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Value of Daily Physical Education Questioned! Revision 2

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The purpose of this study was to explore the relationship between the number of days per week a child participates in physical education class and physical fitness test scores among elementary students. A total of 1,122 boys and 1,129 girls from 31 elementary schools located in the Midwest region of the U.S. took part in the study. The results of the current study, in general, suggest that physical fitness levels of students enrolled in daily physical education programs are no better than the fitness levels of students enrolled in classes meeting less frequently.

Introduction

The number of young people diagnosed with preventable diseases, such as obesity and type II diabetes, is increasing at an alarming rate. The percentage of young people who are overweight has more than tripled over the past three decades. Specifically, the percentage of children that are overweight has increased from 5 to 14 percent for children aged 2 to 5 years, 4 to 19 percent for children aged 6 to 11 years, and 5 to 17 for youth aged 12 to 19 years (Ogden et al., 2006). By 2003-2004, approximately 12.5 million children aged 2 to 19 years were considered overweight (Centers for Disease Control and Prevention [CDC], 2006a). There is strong evidence linking childhood obesity with several serious illnesses and health problems. Heart disease, type II diabetes, high blood pressure, menstrual irregularities, and high cholesterol, among others, are illnesses or health risk factors associated with obesity (Dietz, 1998). In addition, it has been estimated that approximately 80% of overweight adolescents will become overweight or obese as adults (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). Psychological effects such as low self-esteem and depression are also associated with being overweight and obese.

Unhealthy eating habits and a lack of physical activity are two factors widely recognized that contribute to being overweight and obese. As a predisposing factor for childhood obesity, physical inactivity is a major problem in this age of computers, videos, and the Internet. Many children are leading sedentary lifestyles. Although children are more active than adults, many young people do not engage in moderate to vigorous physical activity at the recommended level. According to the results from the 2005 Youth Risk Behavior Survey, only 35.8% of high school students, 44% of males and 28% of females met currently recommended levels of physical activity, that is, doing any kind of physical activity that increased their heart rate and made them breathe hard some of the time for a total of at least 60 minutes/day on five or more of the previous seven days (CDC, 2006b). In a nationally representative sample of children aged 9 – 13 years, findings from the Youth Media Campaign Longitudinal Survey indicated that 61.5% of children in this age group do not participate in any organized physical activity during nonschool hours and 22.6% do not engage in any free-time physical activity (CDC, 2003). By comparison, the *Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity* reported that 43% of adolescents watch more than two hours of television each day (U.S. Department of Health and Human Services [USDHHS], 2001).

Moderate-intensity physical activity on a daily basis is recommended for people of all ages (CDC, 2001). Inactivity for long periods of time is discouraged, especially during daytime hours (National Association for Sport and Physical Education [NASPE], 2006). The CDC recommends that children and adolescents participate in at least 60 minutes of moderate intensity physical activity most days of the week, preferably daily. In 2008, the federal government issued its first-ever *Physical Activity Guidelines for Americans* recommending one hour or more of moderate to vigorous aerobic physical activity daily for children and adolescents. Moreover, adults gain substantial healthy benefits from at least 150 minutes a week of moderate-intensity or 75 minutes a week of vigorous-intensity aerobic physical activity (USDHHS, 2008). The CDC's Task Force on Community Preventive Services (2001) strongly recommended school physical education (PE) programs as an effective means of increasing physical activity among young people. Not only does physical education provide students with opportunities to be physically active, quality programs should also teach them the knowledge and behavioral skills that promote lifelong physical activity. Daily physical education from kindergarten through 12th grade is recommended by the American Heart Association (American Heart Association, 2004), NASPE (2004), the National Association of State Boards of Education (2000), the American Academy of Pediatrics (2000), and is also

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cited as an objective in *Healthy People 2010* (USDHHS, 2000). PE4Life, a nonprofit advocacy organization whose mission is to promote active, healthy living, also recommends daily physical education programs for all children (PE4Life, 2007). It is noted, however, that none of these groups have the authority to mandate daily physical education. In fact, the federal government does not mandate physical education; rather, mandates or regulations are established at the state or local level.

Despite the emphasis on "daily" physical education, research has shown that few states or local districts require physical education five days per week. For instance, according to the results of the School Health Policy and Program Study (SHPPS) conducted by the CDC, 8% of districts nationwide reported providing daily physical education for elementary students, while only 5.8% of high schools surveyed require daily physical education (Burgeson, Wechsler, Brener, Young, & Spain, 2001). The 2006 Shape of the Nation Report (NASPE, 2006) reports that only two states, Louisiana and New Jersey require 150 minutes/week at the elementary level (i.e., equivalent to daily physical education), while only three states (Indiana, Montana, and South Carolina) and the District of Columbia require 225 minutes/week at the secondary level. Moreover, the CDC reports that the percentage of high school students enrolled in daily physical education has declined appreciably since the early 1990s (CDC, 2004). Clearly, "daily" physical education in this era of No Child Left Behind (NCLB) is not frequently included in educational requirements.

The outcome of a quality physical education program is presumably influenced not only by the frequency and duration of class meetings, but also by the curriculum and its delivery. The national standards for physical education, published by NASPE, provide a general framework for guiding curriculum development (2004). The standards identify what students should know and be able to do as a result of participating in a quality physical education program. While the development of a physically active lifestyle is a goal for all children, a physical fitness theme is witnessed throughout the standards, suggesting that the improvement of fitness levels should also be a valued goal of school physical education programs. As a result, many physical education teachers are revamping their curriculum to a fitness-based model in an attempt to meet current recommendations and improve the health, fitness, and well-being of *all* children.

In a longitudinal, quasi-experimental study involving upper-elementary school students, Ignico (1994) investigated the effect of daily physical education (i.e., five days/week) on physical fitness test scores. Forty-two students participated in daily physical education while in the 4th and 5th grade, but then participated in physical education only two days/week during their 6th grade year. Fitness test scores improved in 4th and 5th grade, but then declined when students were in the 6th grade. The author concluded that students who participated in daily physical education, which included three days/week of fitness activities, received a sufficient amount of moderate to vigorous physical activity to achieve desirable fitness levels. Although there are limitations to this study, the results of this study provide evidence to support the benefits daily physical education can have on children's fitness scores.

Cawley, Meyerhoefer, and Newhouse (2007) analyzed data on 37,000 students in grades 9 through 12 from Youth Risk Behavior Surveillance System (YRBSS) surveys conducted in 1999, 2001 and 2003. The purpose of their study was to explore the causal impact of state physical education requirements on student physical activity and weight. Findings suggested that certain state regulations are effective in raising the number of minutes during which students are active in physical education. Results also indicated that additional physical education time raised the number of days per week that students reported having exercised or engaged in strength-building activities. Physical education time had no impact on body mass index (BMI) or the probability that a student is overweight. The authors concluded that there is not yet enough evidence to declare that increased physical education requirements help alleviate overall obesity rates, but it does help increase physical activity among girls.

There is not yet a scientific base to support the many calls for daily physical education, thus curricular decisions are often based on personal opinion or the plea of so-called experts. Further research is clearly needed to establish the efficacy of daily physical education on its valued outcomes and thus provide empirical information to help guide decision makers. Therefore, the purpose of this study was to explore the relationship between the number of days per week a child participates in physical education class and physical fitness test scores among elementary students.

Methods

The present study used a cross-sectional design that utilized fitness test data from the Physical Activity and Nutrition Among Rural Youth (PANARY) project, a large statewide study in Iowa [United States] conducted by the Youth Fitness & Obesity Institute at the University of Northern Iowa. A primary aim of this project was to better understand the physical fitness status and physical activity behaviors of youth residing in small towns and rural communities. A total of 32 elementary schools located throughout the state participated in the project during the 2004-05 school year. From data collected at each of the participating schools, physical fitness test scores for 4th and 5th grade students were extracted for use in the present study. In addition to fitness test scores, selected physical education program information, including the duration and frequency of class meetings, was obtained from each participating school. In total, participants in the study included 2,251 Iowa school children (1,122 boys; 1,129 girls). The Institutional Review Board at the University of Northern Iowa approved the study.

Each participating school utilized FITNESSGRAM test items to measure the health-related physical fitness of enrolled students. Although the specific tests administered varied from school to school, each test was administered by the resident physical education teacher in accordance with the guidelines prescribed by the *FITNESSGRAM/ACTIVITYGRAM Test Administration Manual* (Meredith & Welk, 2004). The measures used in the present study included: curl-ups, push-ups, pull-ups, Progressive Aerobic Cardiovascular Endurance Run (PACER), 1-mile run and body mass index (BMI). The PACER is the recommended test for aerobic capacity in the FITNESSGRAM and consists of running a 20-meter shuttle course with 1-minute paced stages during which speed is progressively increased. Scores on the sit-and-reach test were excluded from the combined data because it was discovered that the prescribed test protocol was not followed by all schools,

making comparisons meaningless.

Although the physical education curriculum at each of the participating schools met state education standards, the strong tradition of local control in Iowa education allowed schools to adjust their physical education program and the associated curriculum to best meet the needs in the local community. No attempt was made to modify a school's curriculum or instructional methods. The participating schools were classified into three groups based upon the frequency per week in which students attended physical education class (i.e., frequency of class meeting). Group 1 (n = 14) consisted of schools in which students attended physical education class two or fewer days per week; Group 2 (n = 14) consisted of schools in which students attended physical education class more than two, but fewer than five days per week (this includes those schools that were on a six-day cycle); and Group 3 (n = 4) consisted of schools in which students attended physical education five days per week (i.e., daily physical education). It is also noted that the length of the physical education class period varied among participating schools, ranging from 22 to 45 minutes in duration. Thirty minute class periods were most frequently reported. Schools in Group 1 (2 or fewer days/wk) averaged 33 minutes per class period, schools in Group 2 (more than 2 but fewer than 5 days/wk) averaged 28 minutes per class period, and schools in Group 3 (5 days/wk) averaged 30 minutes per class period.

One could argue that a more meaningful comparison would be based on the total number of minutes per week that a student is enrolled physical education. While it may well be that from a dose-response respective the total number of minutes per week (volume) of physical education is what matters most. While the authors acknowledge the value of such an approach, this changes the focus away from the frequency of class meeting, particularly regarding daily physical education, which was the basic question underlying the study.

Results

Descriptive statistics including means and standards were calculated using SPSS version 12.0 for each fitness measure by gender for each group of schools based on frequency of class meeting. An alpha level was set at 0.05 for all statistical tests. Initial results showed no significant differences by grade; therefore data from fourth and fifth grades were combined for analyses purposes. Before testing for significant effects of gender and frequency of class meeting, preliminary tests were conducted to determine if data met underlying assumptions associated with the use of parametric statistical tests, namely the assumption of normality and the assumption of homogeneity of variance. Results indicated that data for each of the six fitness measures failed to meet the assumption of normality, and only data for the 1-mile run test and BMI met the assumption of homogeneity of variance. Consequently, the decision was made to use non-parametric statistics to test the effect of gender and frequency of class meeting. The Mann-Whitney U test was used as an alternative to an independent groups t-test to test the gender effect and the Kruskal-Wallis test was used as an alternative to a one-way analysis of variance to test for differences across groups.

For each physical fitness measure, students were classified as to whether or not their score fell within the age and gender specific Healthy Fitness Zone as prescribed by the *FITNESSGRAM/ ACTIVITYGRAM Test Administration Manual* (Meredith & Welk, 2004). The description of healthy fitness zones for gender and age for each fitness measure is provided elsewhere (Meredith & Welk, 2004). The percentage of students meeting FITNESSGRAM Healthy Fitness Zone standard was calculated for each frequency of class meeting group (see Table 1).

Table 1. ***Percentage Meeting FITNESSGRAM Healthy Fitness Zone Standards***

	Frequency of Class Meeting					
	≤ 2 day/wk		> 2 but < 5 day/wk		5 day/wk	
Test Item	M	F	M	F	M	F
Pushups	65.6	60.0	66.2	51.7	62.5	32.6a
Pullups	44.9	32.5	57.0	50.0b	52.8	31.4
Curlups	85.7	85.9	88.6	90.0	94.9c	80.8
PACER	75.1	95.7	69.5	94.1	85.7	100.0
Milerun	55.8	52.4	80.9d	75.0e	68.4	32.4
BMI	67.4	83.9	69.0	83.8	73.2	85.8

Note. The values represent percentages of students whose test scores fall with the HFZ.

[a]Significantly lower percentage than females in other two groups.

[b]Significantly higher percentage than females in other two groups.

[c]Significantly higher percentage than males in ≤ 2 day/wk group.

[d]Significantly higher percentage than males in other two groups.

[e]Significantly higher percentage than females in other two groups.

Gender Differences

Table 2 provides means and standard deviations for each of the six fitness measures according to gender group as well as the results of the Mann-Whitney U statistical analysis used to test for significant differences between gender groups. In addition, the conformity of data for each measure with the assumption of normality and assumption of homogeneity of variance is noted. As previously explained, since all test items were not administered in every school, the sample size for each measure varied. Results indicated a significant difference between males and females on all fitness measures with the exception of BMI (see Table 2). Moreover, the direction of the difference favored males on each of the measures, thus suggesting that fourth and fifth grade males were somewhat more physically fit than their female counterparts. These findings are consistent with those by other researchers who reported males scoring higher than females on measures of cardiorespiratory endurance and muscular strength and endurance (Morrow, 2005; Pate, Wang, Dowda, Farrell, & O'Neill, 2006; Ross & Gilbert, 1985). As a result, the effect of frequency of class meeting on fitness test performance was examined separately for females and males.

Frequency of Class Meeting

A Kruskal-Wallis non-parametric statistical test was used to determine if significant differences existed among the three frequency of class meeting groups on the six measures of physical fitness. Comparisons were made separately for females and males. Tables 3 and 4 provide means and standard deviations on each of

Table 2. ***Means and Standard Deviations by Grade and Gender***

Test	Normal Distribution	Equal Variances	Number		Mean		Standard Deviation		Test Statistic (*U*)
			Males	Females	Males	Females	Males	Females	
Pushups	N	N	219	235	10.56	7.88	8.71	6.82	21227.50*
Pullups	N	N	367	310	1.56	1.01	0.124	0.108	48563.00*
Curlups	N	N	944	963	33.18	30.50	18.59	13.85	418038.50*
PACER	N	N	676	735	34.83	27.26	18.59	13.85	189384.00*
Milerun	N	Y	493	464	10.57	11.68	2.93	2.56	81964.00*
BMI	N	Y	1068	1103	19.77	19.76	4.22	4.09	585877.00

Note. Normal distribution = assumption of normality; Equal variances = assumption of homogeneity of variance.
Test statistic is based on Mann-Whitney U test.
* $p < .05$

the fitness measures and the associated test statistic *(H)* for females and males, respectively.

Pushups. Pushup scores were positively skewed for both males and females, thus indicating a clustering of scores on the lower end of the distribution. A significantly smaller percentage of students in 5-day/week PE classes fell within the FITNESSGRAM Healthy Fitness Zone compared to students meeting fewer days per week (see Table 1). Moreover, a significant difference in performance on the pushup test according to frequency of class meeting grouping was observed for females ($H = 10.30$, $p < .05$). Follow-up post-hoc tests revealed that female students in PE classes meeting two or fewer days per week scored significantly higher on the pushup test ($M = 9.62$) compared to students in PE classes meeting five days per week ($M = 6.11$). In fact, females in 5-day/week classes had the lowest mean score on the pushup test. Whereas this finding is illogical and cannot be easily explained, it is likely due to sampling error. No statistically significant differences were observed for males based upon frequency of class meeting ($H = 2.36$, $p > .05$). It was noted, however, that males attending PE classes more than two, but less than five days per week had the highest mean score on the pushup test.

Pullups. Pullups had a positively skewed distribution for both males and females. A significant difference in performance on the pullup test according to frequency of class meeting grouping was observed for females ($H = 15.62$, $p < .05$). Follow-up post-hoc tests revealed that female students in PE class that meets more than two days per week, but less than five days per week scored significantly higher on the pullup test ($M = 1.72$) compared to students in PE classes meeting five days per week ($M = .53$). In fact, females in 5-day/week classes had the lowest mean score on the pullup test. A statistically significant difference was observed for males based upon frequency of class meeting ($H = 9.87$, $p > .05$). Post-hoc tests showed that males attending PE classes five days a week had the highest mean score on the pullup test ($M= 2.06$).

Curlups. Scores on the curlup test were found to be positively skewed for both males and females, although not to the extent seen in other fitness measures. A significant difference in performance on the curlup test according to frequency of class meeting grouping was observed for females ($H = 11.51$, $p < .05$). Follow-up post-

Table 3. ***Comparisons Based on Frequency of PE Classes per Week (Females Only)***

Test	Normal Distribution	Equal Variances	Number			Mean			Standard Deviation			Test Statistic (*H*)
			Group 1[a]	Group 2[b]	Group 3[c]	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3	
Pushups	N	N	65	58	46	9.62	8.69	6.11	6.64	7.42	6.56	10.30*
Pullups	N	N	168	108	34	0.64	1.72	0.53	1.36	2.52	1.08	15.62*
Curlups	N	Y	439	250	104	30.68	32.07	26.23	17.46	16.40	16.73	11.51*
PACER	N	Y	327	186	16	27.83	29.20	33.31	13.84	14.08	13.57	4.04
Milerun	N	N	245	184	34	12.08	10.74	13.52	2.36	2.35	2.58	51.99*
BMI	N	Y	464	314	120	19.81	19.75	19.34	3.91	4.17	4.51	3.64

Note. Normal distribution = assumption of normality; Equal variances = assumption of homogeneity of variance.
Test statistic is based on Kruskal-Wallis test.
[a] Group 1 = PE class meets 2 or fewer days per week.
[b] Group 2 = PE class meets more than 2 days per week but less than 5 days per week (includes class meetings on 6-day cycle).
[c] Group 3 = PE class meet five days per week.
* $p < .05$

Table 4. ***Comparisons Based on Frequency of PE Classes per Week (Males Only)***

Test	Normal Distribution	Equal Variances	Number			Mean			Standard Deviation			Test Statistic (*H*)
			Group 1[a]	Group 2[b]	Group 3[c]	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3	
Pushups	N	N	61	67	40	9.16	12.43	10.53	5.90	9.89	8.74	2.36
Pullups	N	N	167	147	36	1.05	2.04	2.06	1.73	2.80	2.81	9.87*
Curlups	N	Y	406	281	99	31.40	33.79	37.47	17.65	18.08	20.28	5.71
PACER	N	Y	301	175	14	35.47	34.16	41.71	18.27	18.06	18.07	4.04
Milerun	N	N	248	204	28	11.17	9.60	10.91	2.88	2.29	2.90	37.48*
BMI	N	Y	446	327	113	20.13	19.68	19.06	4.41	4.15	4.20	7.30*

Note. Normal distribution = assumption of normality; Equal variances = assumption of homogeneity of variance.
Test statistic is based on Kruskal-Wallis test.
a Group 1 = PE class meets 2 or fewer days per week.
b Group 2 = PE class meets more than 2 days per week but less than 5 days per week (includes class meetings on 6-day cycle).
c Group 3 = PE class meet five days per week.
* $p < .05$

hoc tests revealed that female students in PE class that meets more than two days per week but less than five days per week scored significantly higher on the curlup test (M = 32.07) compared to students in PE classes meeting five days per week (M = 26.23). In fact, females in 5-day/week classes had the lowest mean score on the curlup test. No statistically significant differences were observed for males based upon frequency of class meeting (H = 5.71, $p > .05$). It was noted, however, that contrary to females, males who had PE five days per week had the highest mean score on the curlup test (M= 37.47).

PACER. The distribution of scores for the PACER test was slightly positively skewed for males and even more so for females. The PACER test revealed no significant difference in performance according to frequency of class meeting grouping for both females and males. Although not statistically significant, students (both males and females) enrolled in 5-day/week PE had the poorest mean PACER score (M = 41.71 for males; M = 33.31 for females).

Mile Run. Mile run results indicated a positively skewed distribution for both males and females. A significant difference in performance on the mile run test according to frequency of class meeting grouping was observed for females (H = 51.99, $p <$ .05). Follow-up post-hoc tests revealed that female students in PE class that meets five days per week scored significantly poorer (i.e. longer time) on the mile run test (M = 13.52) compared to students in PE class that meets more than two days per week but less than five days per week (M = 10.74). There was also a statistically significant difference observed for males based upon frequency of class meeting (H = 37.48, $p > .05$). The post-hoc tests revealed that male students in PE class that meets two or fewer days per week scored significantly poorer on the mile run test (M = 11.17) compared to students in PE class that meets more than two days per week but less than five days per week (M = 9.60).

Body Mass Index. There was a positively skewed distribution for males and females in body mass index. No significant difference was observed in body mass index according to frequency of class meeting grouping for females (H = 3.64, $p > .05$). However a statistically significant difference was observed for males based upon frequency of class meeting (H = 7.30, $p < .05$). Post-hoc tests showed that males attending PE classes five days a week had the lowest mean body mass index (M= 19.06) compared with males that had PE two or fewer days per week (M= 20.13).

Discussion

Daily physical education at all grade levels has been an often cited objective for school physical education programs. The U.S. Surgeon General's Report on Physical Activity and Health (USDHHS, 1996) states "…every effort should be made to encourage schools to require daily physical education in each grade …" (p. 6). The CDC's *Guidelines for School and Community Programs to Promote Lifelong Physical Activity Among Young People* (1997) includes the following statement in their recommendations: "For physical education to make a meaningful and consistent contribution to the recommended amount of young people's physical activity, students at every grade level should take physical education that meets daily and should be physically active for a large percentage of class time." In fact, *Healthy People 2010* (USDHHS, 2000), the national health goals for the nation include two objectives related to daily physical education:

Objective 22.8 – Increase the proportion of the nation's public and private schools that require daily physical education.

Objective 22.9 – Increase the proportion of adolescents who participate in daily physical education programs.

According to Thomas (2004), the phrasing of the *Healthy People 2010* objectives related to physical education suggest that "daily" is the critical word. Despite these pleas for daily physical education, relatively few schools across the nation actually provide students with physical education on a daily basis. As previously mentioned, according to the SHPPS report (Burgeson et al., 2001), 8% of elementary schools, 6.4% of middle schools/junior high schools, and 5.8% of senior high schools provide daily physical education or its equivalent for the entire school year for students in all grades. Furthermore, there appears to be scant scientific

evidence indicating that daily physical education provides greater benefits to students than physical education classes that meet less frequently.

The results of the current study, in general, suggest that physical fitness levels of students enrolled in daily physical education programs are no better than the fitness levels of students enrolled in classes meeting less frequently. There is some indication, however, that students enrolled in classes meeting two days per week or less may be less fit than students having physical education classes more frequently. In comparison, Woodard, Wayda, Buck, Lund, and Pauline (2004) reported that middle school students enrolled in a 20-week daily physical education program with a focus on fitness as well as motor skill development showed significant improvements in body composition, flexibility, and muscular strength/endurance. Measures of cardiorespiratory endurance, however, declined during the Fall term, but showed improvement during the Spring term. The authors noted that although statistically significant, the magnitude of the improvements in the various measures were quite small. However, a major weakness of the study was the lack of a control group or comparison group in the one-group, pretest-posttest research design. In an earlier study, Ignico (1994) concluded that upper elementary students participating in daily physical education received sufficient physical activity to achieve desirable fitness levels. Yet, this study also did not use a comparison group, thus making causal inferences questionable. It is impossible to conclude with much confidence that the changes observed in each of the previously mentioned studies were related to the daily physical education program.

In a retrospective study of adults about 20 years after completing their primary school education, Trudeau, Laurencelle, Tremblay, Rajic, and Shephard (1998) found that daily physical education at the primary school level had a long-term positive effect on the exercise habits of women, but not for men. This study was based on the recall of adult participants in the Trois-Rivieres longitudinal study on growth and development. During their 6-year primary school education, children in the experimental group participated in daily physical education (five hours) each week taught by a physical education specialist, while children in the control group received the standard physical education program taught in the Province of Quebec (40 min/week, supervised by the homeroom teacher). Although the original study was well-controlled, it is difficult to say with certainty that the effects observed are due to the fact that physical education was provided daily; it is possible that the qualifications of the teachers may have influenced the outcome. The study is also subject to possible recall bias in the completion of the questionnaire.

Although the results of the present study cast doubt on the added value of daily physical education in the development of physical fitness, the national physical education standards (NASPE, 2004) identify other important outcomes of school physical education class, namely motor skill development, affective behaviors, knowledge and understanding, among others. These outcomes were not considered in the present study. It would be inappropriate to conclude that daily physical education does not provide meaningful benefits to participating students, yet based on this study, daily physical education does not appear to be particularly advantageous in the development of physical fitness. Although it is somewhat surprising that daily physical education was no better in the development of physical fitness than classes meeting less frequently, it is important to acknowledge that the amount of time a student spends in physical education class each day may not be of sufficient duration to elicit gains in physical fitness. This is particularly true when one considers that few, if any, physical education programs are devoted merely to the development of physical fitness. Compromise is necessary in terms of coverage in the curriculum and class time is committed to other important outcomes (Thomas, 2004). With all the things for which physical education teachers are responsible in a daily lesson, there is likely not enough time for developing physical fitness. Clearly, even though students attend physical education class daily, the dosage of activity required to bring about improvement in physical fitness may not be sufficient. Although physical education class is a primary setting for developing activity patterns that enable youth to sustain a regular exercise program, thus increasing the likelihood of becoming physically fit, in our opinion it is inappropriate that the time allocated for physical education be focused exclusively on the development of physical fitness.

There are several substantial limitations of the study that should be considered. A major limitation of the present study is the variation in the physical education curriculum from one school to another. There was no attempt to standardize the curriculum or class content across schools and it was beyond the scope of the study to investigate the specific impact that the existing curriculum may have on the fitness levels of enrolled students. It is possible that some physical education programs may have emphasized physical fitness more than others. Furthermore, the quality of instruction, availability of resources, and resultant teaching effectiveness may have varied from school to school. All participating schools used certified physical education teachers to deliver their program, although some schools in the study sample employed award-winning physical education teachers, while others did not. Although the specific influence of the teacher is unknown, it is certainly possible that the quality of instruction may have played a role as well. Even though the length of class period varied slightly among schools, it is doubtful that 2 minutes or even 5 minutes variation in class length represents a meaningful difference in explaining the findings of the study. As previously noted, some of the findings seem illogical and are probably best explained as sampling error.

In summary, based on the results of the present study, it would be inappropriate to advocate for daily physical education on the basis that student fitness levels would be improved. It does appear, however, that students attending physical education classes meeting two days a week or less are slightly less fit than those attending classes more frequently. Clearly more research is needed to investigate the effect of frequency of class meetings on valued outcomes of physical education, including physical fitness. Unquestioned emphasis on "daily" physical education without considering program quality may be a misplaced emphasis!

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