self-management skills
    c. cigarettes
    d. consumer skills

34. Body mass index is calculated by using
    a. height and bone width.
    b. weight and waist size.
    c. skinfold measurements.
    d. height and weight.

35. Goals that take a long time to reach are called
    a. short-term goals.
    b. long-term goals.
    c. mid-range goals.
    d. lifelong goals.

36. Being able to complete 25 curl-ups in 5 months is an example of a
    a. short-term fitness goal.
    b. long-term physical activity goal.
    c. long-term fitness goal.
    d. short-term physical activity goal.

37. Someone planning to be active might set a goal such as "walk for 20 minutes, 3 times per week." This would be an example of a
    a. short-term fitness goal
    b. long-term physical activity goal.
    c. long-term fitness goal.
    d. short-term physical activity goal.

38. The best way to meet short-term fitness goals is to
    a. buy fancy equipment.
    b. do regular activity.
    c. set hard long-term goals.
    d. buy a "miracle" product.

39. Effective goals will be
    a. very general or vague.
    b. very hard and challenging.
    c. realistic and specific.
    d. the same as your friend's goals.

40. Moderate physical activity requires
    a. 1-2 times more energy than rest.
    b. 4-7 times more energy than rest.
    c. 9-13 times more energy than rest.
    d. 15-20 times more energy than rest.

41. According to the FIT formula, you should engage in moderate activity
    a. on all or most days of the week.
    b. 3-5 days per week.
    c. 2-3 days per week.
    d. 1 day per week.

42. The most popular activity choice of people over 18 is
    a. football.
    b. bicycling.
    c. swimming.
    d. walking.

43. Experts suggest that you should get your moderate activity in bouts of
    a. at least 30 minutes at a time.
    b. at least 10 minutes at a time.
    c. at least 2 minutes at a time.
    d. it really doesn't matter.

44. To get enough moderate physical activity each day you should burn at least ____ calories per day in moderate activity.
    a. 100
    b. 200
    c. 500
    d. 700

45. For optimal benefits to health and wellness you should try to burn ____ calories over the course of a week.
    a. 2,000-3,500
    b. 5,000-7,500
    c. 10,000-11,000
    d. 12,000-15,000

46. The cardiovascular system includes the
    a. heart, lungs, bones, and muscles.
    b. heart, blood, and blood vessels.
    c. brain, heart, and lungs.
    d. heart, muscles, blood, and blood vessels.

47. For cardiovascular fitness, moderate to vigorous exercise must elevate your heart rate
    a. above normal.
    b. once a week.
    c. into the target fitness zone.
    d. into the high performance zone.

From *Fitness for Life Teacher Resources and Materials, Fifth Edition* by Karen McConnell, Charles B. Corbin, and Darren Dale, 2005, Champaign, IL: Human Kinetics.

Figure 1. Sample Health-Related Fitness Knowledge Test Questions *(cont.)*

Physical Activity Questionnaire for Adolescents

Name: _____ Age: _____

Sex: M_____ F_____ Grade: _____

Teacher: _____

We are trying to find out about your level of physical activity from ***the last 7 days*** (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing and others.

Remember:

A. There are no right and wrong answers—this is not a test.
B. Please answer all the questions as honestly and accurately as you can—this is very important.

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1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one circle per row.)

	No	1–2	3–4	5–6	7 times or more
Skipping	❍	❍	❍	❍	❍
Rowing/canoeing	❍	❍	❍	❍	❍
In-line skating	❍	❍	❍	❍	❍
Tag	❍	❍	❍	❍	❍
Walking for exercise	❍	❍	❍	❍	❍
Bicycling	❍	❍	❍	❍	❍
Jogging or running	❍	❍	❍	❍	❍
Aerobics	❍	❍	❍	❍	❍
Swimming	❍	❍	❍	❍	❍
Baseball, softball	❍	❍	❍	❍	❍
Dance	❍	❍	❍	❍	❍
Football	❍	❍	❍	❍	❍
Badminton	❍	❍	❍	❍	❍
Skateboarding	❍	❍	❍	❍	❍
Soccer	❍	❍	❍	❍	❍
Street hockey	❍	❍	❍	❍	❍

continued

Figure 2. Physical Activity Questionnaire for Adolescent (PAQ-A)

	No	1–2	3–4	5–6	7 times or more
Volleyball	❍	❍	❍	❍	❍
Floor hockey	❍	❍	❍	❍	❍
Basketball	❍	❍	❍	❍	❍
Ice skating	❍	❍	❍	❍	❍
Cross-country skiing	❍	❍	❍	❍	❍
Ice hockey/ringette	❍	❍	❍	❍	❍
Other:					
_____	❍	❍	❍	❍	❍
_____	❍	❍	❍	❍	❍

2. In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? (Check one only.)

I don't do PE	❍
Hardly ever	❍
Sometimes	❍
Quite often	❍
Always	❍

3. In the last 7 days, what did you normally do *at lunch* (besides eating lunch)? (Check one only.)

Sat down (talking, reading, doing schoolwork)	❍
Stood around or walked around	❍
Ran or played a little bit	❍
Ran around and played quite a bit	❍
Ran and played hard most of the time	❍

4. In the last 7 days, on how many days *right after school*, did you do sports, dance, or play games in which you were very active? (Check one only.)

None	❍
1 time last week	❍
2 or 3 times last week	❍
4 times last week	❍
5 times last week	❍

5. In the last 7 days, on how many *evenings* did you do sports, dance, or play games in which you were very active? (Check one only.)

None	❍
1 time last week	❍
2 or 3 times last week	❍
4 times last week	❍
6 or 7 times last week	❍

Figure 2. Physical Activity Questionnaire for Adolescent (PAQ-A) (cont.)

6. *On the last weekend*. how many times did you do sports, dance, or play games in which you were very active? (Check one only.)

None	❍
1 time	❍
2–3 times	❍
4–5 times	❍
6 or more times	❍

7. Which *one* of the following describes you best for the last 7 days? Read *all five* statements before deciding on the *one* answer that describes you.

A. All or most of my free time was spent doing things that involve little physical effort	❍
B. I sometimes (1–2 times last week) did physical things in my free time (e.g., played sports, went running, swimming, bike riding, did aerobics)	❍
C. I often (3–4 times last week) did physical things in my free time	❍
D. I quite often (5–6 times last week) did physical things in my free time	❍
E. I very often (7 or more times last week) did physical things in my free time	❍

8. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.

	None	Little bit	Medium	Often	Very often
Monday	❍	❍	❍	❍	❍
Tuesday	❍	❍	❍	❍	❍
Wednesday	❍	❍	❍	❍	❍
Thursday	❍	❍	❍	❍	❍
Friday	❍	❍	❍	❍	❍
Saturday	❍	❍	❍	❍	❍
Sunday	❍	❍	❍	❍	❍

9. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Check one.)

Yes	❍
No	❍

If Yes, what prevented you?

Figure 2. Physical Activity Questionnaire for Adolescent (PAQ-A) (cont.)

test and survey packet. Students were urged to accurately, and to the best of their knowledge fill out the packet. It is possible that some participants did not take their participation seriously, but for the purposes of this study, it was assumed the students did their best work on each item.

The HRF knowledge test and PAQ-A survey took approximately 30 to 60 minutes to complete. When students were finished they turned in their packet and scantron form to the researcher and returned to regular class activities.

Data Analysis

Statistical analysis for all data in this study was conducted using SPSS version 16.0 software (SPSS, Inc., Chicago, IL, USA). Data were initially entered into an excel spreadsheet and confirmed by another researcher to assure accuracy of the numbers prior to being imported into SPSS. Descriptive statistics were used to determine the participant's demographic characteristics. One-way ANOVA's were used to test for differences by gender in HRF and PAQ-A scores. A Pearson correlation was generated to examine strength of relationship between HRF test and PAQ-A scores. Finally, as a secondary analysis students who reported scores that rounded to 1-2 on the PAQ-A were categorized as low active (n = 50), scores rounded to 3 as moderately active (n = 73), and scores rounded to 4-5 as high active (n = 44). One-way ANOVA with Tukey post hoc tests were generated to examine between group differences on HRF scores. An alpha level of 0.05 was used for all statistical tests.

Results

The majorities of participants in this study are Caucasian (83.4%), 16 years old (70.8%), and enrolled in the 10th grade (83.9%). The final sample included 88 males, 77 females, and two unidentified. The average score on the HRF knowledge test was 42.39 ± 15.21 out of 100 points, meaning that on average students failed the examination. The average score on the PAQ-A was 2.93 out of 5 points, meaning students reported, on average, being moderately active.

One-way ANOVA's reported no significant differences by gender on HRF knowledge tests (Males: 43.34 ± 15.88; Females: 41.30 ± 14.45; p = .391) and PAQ-A scores (Males: 2.85; Females: 3.03; *p*

= .175), thus gender was not factored into the final analysis. There was a moderate positive correlation between HRF knowledge test and PAQ-A scores ($r(166) = .438$, $p < .001$). This means that those who scored higher on the HRF knowledge test also tended to report being more physically active based on the PAQ-A.

One-way ANOVA reported significant HRF knowledge test score differences between low (31.64 ± 12.67), moderate (45.59 ± 12.06), and high (49.16 ± 16.45) active groups ($F(2, 166) = 23.36$, $p < .001$). Tukey's post hoc revealed significant differences between the low active and moderately active groups, and low active and high active groups (p's < .001), but not between the moderately active and high active groups (p = .352).

Discussion

The purpose of this study was to examine the relationship between HRF knowledge and physical activity levels of students enrolled in fitness-for-life physical education classes. The results may have implications for the teaching of fitness-for-life type classes. There were no gender-related differences in HRF test scores or PAQ-A scores, both male and female participants demonstrated similar knowledge and relative physical activity levels. These results are in contrast to previous studies which have indicated that adolescent females are less active than adolescent males (Taymoori & Lubans, 2008; Trost, Pate, Sallis, Freedson, Taylor, Dowda, & Sirard, 2002; USDHHS, 1996). Given the reported trend of decreased physical activity among adolescent females it is encouraging that the females in this study, on average, reported a similar moderate level of physical activity as males. Despite most students failing the HRF knowledge test; a positive relationship was indicated between their HRF test score and physical activity levels. In addition, there were significant differences between the low, moderate, and high active groups. This means that the students with greater HRF knowledge reported higher physical activity levels.

Previous studies have indicated that conceptually based physical education classes have been effective in increasing HRF knowledge (Adams et al., 2006; Slava et al., 1984). However, these studies did not address the physical activity levels of the participants. Data from this study indicate that a by product of HRF knowledge could be increased physical activity levels, a result both teachers, parents

and policy makers should be encouraged to hear. Although this finding is very encouraging, it is important to note this correlation does not demonstrate a cause and effect relationship. It is possible that students who were already more physically active were more knowledgeable prior to taking the class or were more inclined to be interested in the course content, thus scoring higher on the exam. While the results of this study are generally supportive towards the implementation of conceptually based physical education classes at the high school level, further experimental studies are needed to evaluate the change in physical activity relative to HRF knowledge and participation in concepts based physical education classes.

Although the relationship between HRF knowledge and physical activity was an encouraging finding it was troubling that most of the participants failed the HRF knowledge test (82% achieved a score of less than 60). This finding is however in agreement with previous investigations. Desmond, Price, Lock, Smith and Stewart (1990) used a 70-item questionnaire to study fitness conceptions of high school students and found that a large percentage of students held misconceptions of fitness. In addition, Stewart and Mitchell (2003) reported a state-wide average score for students of 57% on a cognitive test of fitness concepts. A possible reason for the low scores on the HRF knowledge test in this study is variability in what was taught and how the conceptually based physical education classes are taught. This is likely a result of a general lack of teacher accountability for meeting performance standards in fitness-for-life classes (Stewart & Mitchell, 2003). The investigators did not look into how or what was taught in the classes, only that their stated purpose was to teach the fitness-for-life curriculum. The HRF knowledge test was a standardized test and therefore, participants may not have been taught some of the concepts covered in the test. It is also possible that some participants did not take the test or questionnaire seriously as there was no benefit to their participation. This would likely result in lower scores on the HRF knowledge test and over reporting on the PAQ-A. In future studies it may be helpful to provide incentives to help motivate students to participate.

Strengths of this study included the use of a valid and reliable physical activity self-report instrument and the use of previously designed valid test questions related to the fitness-for-life curriculum. In addition, data was collected at the end of a semester, after students had presumably been exposed to lifetime fitness (HRF knowledge)

concepts. Some limitations of this study are the lack of data on what was taught and how the physical education classes were taught. Experimental and longitudinal studies looking at the change in knowledge and physical activity would be helpful in explaining the low HRF knowledge scores as well as offering more support to the hypothesis of increased knowledge leading to increased physical activity. Future studies should consider testing student HRF knowledge and physical activity at the start of the semester and examine the change scores over the course of a semester. Further, this study has a relatively small and predominately White sample size, which potentially limits generalizability of the results. Future studies should be conducted with larger sample sizes and in more ethnically diverse populations.

Implications and Conclusions

The results of this study suggest that the fitness-for-life curriculum could be an important tool in the effort to stem the tide of inactivity in youth. Requiring conceptually based physical education is valuable and is directly linked to two national standards for physical education: Standard 3—Participates regularly in physical activity; and Standard 4—Achieves and maintains a health-enhancing level of physical fitness (NASPE, 2004). Although no teaching observations or content analysis was done in this study, the finding that on average students failed the HRF knowledge exam highlights the importance of requiring some form of accountability from the teachers, as well as the schools and school districts' regarding what is taught and the quality of teaching in their fitness-for-life courses. Just as math and science teachers are required to demonstrate the success of students in regards to mandated concepts, so should physical education teachers be held accountable for student learning of the fitness concepts in a lifetime fitness class.

Further research is needed in the areas of assessment and effectiveness of Lifetime fitness classes to determine if accountability would improve instruction and therefore HRF knowledge and consequently student's physical activity levels. Longitudinal studies could also examine the changes in knowledge, attitude towards physical activity, current physical activity levels, and future intent to be physically active among students in fitness-for-life classes in which teachers are held accountable for student learning versus

students enrolled in fitness-for-life classes in which teachers are not held accountable for student learning.

Other directions for future studies could include how the lifetime fitness curriculum is structured and what structure works best for knowledge retention and increased physical activity. Continued experimental research is necessary to confirm the results of this study as well as to demonstrate the value of implementing conceptually based physical education classes in an effort to help America's youth make educationally informed lifestyle choices and live healthy, active lives.

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