Original Article

Comparison of a PE4LIFE Curriculum to a Traditional Physical Education Curriculum

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Abstract

Problem Statement: Physical education (PE) is an important facet of today's middle school curriculum. However, curricula differ between instructors and schools and the optimal method has not been specifically defined. PE4Life is a new curriculum that encompasses a philosophy that offers opportunities for partnership with the community and emphasizes health-related physical fitness. This philosophy differs from past curricula in that it steps away from predominately teaching skill- and sports-related components.

Purpose: The aim of this project was to determine the differences between a traditional PE and PE4Life curriculum for measures of physical fitness.

Approach: Two demographically similar middle schools were selected to participate in the study. One school adopted the PE4Life curriculum while the other used traditional techniques. Both schools utilized only licensed PE instructors. Sixth grade students were tested using the following assessments: Body Mass Index (BMI), PACER, curl-up, push-up, and sit-and-reach. All students were tested at the beginning of the fall and the end of the spring semesters of two consecutive academic years.

Results: There was a significant difference between the two schools ($F[1,202] = 22.67, p < .001$) for PACER over the two academic years. PE-4L increased scores more than PE-T. BMI was also significantly different between schools over the testing period ($F[1,294] = 3.91, p < .05$).

Conclusions: PE-4L had a decrease in BMI over time, while PE-T had an increase in values. Flexibility was consistently better among the students in PE-4L school and improved more in both Year 1 and Year 2. PE-4L was more favorable on the health-related fitness outcomes when compared to PE-T. While further investigation is warranted, these results suggest that PE4Life's focus on health-related physical fitness may be more beneficial for increasing fitness than traditional physical education.

Keywords: physical education; physical fitness; middle school curriculum

Introduction

For the first time in 200 years, today's children have a shorter life expectancy than their parents (Olshansky et al. 2005). Because of the prevalence and severity of obesity, especially that of children, type 2 diabetes, heart disease, kidney failure, and cancer can be expected to strike people at younger ages than in previous generations. The result could be that today's children will end up living two to five years less than they should, the first reversal in life expectancy in the modern era (Daniels 2006; Olshansky et al. 2005). Over the last 25 years, the prevalence of overweight children and adults has more than doubled and the prevalence of overweight adolescents has more than tripled (Ogden et al. 2002). Ultimately, childhood obesity can present devastating physical, psychological, and social consequences.

Paradoxically, because of the emphasis on standardized testing, physical education and recess have taken a back seat and requirements for physical education in our nation's schools have been eroded (Story et al. 2006). A survey in 2000 found that 29% of K-5 schools scheduled no recess (Burgeson et al. 2001). The current National Association for Sport and Physical Education recommendation is 150 minutes per week of physical education for elementary school children and 225 minutes per week for secondary school children. However, only 8% of elementary schools and 6% of middle and high schools meet these recommendations (Burgeson et al. 2000). Unfortunately, as a student's grade level increases, physical education requirements

drop drastically. From 1991-2003, high school students enrolled in physical education classes dropped from 42% to 28% and, of those, only one-third were active more than 25 minutes three to five days a week. This suggests that the quality of the physical education class, in addition to the quantity of physical activity, is less than ideal and should be addressed further (Story et al. 2006).

Ninety-five percent of the nation's children ages 5-17 attend school and no other institution has more access to children and adolescents during the first two decades of their lives. School systems present a prime opportunity to promote physical activity and healthy eating in that young population (Story et al. 2006). Proposed health goals such as warranting that all children have access to safe and convenient places to be physically active, ensuring that the bulk of food available to children meets or exceeds nutritional guidelines, and reducing the promotion of unhealthy food and sedentary behaviors (Sallis and Glanz 2006) certainly fit within the parameters of a school setting.

Perhaps one of the most comprehensive programs was developed by researchers at San Diego State University (Sallis et al. 1997). Sports, Play, and Active Recreation for Kids (SPARK), sought to educate students on the relationship between physical activity, food intake, and body composition. In addition to encouraging children to develop and maintain acceptable levels of fitness and participate in physical activity, SPARK also taught behavioral skills such as sharing, being a good sport, and demonstrating cooperative behavior.

Two independent programs that have used the SPARK curriculum to target specific populations were Pathways and Fun 5. Pathways were developed to increase activity levels and dietary knowledge of American Indians (Davis et al. 1999) with four primary components: curriculum, family, food service, and physical activity. Fun 5 was developed as both an after-school and elementary program for Hawaiian school children. It sought to encourage children to exercise five days per week and eat five servings of fruit and vegetables each day.

Several programs that have combined diet and physical activity have also included an important home component in their programs. One such extensively implemented program was The Child and Adolescent Trial for Cardiovascular Health (CATCH; Luepker et al. 1996). In addition to family education, this elementary and middle school program assisted schools to decrease the amount of dietary fat in school lunches, helped students maintain better eating habits, and increased the amount of moderate to vigorous physical activity in physical education classes.

Eat Well and Keep Moving was a joint venture of the Harvard School of Public Health and the Baltimore Public Schools (Cheung Gortmaker and Dart 2001). It not only incorporated the family, but the community as well. One major strength of this program was its inherent interdisciplinary focus, incorporating nutrition lessons into math, language arts, and science classes. Eat Well and Keep Moving was developed for upper elementary children, but a similar program with identical objectives has been developed for middle school children – Planet Health (Carter et al. 2001).

Other programs have been geared toward more specific populations, such as females and minorities. High school girls were the target for the Lifestyle Education for Activity Program (LEAP). The six components of this intervention included: physical education, health education, school environment, school health services, faculty/staff health promotion, and family/community involvement. Unique to this program was the inclusion of a choice of activities that girls typically enjoy into the physical education component. A LEAP team that was comprised of school personnel served as role models and, supported by university personnel, coordinated the activities (Pate et al. 2005).

Three additional programs to address bone health, body weight, and health behaviors were developed to address specific health outcomes. Sponsored by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, Project FAB (Fitness and Bone) was developed to prevent osteoporosis in adolescent girls. As a result of this program within a special physical education program at school, sedentary female adolescents were able to increase their physical activity and prevent a decline in cardiovascular fitness (Jamner et al. 2004).

The GEMS (Girls Health Enrichment Multi-Site Studies) pilot study (Rochon et al. 2003) targeted 8-10 year-old African American girls. Although this is an after-school program, GEMS sought to curb weight gain during puberty through diet information, physical activity, and parental involvement.

The Physical Activity and Teenage Health (PATH) curriculum was designed to address the needs of minority adolescents. Objectives for this program included increased awareness of positive health behaviors, improved attitudes toward positive health and fitness, increased knowledge of long-term health consequences of lifestyle choices, increased physical activity, and improved physical fitness. Developed in conjunction with recommendations of Healthy People 2000, it combined aerobic and resistance activity with a cognitive component concerning cardiac risk factors to help prevent the onset of cardiovascular disease (Fardy et al. 2006).

One of the newest programs on the scene that is garnering substantial attention is PE4Life (PE-4L) (PE4Life, n.d.). Developed in 2000 to inspire active healthy living (PE4Life, n.d.), its stated mission is to “improve fitness, social behavior, and learning readiness of children by inspiring and empowering schools and their communities to be catalysts for change in advancing quality physical education” (PE4Life, n.d.). The focus of this program was to provide quality daily physical education for all children including applicable knowledge so that children will be able to set and assess their own cardiovascular and fitness goals. One way this can be accomplished is through encouraging the use of technology and non-traditional physical education equipment (e.g. mountain bikes, rollerblades) in physical education classrooms. While PE-4L has a wellness focus, that highlights the importance of team building, bringing together a wide variety of people from the community to impact physical education in the schools. PE-4L proposes the following core principles concerning physical education:

- Be offered to every child every day
- Be available for all students, not just the athletically inclined
- Provide a wide variety of sport, leisure, adventure, and fitness activities to promote an active and healthy lifestyle
- Assess students on their personal progress toward fitness and physical activity goals
- Incorporate current technology on a regular basis
 - Extend beyond the walls of the gymnasium to form community and business partnerships

Of all the characteristics above, the most unique characteristic of the PE-4L philosophy is its call for a partnership between school districts and local businesses and agencies to raise money for technology and equipment to be used by that particular community. As a result, PE-4L schools differ in curriculum in regards to the actual amount of equipment and technology available, but are similar in philosophy. However, the PE-4L program offers support for implementation, assessment, evaluation, and follow-up services with community partnerships. Schools using PE-4L have shown increases in fitness scores, improved academic scores, and decreased disciplinary incidents (PE4Life, n.d.).

Clearly, there have been a myriad of interventions geared to increasing the quality of life of our children through school-based programs. Some of these programs have focused solely on the physical aspect while some have intertwined diet and behavioral goals. While all of these programs have ambitious goals and claim numerous success stories, ongoing research is imperative to ensuring a fit between the program and the constituents.

The purpose of the present study was to compare the efficiency of two physical education programs, PE-4L and a skill/sport based curriculum. Specifically, this study measured student fitness outcomes in two school districts, one that used the PE-4L curriculum and one that used a traditional physical education curriculum. It was hypothesized that both boys and girls in a school where the PE-4L program was adopted would show greater improvements in fitness scores than children with a physical education curriculum that was not based on PE-4L.

Material and Method

Participants

Participants were initially sixth grade students at two middle schools in Northwest Arkansas. The middle schools were matched on demographical information (Table 1). Informed consent was obtained from the schools and both the students and their parents/legal guardians. Institutional Review Board approval was obtained from the University of Arkansas before any testing began.

Table 1

School Demographics

Variable	PE4Life	non-PE4LIFE
Total Students	889	897
Free/reduced lunch eligible (%)	44.7	53.5
Minorities (%)	32.5	36.5

Note. Minority classification was considered all other races/cultures than Caucasian.

School Comparisons

Two comparable middle schools were chosen from different school districts within Northwest Arkansas. One school followed the PE-4L philosophy while the other taught the traditional physical education

curriculum (PE-T). Although sports and games were part of both curricula, the cornerstone of the PE-4L lessons during the school year was physical fitness 100% of the time. To meet those objectives, the PE-4L had weight-lifting equipment, mountain bikes, heart rate monitors, Dance-Dance Revolution monitors, treadmills, and exercise bikes. PE-T followed a multi-activity curriculum. The focus of this school was more on skill acquisition as opposed to fitness attainment. This particular curriculum was designed around sports units (e.g. basketball, soccer, baseball/softball). No exercise equipment (treadmills, exercise bikes) was available to students in the first year, but the school added Dance-Dance Revolution in the second year. Each school had administered the Fitnessgram in previous years and all students were familiar with fitness testing.

Both schools employed licensed physical education instructors (PE-4L: 2 male and 2 female; PE-T: 3 male and 2 female). Class size at both schools averaged approximately 20 students per teacher. Middle school level at both schools included only sixth and seventh grades. The first year of the testing utilized the sixth graders; in the second year, the participants were then seventh graders.

Testing Procedures

Testing was conducted at the beginning and end of the academic years (fall and spring). Testing took place over two days at each school and included the test of cardiovascular fitness and flexibility on Day 1 and the tests of muscular endurance on Day 2. Initially all tests were selected from the Fitnessgram/Activitygram® battery of fitness tests (Meredith and Welk 2005). In the first year, students completed the Progressive Aerobic Cardiovascular Endurance Run (PACER), curl-up, push-up, and back-saver sit-and-reach tests. Second year fitness tests were changed at the request of the schools' physical education teachers to be more in line with their previous testing procedures. In the second year, students completed the PACER, one-minute sit-up, and the V-sit-and-reach tests. The push-up test was administered in the second year only by the PE-T school, so it was not able to be included in the analysis with those variables. Body mass index (BMI) was tested by the physical education teachers at each school in the spring and fall of both years.

PACER. Participants stood at the starting line of a course that had a marked ending line 20 meters away. After a five second countdown, the participants began the test keeping pace with a compact disc used for the PACER test. They ran to the opposite end of the course trying to touch the ending line before the "beep". Participants then turned and ran to the other end. After one minute there was a triple beep which indicated the speed was about to increase. When a participant failed to reach the end line before the beep they had an opportunity to catch up with the pace. However, if they failed to reach the end for a second time the test was terminated. The final score was the number of laps completed including the first failed attempt.

Curl-up. Participants lied down on a mat with their knees bent with their heels on the floor and slightly apart. The participants' arms were at their sides parallel to their trunk. The ends of their fingertips, of both hands, were marked with a piece of tape and an additional piece was used to mark a spot 4.5 inches away. The participant was instructed to slowly curl up so their fingers touched the second piece of tape and then return to the starting position. They were told to do this in time with a compact disc that had a cadence of 20 curl-ups per minute. The tester ensured that the participants used appropriate form during the test. The test was stopped if the participant completed 75 curl-ups or the tester had to correct their form two times. Things that would require form corrections included pausing, heels losing contact with the mat, or head not returning to the mat after each curl-up. The final score was either 75 if the test was completed or the maximum number achieved before the second form correction. This test was performed only in the first year of the study.

Push-up. Participants were instructed to lie in the prone position with their hands below their shoulders, legs straight behind them, back straight and to use their toes as the pivot point. They lowered themselves down so that their arms were at a 90° angle. They continued to do this to the pace of the compact disc which was 20 push-ups per minute. The test was stopped when their form was corrected for the second time. Corrections included not keeping rhythm, not going to 90°, incorrect body form, and not fully extending arms. The score was based on the number completed before the second form correction. This test was performed only in the first year of the study.

Back-saver sit-and-reach. All participants removed their shoes and sat on the floor with one foot was securely placed against the sit-and-reach box while the other foot was placed flat on the floor beside the knee of the other leg. Their arms were fully extended over the box with one hand parallel over the other. The participant then stretched forward keeping both hands even. They stretched four times and held the last stretch for one second and the distance reached on the final stretch was recorded. The participant then switched legs and repeated the test. This test was performed only in the first year of the study.

V-sit-and-reach. Participants removed their shoes and sat with their feet shoulder-width apart and knees fully extended. The administrator marked the floor in inches with 0 being in line with the participants' toes. The participant was instructed to stretch forward with one hand parallel over the other. They had two practice trials

and held the position on the 3rd trial. The score achieved on the 3rd trial was recorded. If the participant failed to reach their toes the score would be a negative number and the score would be positive if they reached past their toes. This test was performed only in the second year of the study.

One-minute sit-up test. Participants lied supine on the floor with knees bent and feet flat on the floor 12-18 inches away from their buttocks. Their arms were crossed over their chest so that the hands were on the opposite shoulder. The tester held the feet of the participants to ensure that they remained in contact with the floor at all times. At the tester's signal the participant curled up to the sitting position and touched their thighs with the elbows while keeping the arms touching their chest. They then curled back down to the point that their mid-back touched the mat. They performed as many sit-ups as possible in one minute. Their score was the number of sit-ups correctly performed. Sit-ups were not counted if their arms did not remain in contact with their chest, they did not touch their thighs with their elbows, or if they did not touch the mat with their mid-back. This test was performed only in the second year do the study.

Data Analysis

Data were analyzed using JMP 7.0 (SAS Institute Inc.; Cary, NC) and SAS 9.1 (SAS Institute Inc.; Cary, NC). Data were analyzed using general linear modeling with repeated measures. Three analyses were run. To examine differences for the PACER and the BMI over the 2-year period, a repeated measure MANOVA was conducted. Additionally, two multivariate analyses, one that included each year's remaining fitness variables minus the PACER, were conducted. Significance for all analyses was set at $p < .05$.

Results

The purpose of this multi-year study was to determine if children in a school that followed the PE-4L curriculum showed greater fitness gains than students in a school that used a traditional physical education curriculum. Three separate analyses were conducted due to the changes in the fitness tests given over the two-year period. As a result of these changes, only two variables, PACER and BMI, could be analyzed from the first testing in the fall to the final testing in the spring two years later. As the correlation between these two variables was only moderate at each testing point ($r = -.33$ and $r = -.45$), a repeated measure MANOVA was employed with time pertaining to two time points: fall of Year 1 and spring of Year 2. Four other fitness variables in Year 1 were examined in a second MANOVA across one school year, from fall to the next spring. In the second year of testing, the fitness tests, except for PACER, were different from the year before; therefore, a third analysis for those tests from fall to spring of Year 2 was conducted.

To examine differences in PACER and BMI across the two years, a repeated measures (school x sex x time) MANOVA was conducted. Significant multivariate effects were found for school, ($F(2, 167) = 8.75, p < .001$); sex, ($F(2, 167) = 9.90, p < .001$); time ($F(2, 167) = 21.30, p < .001$); and time by school, ($F(2, 167) = 9.95, p < .001$). Univariate for the PACER showed significant main effects differences for sex, ($F(1, 202) = 17.65, p < .001$), school ($F(2,202) = 17.25, p < .001$), and time ($F(1,202) = 34.25, p < .001$). Students improved their PACER scores across the two years (Time 1: $M = 26.83, SD = 15.22$; Time 2: $M = 31.85, SD = 18.45$; $d = .33$) and students in the PE-4L school scored higher ($M = 34.29, SD = 17.10$) than student in the PE-T school ($M = 27.37, SD = 16.39$; $d = .42$). However, these main effects were superseded by a significant time by school interaction ($F(1,202) = 22.67, p < .001$). Students in the PE-4L school improved their PACER scores (29.28 to 37.14; $d = .50$) to a greater extent than did those in the PE-T school (23.39 to 30.02; $d = .50$) (Figure 1).

Univariates for BMI revealed no significant between-subject effects. A significant time main effect was found; however, this was superseded by a school by time interaction ($F(1, 294) = 3.91, p < .05$). Students in the PE-4L school lowered their BMI scores (21.63 to 21.54; $d = .02$) while BMI scores for students in the PE-T school rose slightly (21.79 to 21.84; $d = .01$) (Figure 2).

In the first year of testing, the other variables (sit and reach-right leg, sit and reach-left leg, curl-up, push-up) were examined in a repeated measures (sex by school by time) MANOVA. Significant multivariate between-subject effects were found for sex ($F(4, 391) = 37.54, p < .001$), school ($F(4, 391) = 6.47, p < .001$), and school by sex ($F(4, 391) = 5.23, p < .001$). Univariate analysis for sex were significant for sit and reach-right leg ($F(1, 499) = 53.97, p < .001$), sit and reach-left leg ($F(1, 499) = 54.49, p < .001$), curl-up ($F(1, 466) = 20.48, p < .001$), and push-up ($F(1,476) = 49.80, p < .001$). Girls were more flexible than boys on both sit and reach tests while boys scored higher than girls on both the curl-up and push-up tests. Significant school differences were found for sit and reach-left leg ($F(1, 499) = 5.18, p < .05$), and curl-up ($F(1, 466) = 12.06, p < .001$). PE-4L students had higher sit and reach-left leg scores, while non-PE-4L students had higher curl-up scores. A school by sex interaction was found for the curl-up ($F(1, 466) = 5.85, p < .05$), and the push-up ($F(1, 476) = 10.44, p < .01$). Means for the curl-up were as follows: PE-4L boys - 26.87, PE-4L girls - 23.85, PE-T boys - 34.94, PE-T girls - 25.40. Follow-up tests showed that curl-up scores for PE-T boys scored higher than all of the other groups, but neither PE-4L boys nor PE-4L girls differed significantly from PE-T girls. For the

push-up, PE-T boys scored higher than PE-4L boys (13.01 vs. 9.48; $d = .43$), but there was no significant difference in push-up scores between the two groups of girls (6.70 vs. 7.91).

Several significant within-subject effects were also found: time ($F(4, 391) = 129.90, p < .001$), sex by time ($F(4, 391) = 2.86, p < .05$), and school by time ($F(4, 391) = 11.17, p < .001$). Students improved their scores for all tests from fall to spring. Girls improved scores on both sit and reach tests more so than did boys. However, the school by time interaction showed that, for both sit and reach tests, the PE-4L students scored higher in the spring than did PE-T students even though PE-4L student scores were lower than PE-T students in the fall (Figures 3 and 4).

The analysis in the second year included only the one-minute sit-up and V-sit and reach test, as the PACER was included in the multi-year analysis. Multivariate analysis revealed main effects for school ($F(2, 236) = 4.81, p < .01$); sex ($F(2, 236) = 60.93, p < .001$); and time ($F(2, 236) = 14.61, p < .001$). Also found was a time by school interaction ($F(2, 236) = 9.04, p < .001$) as well as a time by school by sex interaction ($F(2, 236) = 3.44, p < .05$). Univariate analyses showed that, overall, students improved on the V-sit and sit-up tests, that females had higher V-sit scores than males and males had higher sit-up scores than females, and that students in the PE-4L school had higher sit-up and V-sit scores than did PE-T students. However, the school by sex by time interaction for V-sit showed that both boys and girls in the PE-4L school improved from fall to spring with the girls showing the greatest improvement (boys: 0.02 - 0.95, $d = .27$; girls: 2.23 - 3.43, $d = .47$). In the PE-T school, the boys' and girls' scores actually decreased (boys: -0.39 - -0.76, $d = .10$; girls: 2.98 - 1.95, $d = .29$) (Figure 5).

The school by sex by time interaction for the one-minute sit-up showed that girls at both schools (PE-4L: 33.12 - 34.70, $d = .18$; PE-T: 27.20 - 27.42, $d = .03$) and boys in the PE-T school (36.58 - 38.57, $d = .23$) improved slightly, while boys in the PE-4L school showed a large improvement (36.63 - 43.17, $d = .64$). These results are shown in Figure 6.

Discussion and Conclusions

This study examined the fitness outcomes of middle school students who were enrolled in a school that followed the PE-4L curriculum versus those who attended a middle school where a more traditional physical education curriculum was employed. Originally, fitness tests were to be followed across a two-year span; however, due to changes in the testing by the teachers, only the PACER and BMI could be analyzed over those years. The PACER was probably the most rigorous of all the fitness tests conducted, as it uses more of the total body to accomplish the task than the other tests. Although PE-4L students had higher scores at the first testing, they also made greater improvements across the two years than did those in the traditional curriculum. Usually, a greater improvement can be found when scores are low at the outset. However, this was not the case here. It is possible that students in the PE-4L school have more motivation to keep going after being tired. Although motivation cannot be shown to be the reason for the difference, motivation and the will to keep going when fatigued is a necessary component in exercise adherence. Therefore, if students felt that they were motivated, possibly based on how fitness was taught (e.g., with fun technology that might have kept the students interested for a longer period of time), the PE-4L curriculum may, in that way, have contributed to those differences.

BMI was also measured across the two years. Only slight change was found across that time period for both schools, but it is significant that the BMI for PE-4L students decreased while the others rose. Looking at the norms for BMI (CDC 2010) for preteens (11-13 year olds), the means for both schools was close to the 85th percentile, with the PE-T school being a little over that threshold. A value between the 85th and 95th percentile puts the student in the overweight category. As children get older, the score for the 85th percentile rises. Therefore, it would not be unusual for the mean to go up over the two years, such as happened for the PE-T school students. In spite of that scenario, however, the lowered average BMI from the first year to the second year for PE-4L school students is a very encouraging outcome.

While not all fitness tests gave the advantage to the PE-4L school, flexibility consistently was greater for students in that school. In both the sit-and-reach tests of the first year and the V-sit in the second year, a school by time interaction was noted. In the sit-and-reach tests, PE-4L students had less flexibility in the fall than PE-T students. However, this finding was reversed in the spring testing. In the second year, while PE-4L students, especially the girls, increased their V-sit scores, both boys and girls in the PE-T school decreased in flexibility. Strength gains can be enhanced through various common activities, but flexibility is a fitness component that needs to be intentionally targeted to observe changes. Therefore, it is not surprising that focusing on overall fitness, which is part of the mission of the PE-4L curriculum, would also increase scores on the tests of flexibility to a greater extent than a multi-activity curriculum.

The fitness tests that dealt with muscular fitness outcomes showed mixed results. The only fitness test that involved differences in the schools across time was the one-minute sit-up in the second year. This difference can be attributed to the boys in the PE-4L school showing a large improvement from fall to spring while the other group improved at a much lesser rate. In the first year, only school and gender differences were

found for the curl-up and the push-up tests, and those differences were due to the consistently high scores displayed by PE-T boys in both fall and spring for those two tests. Perhaps, a curriculum that contains large muscle activities like those found in the multi-activity curriculum of the s school could contribute to muscular endurance gains without focusing on fitness. It also appeared that the boys in the PE-T school were much stronger from the outset than boys in the other school. The absence of an interaction involving time suggests that both groups, including the girls, increased strength similarly across time. It appears that muscular strength/endurance activities can be increased by a number of methods, including focusing on fitness and encouraging participation in sporting activities in physical education classes. What is necessary, however, is that students participate fully in those activities to gain the benefits. If a student is not motivated to play traditional activities, not gains will occur.

Not surprisingly, students showed improvement in all fitness tests, except the V-sit, regardless of the curriculum. This result was expected, as children are getting stronger with age. However, the gains by girls in the fitness tests were encouraging because girls of this age may be experiencing an increase in adipose tissue around the time of puberty (Payne and Isaacs 2008). It should also be noted that students in the PE-T school did not have the benefits of the fitness equipment that was available to students in the PE-4L school. While both schools had climbing walls, the fitness equipment of the PE-4L school could have made a difference, especially in the PACER test. Students may have had more fun, and more motivation, while using that equipment. No school by time differences was shown in the strength tests and possibly this was a result of both schools having climbing walls. Clearly, fitness gains can be made without technology, but it appears that technology can enhance learning, and possibly motivation. A unique characteristic of the PE-4L philosophy is its encouragement of the use of technology within its curriculum.

One obvious limitation of this study was the inability to measure students on all tests across two years due to unanticipated changes in the fitness testing. Even so, the two tests that were able to be measured during that time, BMI and the PACER, showed that the PE-4L curriculum enhanced scores on both tests. In addition, from fall to the next spring, several school differences were found which showed that short programs within physical education classes can indeed make a difference. A second limitation was that the design involved only two schools. However, several classes were used at both schools and those classes were taught by several different teachers. In addition, the schools were matched on important demographic variables prior to their involvement. The use of a pre-post design was considered appropriate for this quasi-experiment.

It is clear, based on the health status of our children that physical education classes need to respond to the childhood obesity crisis. Traditional methodology and standard curriculum have only been moderately effective. As students are increasingly exposed to technology at an earlier age, including technology in our physical education classrooms may be the motivation needed to combat this crisis. Programs such as PE4life warrant further exploration.

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