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A Two-year Assessment of 5th Grade Students' Health-related Physical Fitness Components

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Abstract

The purpose of this study was to examine the extent to which 5th grade students achieved a healthy fitness zone for six fitness tests as a result of participating in a three-year Carol White Physical Education Program (PEP) grant intervention. Participants in this study were nine physical education teachers and 5th grade students who were enrolled in nine different elementary schools within the same school district.The students took six FitnessGram tests during a regular physical education lesson in PEP years 2 and 3. The percentages of the students' reaching the HFZ for the fitness tests were moderately high to extremely high, ranging from 62.3% to 95.7%. The *t*-tests indicated that boys performed statistically significant better than girls on the PACER and Push-up tests. Conversely, girls performed statistically significant better than boys on the Trunk Lift and Right/Left Shoulder Stretch tests. No gender differences were found on the Curl-up tests.

Keywords: Fitness Tests, Healthy Fitness Zone, Assessment

Health-related physical fitness lays a foundation for participating in a variety of sports and physical activities. Maintaining and enhancing physical fitness is a cornerstone for establishing a physically active lifestyle throughout childhood and adolescence, and into adulthood (National Association for Sport and Physical Education [NASPE], 2004; U. S. Department of Health and Human Services [USDHHS], 2008).

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The nature and relative importance of different health-related physical fitness components in determining specific health outcomes has been an emerging focus of investigations in health professions (i.e., Barnett, Beurden, Morgan, Brooks, & Beard, 2008; Hurtig-Wennlöf, Ruiz, Harro, and Sjöström, 2007; Katzmarzyk, Malina, & Bourchard, 1999).

A healthy level of cardiovascular endurance is positively associated with a healthier cardiovascular profile in children and adolescents, but it is negatively related to obesity and cardiovascular disease factors (Barnett et al., 2008; Hurtig-Wennlöf et al., 2007). In a review of the relationship between physical fitness and health outcomes in youth, Ortega, Ruiz, Castillo, and Sjöström (2008) reported thatcardiorespiratory endurance levels are related to total and abdominal adiposity. Children with a healthy cardiorespiratory endurance level had a lower overall adiposity. There is an inverse relationship between cardiorespiratory fitness and cardiovascular disease risk factors in children and adolescents. Furthermore, researchers reported that cardiovascular endurance was strongly related to cardiovascular disease risk factors (Barnett et al, 2008; Hurtig-Wenniöf et al., 2007). In examining the relationships between physical activity, physical fitness, and coronary heart disease risk factors in youth, Katzmarzyk et al. (1999) noted that physical fitness explained between 11 and 30% of the variance in the coronary heart disease risk factors. Supporting the above findings, Hurtig-Wennlöf et al. (2007) also found that cardiovascular fitness was more strongly related to defining healthy cardiovascular profile and more negatively associated with cardiovascular disease risk factors than objectively measured physical activity in children. In addition, Ortega et al. (2008) reported that cardiorespiratory endurance and muscular strength/endurance are associated with established and emerging cardiovascular disease risk factors. Ortega et al. (2008) suggested that improvements in muscular fitness seem to have a positive effect on skeletal health.

Maintaining and improving health-related physical fitness is one desired learning outcome described in NASPE (2004) national physical education content standards. NASPE (2004) recommends that a Comprehensive School Physical Activity Program is an effective approach to promoting physical activity and physical fitness through quality physical education and other physical activity opportunities, including recess. One of the major goals for a quality physical education is to promote students' health-related physical fitness.

Quality physical education incorporates fitness activities into a regular physical education class and provides a variety of physical activities that are fitness-enhancing and developmentally appropriate for students. Quality physical education provides students with meaningful and appropriate instructional practices so that students have adequate opportunities to engage in moderate to vigorous activities in order to enhance their physical fitness levels during a lesson (NASPE, 2004). Conducting a systematic review of 13 school-based physical activity interventions, the Centers for Disease Control and Prevention [CDC] (2011) task force highly recommended that a school-based quality physical education is a cornerstone to increase physical activity and to promote physical fitness. However, NASPE's Shape of the Nation Report (2010) reported that elementary school students in 47 states do not have a daily 30-minute physical education lesson, except for three states: Alabama, Florida, and Louisiana. The insufficient time given to a physical education class makes it impossible to meet the nationally recommended 150 minutes ofphysical education per week. Therefore, recess serves as a supplemental role in providing children with a substantial proportion of the needed physical activity through physically active recess programs (NASPE, 2010; USDHHS, 2010).

Due to the critical role of physical fitness in promoting health outcomes and a physically active lifestyle, assessing students' health-related fitness allows teachers to determine how well students achieve NASPE physical education standard 4 that focuses on maintaining a healthy fitness level. Healthy physical fitness in children and adolescents tend to track healthy fitness in adulthood (Barnett et al., 2008; USDHHS, 2008). Therefore, there is a pragmatic need for improving and assessing children's health-related fitness. To our knowledge, only two cross-sectional studieshave examined elementary school students' health-related fitness levels. Erwin and Castelli (2008) examined elementary school students' achievement of NASPE content standard 4. In their study, one hundred seventy-eight fourth- and fifth-grade students completed five FitnessGram test items. They found that 40% of the participants reached the Healthy Fitness Zone (HFZ) for all five tests including PACER, curl-ups, push-ups, sit/reach, and BMI. In another study by Castelli and Valley (2007), they examined 230 children's levels of physical fitness in relation to their achievement of NASPE content standard 4 (2004) in a summer physical activity program using the same five FitnessGram tests as above.

Throughout participating in an 8-week (3 hours per day, four days a week) summer program, 34% of the participants obtained the HFZ for only four tests and a majority of students fell short of meeting the HFZ for all five tests.

This study aimed at examining the extent to which 5th grade students achieved the HFZ in relation to NASPE content standard 4, as a result of participating in a three-year Carol White Physical Education Program (PEP) grant project intervention. The specific objectives of this study were to investigate: (a) levels of the 5th grade students' physical fitness during the PEP grant project year 2 and year 3; (b) differences of physical fitness between the year 2 cohort and the year 3 cohort; and (c) gender differences of physical fitness the year 2 cohort and the year 3 cohort. The significance of this study lies in providing longitudinal empirical evidence for how the PEP grant project can impact elementary school students' achievement of desired learning outcomes in relation to NASPE content standard 4.

Methods

Participants and Research Settings

Participants in this study were 5th grade students who enrolled in nine elementary schools within the same school district in the United States during the second and third PEP project year. The three-year PEP grant project was designed to help elementary school students become physically active, mentally healthy, and socially cooperative children through implementing the Coordinated Approach to Child Health (CATCH) physical education (PE) curriculum and Mileage Club (MC) Recess Program**.**The CATCH PEis a proven standards-based and age-appropriate curriculum (CDC, 2008). The CATCH PE curriculum provides developmentally appropriate physical education content for grades 3-5. The CATCH PE 3-5 offers 500 learning activities on 20 modules which cover a wide array of skill themes and physical fitness activities.The MC Recess Programis a lunch hour program whereby students walk or run on a designated ¼ mile pathway. After five miles, students were awarded a "toe token" to place on their shoelaces to motivate students to engage in a structured physically active recess program. The recess coordinators monitored students' progress, distributed awards, and kept track of both student and classroom achievements.

The school district housed nine elementary schools and served 4,000+ students in K-5. The student population was pre-dominantly White (> 90%). K-2 students had a 30-minute physical education class and a 30-minute wellness class per week, while students in grades 3-5 had one 60-minute physical education class per week. The class size ranged from 18-28 students. The university institutional review board and the school district granted the permission for conducting this study. The students who returned the consent form signed by their parent(s)/guardian(s) indicated their voluntary participation in this study.

Context of Curriculum, Recess, and Fitness Tests Trainings

Nine elementary physical education teachers (5 females and 4 males) taught physical education to K-5 students at nine different elementary schools within the same school district. At the time of this study, the teachers' experience of teaching elementary physical education varied from 6 years to over 20 years. Each physical education teacher had a spacious gymnasium with a climbing wall.

Prior to PEP year 2, all nine physical education teachers participated in three days of CATCH PE curriculum training workshops. Prior to PEP year 3, the physical education teachers reviewed and studied the curriculums during one full-day summer workshop. The teachers were provided with a complete CATCH PE K-5 curriculum package and needed equipment using the specified PEP grant money for the curriculum implementation.

Prior to PEP year 2, a mileage club recess coordinator was hired for each school building. To help a recess coordinator effectively run the Mileage Club Recess Program, all recess coordinators and the physical education teachers attended a three-hour Mileage Club Orientation meeting. The PEP project coordinator presented the strategic plan for organizing and running the MC Recess Program for each school building. The physical education teachers worked with their schools' MC recess coordinator to run and promote MC Recess Programin each of the nine schools. We purchased and provided MC materials and related equipment for each school building using specified PEP Grant Money.

All nine physical education teachers participated in one half-day workshop to learn how to administer the Progressive Aerobic Cardiovascular Endurance Run (PACER) test to their students in terms of the testing directions, protocols, recording sheet, class organizations, and criteria for HFZ. They also participated in another half-day workshop to learn how to administer the FitenssGram curl-ups, push-ups, trunk-lift, shoulder stretch tests to their students in all parts related to each test as above.

FitnessGram Tests

Five items of the FitnessGram test were used to measure levels of health-related physical fitness components of the students in order to determinethe extent to which the students achieved NASPE content standard 4 (achieves and maintains a health-enhancing level of physical fitness). The FitnessGram test, developed by the Cooper Institute, is a nationally recognized, valid, and reliable fitness assessment toolkit for assessing five components of health-related fitness: cardiovascular endurance, muscular strength and endurance, flexibility, and body composition through a variety of test items (Meredith & Welk, 2007). It uses "criterion referenced" standards to compare the testing scores to the HFZ based on specific age and gender guidelines to evaluate boys' and girls' physical fitness level on each test and suggest areas for improvement.

Prior to the designated fitness testing week (the first two weeks of May in 2011 and 2012), the teachers had their own schedule to help students learn and practice each test by using a specific portion of a lesson or a specific unit. To help students become familiar with the testing protocols and to improve physical fitness levels, the teachers incorporated the FitnessGram tests into their routinized warm-up session of a regular physical education. During the first two weeks of May, each physical education teacher administered six fitness tests to their 5th grade students in regular physical education lessons. The fitness tests included: (a) 15-meter version of PACER for cardiovascular endurance, (b) curl-up test for abdominal muscular strength and endurance, (c) push-up test for upper body strength and endurance, (d) trunk lift for trunk extensor strength and flexibility, and (e)right/left shoulder stretch tests for flexibility.

"The FitnessGram Standards for Healthy Fitness Zone for Boys" (Meredith & Welk, 2007, p. 61) and the "FitnessGram Standards for Healthy Fitness Zone for

Girls" (Meredith & Welk, 2007, p. 62) were used to determine whether a student's score on each test was placed into the HFZ. The HFZ is defined specifically for each test type, age, and gender (Meredith & Welk, 2007). The FitnessGram test software (8.4 version) was used to record the testing results.

Data Analysis

Frequencies and percentages of meeting the HFZ on each test were computed to describe the 5th grade students' physical fitness testing results in PEP years 2 and 3. To examine if there was a mean score difference between the year 2 cohort and the year 3 cohort on each test, an independent *t*-test was conducted. Descriptive statistics were also used to describe percentages of boys and girls meeting the HFZ on each test based on age and gender guidelines. To examine if there was a significant difference of observed frequency for meeting the HFZ between boys and girls, a chi-square method was conducted for each test in the PEP years 2 and 3. Regardless of gender-specific criteria for each test, to examine if there was a mean score difference of each test between the boys and the girls, an independent t-test was performed for PEP year 2 and 3. The standardized-difference effect size (Cohen's *d*) (Trusty, Thompson, & Petrocelli, 2004) was used to report the mean differences of the dependent variables between the PEP year 2 cohort and the PEP year 3 cohort and between boys and girls in PEP years 2 and 3.

Results

PACER Test Results in Years 2 and 3

Percentages for meeting the healthy fitness zone.Figure 1 presents the fitness test results of the 5th grade students in PEP year 2 and year 3.

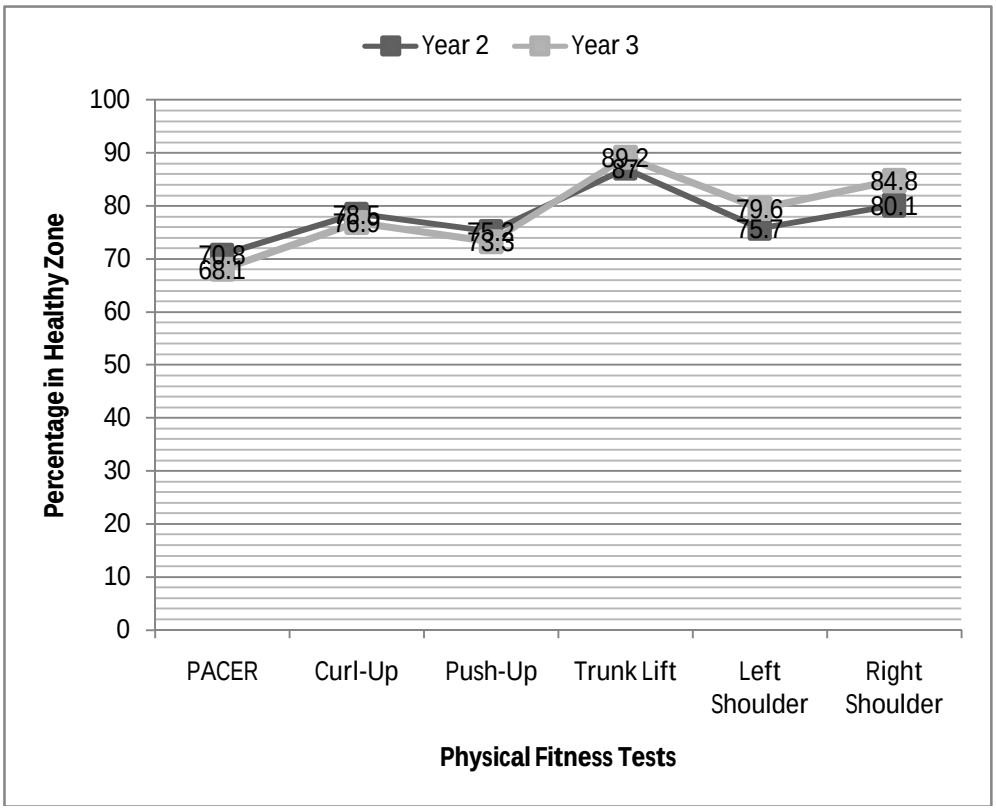

Figure 1. Comparisons of fitness tests between the year 2 and year 3

Regarding the 15-meter PACER test (Meredith & Welk, 2007), the HFZ for a 11-year-old boy is to run 30 to 94 laps and the HFZ for a 11-year-old girl is to run 19-54 laps. In PEP year 2, 627 students completed the PACER test. 391 students (62.3%) metthe HFZ for the PACER test. The participants in the year 2 cohort ran an average of 33.3 laps (*SD*=18.06). In contrast, of the 650 studentswho completed the PACER test in PEP year 3, 418 students (64.3%) met the HFZ for the PACER test. The participants in the year 3 cohort ran an average 31.2 laps (*SD*=16.69).The results of *t*-test indicated a significant difference of the mean scores for the PACER tests between the two cohorts (t=2.18, df=1258.52, p< .05, Cohen's d =.12). The results indicated that the participants in the year 2 cohort ran significantly more laps than the participants in the year 3 cohort.

Gender differences. Figure 2 illustrates the fitness testing results of the boys and the girls in PEP year 2.

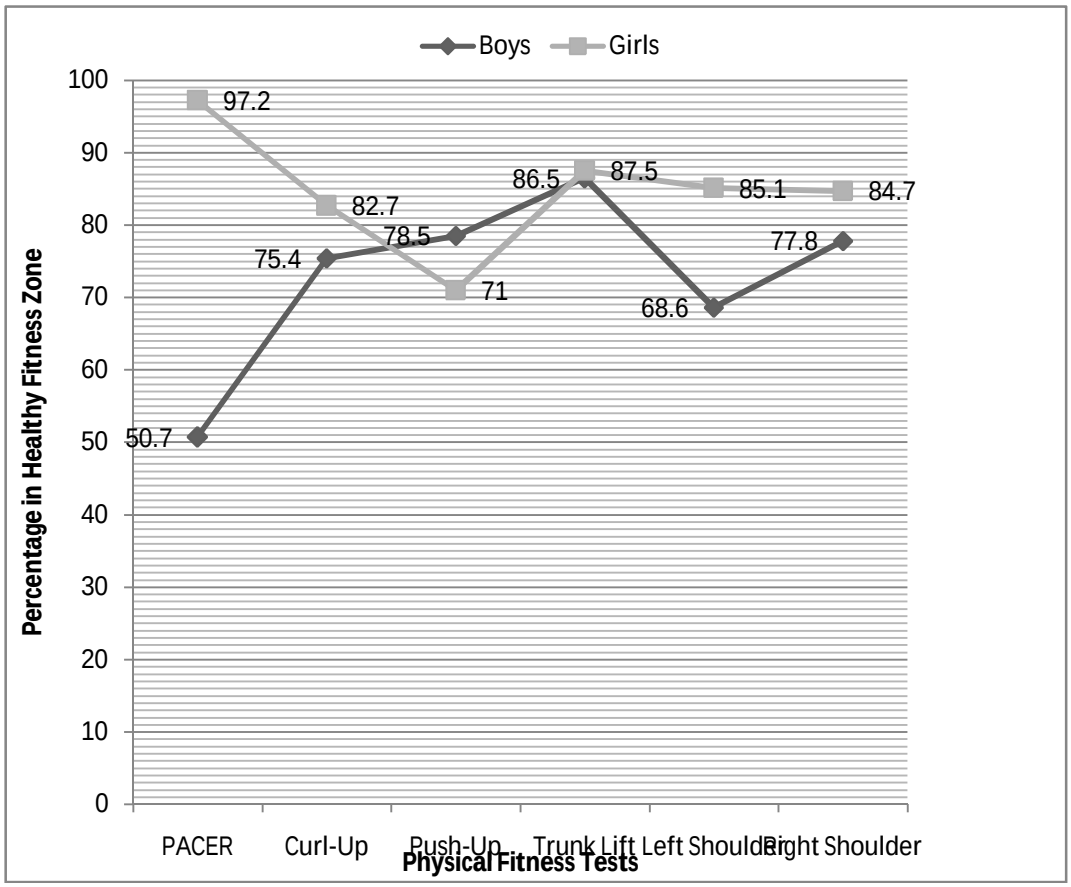

Figure 2. Comparisons of fitness tests by gender in the PEP year 2

194 out of 335 boys ran 30 laps or more, indicating that 57.9% of the boysfell within the HFZ for cardiovascular endurance. In contrast, 197 out of 292 girls ran 19 laps or more, indicating that 67.5% of the girls were within the HFZ. Comparing the performance between genders, the results of the chi-square test revealed a significant difference of percentages for meeting the HFZ between boys and girls (X^2 = 6.07, *df* = 1, $p \leq .01$). The results indicated that the percentage of girls who met the HFZ was higher than that of boys. Percentage-wise, the girls outperformed the boys in meeting the cardiovascular endurance healthy fitness zone.

However, without considering the gender-specific criteria, the results of the*t*-test revealed that the boys significantly outperformed the girls on the PACER test ($M_{\text{boys year 2}}$= 35.9 vs. $M_{\text{girls year 2}}$= 30.4, *t* = 3.89, *df* = 617.26, $p < .01$, Cohen's *d*=.31).

Figure 3 illustrates the fitness testing results of the boys and the girls in PEP year 3.

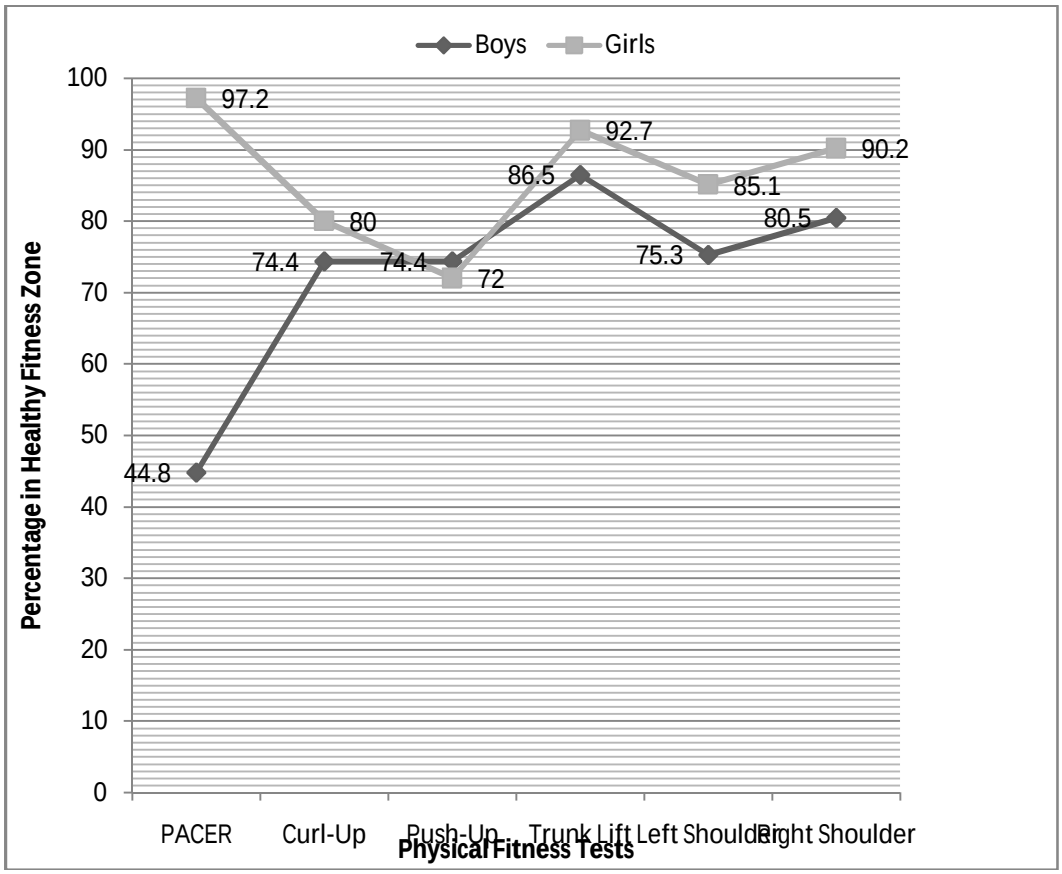

Figure 3. Comparisons of fitness tests by gender in the PEP year 3

In PEP year 3, 212 out of 355 boys ran 30 laps or more, indicating that 59.7% of the boys fell within theHFZ. In contrast, 206 out of 295 girls ran 19 laps or more, indicating that 69.8% of the girls achieved in the HFZ. The chi-square testrevealed a significant difference of percentages for meeting the HFZ between boys and girls (X^2 = 7.18, *df* = 1, $p < .01$).

The results indicated that the percentage of girls who met the cardiovascular endurance HFZ was significantly higher than that of the boys based on the gender-specific guidelines. However, the results of the *t*-test yielded that boys ran significantly more laps than girls on the PACER test ($M_{\text{boys year 3}}$= 35.5 vs. $M_{\text{girls year 3}}$= 26.0, *t* = 7.78, *df* = 620, $p <.0$, Cohen's *d*= .62).

Curl-up Test Results in Years 2 and 3

Percentages for meeting the healthy fitness zone. The HFZ for the Curl-up test is 15-28 completed curl-ups for both 11-year-old boys and 15-29 curl-ups for 11-year-old girls (Meredith & Welk, 2007). In PEP year 2,627 participants completed the Curl-up test and 497(79.3%) reached the HFZ. The participants in the year 2 cohort completed an average of 34.3 curl-ups (*SD*=21.97). In contrast,of the 650 participants who completed the Curl-up test in PEP year 3, 572 participants (88%) met the HFZ. The participants in the year 3 cohort completed an average of 34.18 curl-ups (*SD*=20.94).The results of the *t*-test indicated no significant difference of the mean scores on Curl-up tests between the year 2 cohort and the year 3 cohort (t=0.110, df =1266.15, p> .05, Cohen's d= .01).

Gender differences. In PEP year 2, 276 out of 335 boys completed 15 curl-ups or more, indicating that 82.4% of the boys fell within the HFZ. In contrast,221 out of 292 girls completed 15 curl-ups or more, indicating that 75.7% of the girls were within the HFZ. The results of thechi-square testrevealed asignificant difference of percentages for meeting the HFZbetween boys and girls (X^2 = 4.265, df = 1, p < .05). However, the results of the t-test revealed no significant difference of the mean scores between boys and girls on the Curl-up test in year 2 ($M_{\text{boys year 2}}$= 35.4 vs. $M_{\text{girls year 2}}$= 32.9, t = 1.43, df = 621.17, p >.05, Cohen's d= .11).

In PEP year 3, 307 out of 355 boys completed 15 curl-ups or more, indicating that 86.5% of the boys fell within the HFZ. 265 out of 295 girls completed 15 curl-ups or more, indicating that 89.8% of the girls were in HFZ. The results of the chi-square testrevealed no significant difference of percentages for meeting the HFZ between boys and girls (X^2 = 2.034, df = 1, p > .05). Furthermore, the results of the *t*-test also yielded no significant difference between boys and girls on the Curl-up test ($M_{\text{boys year 3}}$= 35.0 vs. $M_{\text{girls year 3}}$= 33.2, t = 1.10, df = 639.58, p> .05, Cohen's d=.09).

Push-up Test Results in Years 2 and 3

Percentages for meeting the healthy fitness zone. The HFZ for 11-year-old boys is 8-20 completed push-ups and for 11-year-old girls is 7-15 completed push-ups (Meredith & Welk, 2007). Of the 627 participants who completed the Push-up test in PEP year 2, 466 participants (74%) reached the HFZ.

The participants in the year 2 cohort completed an average of 13.2 push-ups (*SD*=10.38). In PEP year 3, 650 participants completed the Push-up test and 480 students (74%) met the Push-up HFZ. The participants in the year 3 cohort completed an average of 13.6 push-ups (*SD*=10.0). The results of the *t*-test yielded no significant difference of the mean scores on the Push-up tests between cohort years 2 and 3 (*t*= -0.684, *df* =1268.09, *p*> .05, Cohen's *d*= .04).

Gender differences. In PEP year 2, 263 out of 335 boys completed 8 push-ups or more, indicating that 78.5% of the boys fell within the HFZ. In contrast, 203 out of 292 girls completed 7 push-ups or more, indicating that 69.5% of the girls were within the HFZ. The results of the chi-square testrevealed a significant difference of percentages for meeting the HFZ between boys and girls (X^2 = 6.602, *df* = 1, $p \leq .01$). The results indicated that the percentage of boys who met the HFZ was higher than that of the girls. Furthermore, the *t*-test also revealed a significant difference of the mean scores on the Push-up test between boys and girls ($M_{\text{boys year 2}}$= 14.4 vs. $M_{\text{girls year 2}}$= 11.8, *t* = 3.25, *df* = 624.16, *p* < .01, Cohen's *d*= .26).

In PEP year 3, 271 out of 355 boys completed 8 push-ups or more, indicating that 76.3% of the boys fell within the HFZ. In contrast, 209 out of 295 girls completed 7 push-ups or more, indicating that 70.8% of the girls were in the HFZ. The chi-square testrevealed no significant difference of percentages for meeting the HFZ between the boys and girls (X^2 = 2.515, *df* = 1, *p* > .05). However, the results of the *t*-test yielded a significant difference between boys and girlson the Push-up test ($M_{\text{boys year 3}}$= 15.2 vs. $M_{\text{girls year 3}}$= 11.6, *t* = 4.74, *df* = 646.72, *p*< .01, Cohen's *d*= .37) when the gender-specific criteria was eliminated.

Trunk Lift Test Results in Year 2 and Year 3

Percentages for meeting the healthy fitness zone. The HFZ for the Trunk Lift test specifies that lifting the upper body 9 inches off the floor from the prone position as the HFZ cut-off for both 11-year-old boys and girls (Meredith & Welk, 2007). In PEP year 2, 627 students completed the trunk lift test and 565 (90.1%) participants reached the HFZ. The participants in the year 2 cohort lifted their trunk an average of 11.3 inches (*SD*=2.33) off the ground. Impressively, of the 650 5th graders who completed the trunk lift test in PEP year 3, 622 (95.7%) participants met the HFZ. Similarly, the participants in the year 3 cohort lifted their trunk an average of 11.6 inches (*SD*=1.26) off the ground.

The results of the *t*-test indicated a significant difference of the mean scores on the Trunk Lift test between cohort years 2 and 3 (t= -2.84, df =958.07, p< .05, Cohen's d= .18).

Gender differences. In PEP year 2, 298 out of 335 boys lifted their trunk 9 inches or more off the ground, indicating that 89% of the boys fell within the HFZ.267 out of 292 girls successfully lifted their trunk 9 inches or more off the ground, indicating that 91.4% of the girls were within the HFZ. The chi-square testrevealed no significant difference of percentages for meeting the HFZ between boys and girls (X^2 = 1.08, df = 1, p > .05). The results of the *t*-test also revealed no significant differences between boys and girls in the Trunk Lift test ($M_{\text{boys year 2}}$= 11.20 vs. $M_{\text{girls year 2}}$= 11.31, t = -0.579, df = 591.16, p >.05, Cohen's d= .05).

In PEP year 3, 338 out of 355 boys successfully lifted their trunk 9 inches or more off the ground, showing that 95.2% of the boys fell within the HFZ. 284 out of 295 girls successfully lifted their trunk 9 inches or more off the ground, indicating that 96.3% of the girls were in the HFZ. The chi-square test revealed no significant difference of percentages for meeting the HFZ between boys and girls (X^2 = .439, df = 1, p > .05). Similarly, the results of the *t*-test yielded no significant difference of the mean scoreson the Trunk Lift test between boys and girls ($M_{\text{boys year 3}}$= 11.48 vs. $M_{\text{girls year 3}}$= 11.64, t = -1.70, df = 642.65, p> .05, Cohen's d= .13).

Left Shoulder Stretch Test Results in Years 2 and 3

Percentages for meeting the healthy fitness zone. For the Left Shoulder Stretch test, the ability to touch opposite fingertips together behind the back on the left side of the body is thecriterion for 11-year-old boys and girlsto meet the HFZ (Meredith & Welk, 2007). In PEP year 2, of the 625 students who completed the left shoulder stretch test, 468(74.9%) participants reached the HFZ.The mean score for participants in the year 2 cohort was .75 (SD= 0.43). In PEP year 3, of the 650 participants who completed the left shoulder stretch test, 517 (79.5%) students met the HFZ. The mean score for participants in year 3 cohort was .80 (SD=0.40). The *t*-test indicated a significant difference of the mean scores on the Left Shoulder Stretch tests between cohort year 2 and year 3 (t= -1.982, df =1257.39, p< .05, Cohen's d=.11).

Gender differences. In PEP year 2, 239 out of 334 boys successfully touched opposite fingertips together behind the back on the left side, indicating that 71.5% of the boys fell within the HFZ. 229 out of 291 girls (78.7%)were in the HFZ. The chi-square test revealed a significant difference of percentages for meeting the HFZ between boys and girls (X^2 = 4.133, *df* = 1, *p* < .05). The results of the *t*-test also revealed a significant difference between boys and girls on the left shoulder stretch test ($M_{\text{boys year 2}}$= 0.72 vs. $M_{\text{girls year 2}}$= 0.79, *t* = -2.070, *df* = 621.94, *p* <.05, Cohen's *d*= .17).

In PEP year 3, 262 out of 355 boys successfully touched opposite fingertips together behind the back on the left side, indicating that 71.5% of the boys fell within the HFZ. In contrast, 255 out of 295 girls (86.4%) were in the HFZ. The chi-square test yielded a significant difference of percentages for meeting the HFZ between boys and girls (X^2 = 15.811, *df* = 1, *p* < .01). The results of the *t*-test also revealed a significant difference between boys and girls on the test ($M_{\text{boys year 3}}$= 0.74 vs. $M_{\text{girls year 3}}$= 0.86, *t* = -4.111, *df* = 645.37, *p* <.01, Cohen's *d*= .32).

Right Shoulder Stretch Test Results in Years 2 and 3

Percentages for meeting the healthy fitness zone. The ability to touch opposite fingertips together behind the back on the right side of the body is the criteria for 11 year old boys and girls to meet the HFZ (Meredith & Welk, 2007).

In PEP year 2, of the 627 students who completed the right shoulder test, 565(90.1%) participants reached the HFZ. The mean score for participants in year 2 cohort was .87 (*SD*= 0.33). In year 3, of the 650 5th graders who completed the test, 572 (88%) participants met the HFZ. The mean score for participants in year 3 cohort was .88 (*SD*=0.33). The results of the*t*-test indicated no significant difference of the mean scores between cohort years 2 and 3 (*t*= -0.347, *df* =1268.19, *p*> .05, Cohen's *d*= .02).

Gender differences**.** In PEP year 2, 298 out of 335 boys (89%)fell within the HFZ. 267out of 292 girls (91.4%) were in the HFZ. A chi-square test revealed a significant difference of percentages for meeting the healthy fitness zone between boys and girls (X^2 = 6.551, *df* = 1, *p* < .01). The results of the t-test also revealed a significant difference between boys and girls in the test ($M_{\text{boys year 2}}$= 0.84 vs. $M_{\text{girls year 2}}$= 0.91, *t* = -2.656, *df* = 615.84, *p* <.05, Cohen's *d*= .21).

In year 3, 296 out of 355 boys (83.4%) fell within the HFZ. 276 out of 295 girls (93.6%) were within the HFZ. The Chi-square test yielded a significant difference of percentages for meeting the HFZ between the boys and girls (X^2 = 15.808, *df* = 1, *p* < .01). To further examine the mean scores for the test between boys and girls, the results of the t-test revealed a significant difference between boys and girls($M_{\text{boys year 3}}$= 0.83 vs. $M_{\text{girls year 3}}$= 0.94, *t* = -4.168, *df* = 617.81, *p* <.01, Cohen's *d*= .34).

Discussion

This study was central to examining levels of the 5th grade students' physical fitness during PEP years 2 and 3. Overall, the participants in the two year cohorts showed consistently high percentages for meeting the HFZ on each fitness test. On average, 78.5% of the 5th graders in year 2 cohort and 81.55% of the students in year 3 cohort were in the HFZ for cardiovascular endurance, abdominal and upper body muscular strength and endurance, trunk extension strength and flexibility, and upper body flexibility. The overall average percentage of the year 2 cohort and of the year 3 cohortfor meeting the HFZ were much higher than that of the participants (40%) in a study by Erwin and Castelli (2008) for five FitnessGram test items. The results might be related to the students' participating in a quality physical education and physically active recess program during the PEP years. As described in the methods, the physical education teachers taught CATCH PE curriculums to their students and implemented the MC recess program during a daily lunch recess.

The results support the idea that implementation of a comprehensive school-based physical activity program plays a key role in improving and maintaining students' health-enhancing physical fitness (NASPE, 2010; USDHHS, 2008).

For the PACER test, similar to the percentage for meeting the HFZ in the previous studies (Castelli & Valley, 2007; Erwin & Castelli, 2008), 62% of the year 2 cohort and 64% of the year 3 cohort met the HFZ for cardiovascular endurance. However, when examining the average number of laps successfully completed by the students in the two year cohorts without considering the gender-specific criteria for the HFZ, we found that the average running laps completed by the two year cohorts (M_{year2} = 33, *SD* = 18.06, M_{year3} = 31, *SD* = 16.69) were higher than 30 laps (cut off number for boys) and much higher than 9 laps (cut off number for girls).

Both average running laps of the two year cohorts were higher than the average running laps of 23.28 in the study by Erwin and Castelli (2008).

Regarding the Curl-up test, 79% of year 2 cohort and 88% of the year 3 cohort met the HFZ. The results were higher than 76% of participants who were in the HFZ in the study by Erwin and Castelli (2008). More encouraging results indicated that the average of 34 curl-ups performed by the students in the two year cohorts was higher than the high end of the HFZ for boys (15-28) and for girls (15-29). Again, the average curl-ups completed by the students in the two year cohorts was also higher than the mean score of 31.60 for curl-up tests in the study by Erwin and Castelli (2008). The results indicated that the about four-fifths or more of the participants in this study demonstrated the HFZ of abdominal muscular strength and endurance.

For the Push-up test, 74% of the participants inthe year 2 and the year 3 cohorts were in the HFZ, which was higher than 69% of the participants who met the HFZ in Erwin and Castelli's study (2008). In addition, the average of 13 push-ups completed by the participants in the two year cohorts fell in the mid range of the HFZ (8-20 for boys, 7-15 for girls).The mean score of the push-ups in the two year cohorts was higher than the average of 11.84 push-ups completed by the participants in the study of Erwin and Castelli (2008). The results indicated that about three-fourths of the participants had strong upper body muscular strength and endurance.

With respect to the results of the Trunk Lift test, the participants in the two year cohorts demonstrated the highest percentage for meeting the HFZ (90% in PEP year 2 and 95% in PEP year 3) among the five fitness tests. The average of 11.3 in PEP year 2 and that of 11.6 in PEP year 3 were close to the high end of the HFZ for the trunk lift test (9-12 inches for both boys and girls). The results indicated that a very high percentage of the participants in this study showedgood strength and flexibility in the trunk extensor.

With regards to the results of the shoulder stretch tests,75% of the participants in PEPyear 2 and 80% of the participants in PEP year 3 cohorts were in the HFZ for the left shoulder stretch test. 90% of participants in PEP year 2 and 88% of participants in PEP year 3 were in the HFZ for the right shoulder stretch test. The results indicated that a majority of the participants in this study had good flexibility in shoulders, with better flexibility in the right shoulder than in the left shoulder.

Examining the results across the fitness tests, this study showed that the lowest percentage of the participants who met the HFZ was for the PACER test. Consistent with the results reported by Erwin and Castelli (2008), this study indicated that although the mean laps successfully completed by the participants in the two year cohorts were higher than the cut-off point (30 laps for boys and 19 laps for girls), roughly one-third of the participants in this study needed to improve their cardiovascular endurance. Healthy cardiovascular endurance is a determinant of a strong heart, healthy lungs, and efficient blood vessels (Katzmarzyk et al., 1999). Having healthy cardiovascular endurance helps reduce the risk of life-threatening diseases, improve mental state, and enhance efficient body function (CDC, 2011; Ortega et al., 2008; USDHHS, 2008).

Given the critical role of cardiovascular endurance in generating healthy cardiovascular profile in youth, which tracks into adulthood, this study suggests that the urgent need is to help all children meet the HFZ for cardiovascular endurance. To help all children achieve NASPE content standard 4 in terms of cardiovascular endurance, it is the physical education teacher's responsibility to provide adequate physical activities to improve physical fitness. Physical education teachers need to engage their students in maximum participation in skill practice, game play, and health-related physical activities by providing developmentally appropriate learning experiences. They also need to reduce class management time and increase the time spent in moderate to vigorous physical activity engagement during a lesson. Physical education teachers also need to work with school staff to engage students in physically active recess programs throughout the school day.

In line with the results of the flexibility test in previous studies (Erwin and Castalli, 2008; Reeves, Broeder, Hennedy-Honeycutt & East, 1999), most of the participants in the two year cohorts demonstrated a healthy level of flexibility in the back and shoulders. In addition, the results of these tests indicated that a majority of the participants demonstrated strong muscles in the core, shoulders, and the back. The results are very encouraging because the participants' having strong muscles in the core, shoulders, and the back is instrumental to developing their good body postures. The children are in the critical age of developing their proper body postures. Improvement in these major muscles groups is also beneficial to their healthy lean body mass and bone mass (CDC, 2011; Ortega et al., 2008).

This study indicated that overall, at least three-fourths or more of the participants showed adequate progress toward meeting NASPE content standard 4 in terms of muscular strength, muscular endurance, and flexibility.

Regarding gender differences in these fitness tests in PEP years 2 and 3, this study indicated that in PEP year 2, the percentages of the girls who met the HFZ for the PACER, Trunk Lift, and Shoulder Stretch tests were higher, compared with the boys. In contrast, the boys had higher percentages than the girls on the Curl-up and the Push-up tests. However, in PEP year 3, the proportions of the girls who were in the HFZ for the PACER, Curl-up, Trunk Lift, and Shoulder Stretch tests were higher than those of the boys, except for the Push-up test.

However, without considering gender-specific guidelines, the results of the mean scores indicated that the boys performed significantly better than the girls regarding the PACER tests and the Push-up tests in PEP years 2 and 3. Erwin and Castelli (2008) also reported that the boys statistically outperformed the girls on PACER tests, but not for the push-up test. Similarly, Barnett et al. (2008) found that boys ran more laps than girls on the cardiovascular endurance test. Consistent with the findings of previous studies (Castelli & Valley, 2007; Erwin & Castelli, 2008), the girls in this study performed statistically better than the boys on the flexibility tests during PEP year2 and on the trunk lift test during PEP year 3.

There were no significant differences on curl-up tests during the two PEP years between the boys and the girls. The results confirmed the study by Erwin and Castelli (2008) who found no gender differences on the Curl-up test.

This study suggests that girls need to improve their upper body muscular strength and endurance. Upper body muscular strength and endurance are considered the bedrock conditioning for successfully performing object control skills used in team sports, individual sports, and lifetime sports. Improving upper body strength and endurance for girls would help promote their participation in organized and non-organized sports and physical activities. Due to the fact that cardiovascular endurance is a key predictor of physical activity participation, this study also suggests that physical education teachers need to incorporate life-time sports and health-related fitness activities into a regular physical education lesson and a recess program. These non-competitive sports and activities will better suite girls' interests and needs.

Improving the girls' overall cardiovascular endurance is a challenging and urgent task for physical education teachers to further pursue.

In conclusion, the percentages of the students' reaching the HFZ for the six fitness tests in PEP year 2 and 3 had a wide range, from moderately high to extremely high (62.3% - 95.7%). The lowest percentage of the students reaching the HFZ was the PACER test and the highest percentage was the trunk lift test. Based on the gender-specific standards for the HFZ, the percentages of the girls meeting the HFZ for the five fitness test items in the two years were higher than those of the boys. In contrast, the boys consistently had higher percentages of meeting the HFZ for the Push-up tests in PEP years 2 and 3, compared to the girls. However, regardless of the gender-specific standards, the results of the *t*-tests indicated that the boys had statistically significant higher mean scores than the girls on the PACER and Push-up tests. Conversely, the girls' mean scores were statistically significant higher than the boy's on the trunk lift and right/left shoulder stretch tests. No significant differences of the mean scores between boys and girls on the curl-up tests in the two years were found.

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