

# Impact of Promoting Lifestyle Activity for Youth (PLAY) on Children's Physical Activity

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**ABSTRACT:** *This study examined effects of a school-based intervention called PLAY (Promoting Lifestyle Activity for Youth) on physical activity levels and body mass index (BMI) of students. Participants included 606 fourth-grade students selected from a stratified sample of 35 schools in Arizona and placed into four groups: PLAY & PE, PLAY Only, PE Only, and No Treatment. A treatment-control, post-measurement design assessed physical activity using the YAMAX pedometer, and height and weight data were collected following the intervention. One-way ANOVAs were used to analyze the data. Results indicated the treatment was effective at increasing the physical activity level of children, especially girls. No significant differences between groups were found for BMI. Programs such as PLAY, which can increase the activity level of children, may have significant health implications for youth. (J Sch Health. 2003;73(8):317-321)*

Promoting physical activity for children has received considerable attention during the past decade. During childhood, physical and psychological health are related to participation in regular physical activity.<sup>1</sup> In addition, physical activity and physical inactivity track from childhood to adulthood.<sup>2,3</sup> The tracking of physical activity has strong implications, given the documented health benefits of regular physical activity for adults.<sup>4</sup> Many skills adults use to become physically active are learned while engaging in physical activity during childhood.<sup>5</sup> Obesity among American youth also has become a national concern. Physical activity has been recommended as an important component in combating the increasing prevalence of obesity.<sup>6</sup> Because evidence continues to mount regarding benefits of physical activity for children, promoting physical activity has become a national health priority.

The focus on youth physical activity has led to the creation of physical activity guidelines and recommendations specific to adolescents, children, and infants.<sup>1,5,7,8</sup> The revised NASPE guidelines for youth, aged 5-12 years, recommend that children accumulate 60 or more minutes of developmentally appropriate physical activity on all or most days of the week.<sup>5</sup> The NASPE guidelines recommend that children participate in a variety of activities and avoid extended periods of inactivity. Other sources suggest girls should accumulate 11,000 steps per day and boys accumulate 13,000 steps per day.<sup>8</sup> Such recommendations provide practitioners and researchers with a goal to work toward when developing activity interventions.

Researchers and practitioners also offer recommendations for developing physical activity interventions. Because most students attend school, schools should accept some responsibility for promoting physical activity in children, including time for structured play during the school day beyond recess time.<sup>9,10</sup> Other research recommends interventions make physical activity enjoyable and attrac-

tive to students.<sup>11</sup>

Some research suggests interventions can increase the physical activity level of children.<sup>12</sup> Stone et al<sup>13</sup> reviewed 22 school-based studies that examined effects of physical activity interventions on children and young adults. Improvements in knowledge and attitudes related to physical activity were reported in these studies; however, little evidence suggested physical activity levels increased because of the interventions. However, most of these studies used subjective measures (personal recall) of physical activity.

Ernst and Pangrazi<sup>14</sup> examined the effectiveness of an intervention to promote youth physical activity in Arizona. This program, Promoting Lifestyle Activity in Youth (PLAY), used a self-report instrument to assess physical activity. The Physical Activity Questionnaire for Older Children (PAQ-C) was used to assess the influence of PLAY on the physical activity level of children. Results indicated groups participating in PLAY significantly increased their physical activity level, while control groups reported no significant increase in physical activity level. Mixed findings from these studies suggest a need for further examination of the effectiveness of physical activity interventions.

This study involved evaluation of the PLAY program using an objective measure of physical activity, the pedometer, a device that measures vertical movement as steps or counts. Using pedometers to assess physical activity level has been validated and widely used as a research tool.<sup>15,16</sup> Sequeira et al<sup>17</sup> found the pedometer a more practical, less biased, measure of physical activity than questionnaires such as PAQ-C. Therefore, this study examined effects of the PLAY intervention on student physical activity level defined as total step counts, and on body mass index (BMI).

## METHODS

### The PLAY Philosophy

The PLAY program, implemented by the Arizona Department of Health Services, promotes moderate to vigorous physical activity for children in grades four to six. This process-oriented program shifts the focus from fitness and toward regular participation in daily physical activity. Implemented in 1996, PLAY meets many of the Arizona Department of Education's Comprehensive School

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Education Standards. Since its inception, more than 24,000 students have participated in PLAY each year. The intervention seeks to teach children active lifestyle habits and encourage them to accumulate 30-60 minutes of moderate to vigorous physical activity daily. PLAY requires a 15-minute activity break during the school day to teach youth a variety of physical activities. Participation also involves self-monitoring by students to develop awareness of the amount of activity they perform each day. In general, PLAY was designed to promote the attitudes and behaviors necessary to participate in a lifetime of physical activity.

Prior to implementing the intervention, teachers received training from county health coordinators who facilitate PLAY. Training included information regarding the PLAY philosophy, implementing the intervention, and teaching students in an active setting. Proper implementation included teaching students to self-monitor physical activity using daily activity logs provided by PLAY. In addition, teachers were trained to avoid false motivators such as incentives and public display of physical activity behavior. County health coordinators visited schools regularly to monitor the intervention and answer questions.

PLAY can be implemented in any school setting. The intervention focuses on physical activity and does not teach physical skills; it is not intended to replace a comprehensive physical education (PE) program. However, PLAY can provide an important supplement to a daily PE program. The intervention places responsibility for physical activity on the classroom teacher, who becomes a model for helping children develop active lifestyles. By implementing PLAY, schools choose to become more involved in meeting Arizona health objectives, especially those related to physical activity.

PLAY places responsibility for meeting physical activity recommendations on the students, thus teaching them useful self-management skills at an early age. PLAY encourages children to select physical activities they enjoy most, so students are encouraged to participate in activities that meet their individual needs and interests.

## Participants

A total of 35 Arizona schools participated. Schools were stratified into four groups based on their participation in PLAY and/or the existence of a PE program (Table 1). Schools were selected randomly within each group with one exception, the No Treatment group. Because the total number of schools without a PE or PLAY program was limited, all schools in the No Treatment group were selected. Selected schools then were asked to participate. Thirty-seven schools accepted and one school declined to participate.

Participants included 606 fourth-grade students (315 girls, 291 boys) and their teachers. Mean age for boys as well as for girls was 9.8 years (SD = .6). The study was limited to fourth graders to ensure that participants had no previous exposure to PLAY. The intervention and data collection occurred in spring 2002. Informed consent letters were signed by all parents/guardians of participants, and each participant signed an informed assent form as recommended by the Institutional Review Board.

## Instruments

Data were collected using two measures: pedometer step counts and BMI. Student physical activity level was

assessed within four weeks after conclusion of the intervention. Height and weight of each student was recorded during the week of physical activity data collection and used to calculate BMI.

**Physical Activity.** Student physical activity level was assessed using a Yamax pedometer (Tokyo, Japan, MLS-2000). Numerous studies have shown this tool as accurate and reliable with adults as well as children.<sup>15,16,18,19</sup> When compared to heart rate monitors and several accelerometers, pedometers report less measurement error.<sup>15</sup> Kilanowski et al<sup>16</sup> found that, when used with children, the pedometer correlates highly both to direct observation and to accelerometry.

**Body Mass Index (BMI).** BMI assesses weight relative to height and provides an easy method for evaluating a large number of participants. Calculated as [(Weight in Pounds/Height in Inches<sup>2</sup>)\*703], BMI was used to determine international cut points for children who will pass through a BMI of 25 and 30 at age<sup>18,20</sup>

## Research Design

A treatment-control, post-measurement design was used. Table 1 presents the study design and number of participants in each group. BMI data were not available for seven students, so the number of students with physical activity data and number of students with BMI data differ. Because PE promotes physical activity, it was used as an independent variable. Although the quality of PE programs at study schools was not assessed, the potential influence of PE on physical activity level and BMI could not be disregarded.

Students in the PLAY & PE and PLAY Only groups participated in PLAY, a 12-week intervention implemented during the school day. PLAY was facilitated by classroom teachers and provided children with 15 minutes of daily physical activity. It was implemented in three steps.

**Step 1: Promote Play Behavior.** This phase was implemented over a one-week period. Teachers discussed the

Table 1  
Study Design

PLAY & PE	PE Only
10 schools	10 schools
<i>Physical Activity Data</i>	<i>Physical Activity Data</i>
185 students	178 students
(91 girls, 94 boys)	(93 girls, 85 boys)
<i>BMI Data</i>	<i>BMI Data</i>
183 students	175 students
(89 girls, 94 boys)	(90 girls, 85 boys)
PLAY Only	No Treatment
9 schools	6 schools
<i>Physical Activity Data</i>	<i>Physical Activity Data</i>
150 students	93 students
(75 girls, 75 boys)	(56 girls, 37 boys)
<i>BMI Data</i>	<i>BMI Data</i>
150 students	91 students
(75 girls, 75 boys)	(54 girls, 37 boys)

importance of physical activity and PLAY procedures with the class. Students and teachers participated in 15 minutes of activity each school day. This step was guided by the following: a) the teacher's role was to prompt students to move. Walking was the minimum level of activity expected. Standing and sitting were discouraged. For example, waiting in line during a game was acceptable, but sitting and visiting with friends was unacceptable. b) Children chose a pace that was comfortable for them. "Pushing" children to a more rigorous pace was neither required nor expected. c) The importance of physical activity was discussed frequently. Teachers were instructed to show they cared (by being physically active, if possible) about students being physically active. Teachers were reminded that, when children see a significant adult valuing physical activity, it may affect their physical activity level.<sup>14</sup>

**Step 2: Introduce Teacher-Directed Activities.** This phase was implemented for three weeks. Students and teacher continued to participate in 15 minutes of daily activity. However, in this step, the teacher introduced a variety of games and activities. All teachers taught the same games on the same days. For example, on day one, "exercise tag" was taught. On day two, the game was "medic tag." A total of 15 activities was taught. Teachers received teaching cards with an explanation of the game and teaching tips. This step exposed students to a variety of enjoyable games and activities that could be played outside of school with minimal equipment.

**Step 3: Encourage Self-Directed Activity.** This phase was implemented for eight weeks. It encouraged students to become self-directed in achieving 30 minutes or more of daily physical activity independent of the teacher. Types of activities available to students outside of school were discussed by the class. During this eight-week period, students recorded their activity on their PLAY log sheet. Participants were encouraged to spend at least 30 minutes a day (outside of school) in activity, be active at least five days per week, and record their daily activity. At the beginning of each school day, students were asked by the classroom teacher to record their previous day's activities. The step sought to teach children to assume responsibility for developing regular physical activity habits.

Students in the No Treatment and PE Only groups did not participate in PLAY. To ensure that all participants received equal attention, and that they monitored some type of behavior these participants recorded "things I do after school" for eight weeks. These participants were given a sheet similar to the groups involved in PLAY, with the only exception that all activities were recorded, including sedentary activities. Examples of "things I do after school" included watching TV, walking a dog, playing with friends, and reading. Teachers instructed students to record their previous day's activities (both active and sedentary) each morning (similar to the PLAY students).

## PROCEDURES

Before implementing the intervention, all county health department physical activity program coordinators (coordinators) received training about PLAY and how to teach the activities. Teachers and coordinators received guidelines regarding implementation of PLAY and the protocol for groups not in PLAY. Coordinators also were trained to collect pedometer data and appropriately seal the pedome-

ters. Teachers then were trained by coordinators to implement the intervention and to teach all 15 activities and games. Materials for both PLAY and the groups not in PLAY were distributed to schools prior to implementation.

Due to a limited number of pedometers, data collection was completed over a three-week period after the last day of intervention. To eliminate the impact of the 15-minute activity break on activity level, teachers were instructed to discontinue the activity periods at the conclusion of PLAY. Participants wore sealed pedometers for four consecutive weekdays. Pedometers were sealed using a cable tie to prevent inadvertent resetting, then attached to the waistband or belt. If no waistband or belt was available, a small belt was provided. Children were instructed to engage in normal activities. Prior to the study, children were oriented to pedometers and allowed to explore how they worked.

On the morning of the first day of data collection, participants were given a sealed pedometer with a number. Children were instructed to wear the pedometer all day (with the exception of swimming or baths) and to take the pedometer off before going to bed. When getting dressed in the morning, the pedometer was put back on and worn to school. A trained researcher then unsealed the pedometers, recorded step counts, resealed the pedometers, and returned them to the classroom within an hour. This process was repeated at the same time each day to ensure a 23-hour count.

After turning in the pedometers, students completed brief surveys to: a) establish that children were wearing pedometers, and b) determine the type of physical activities the children participated in the previous day. During the week of data collection, these surveys were used to check student adherence to the protocol and to monitor missing or unusual data. Data more than 6,000 steps different from the mean of previous days were deemed unusual. This number was based on previous research which found standard deviations of approximately 3,000 DSC in children of the same age.<sup>21</sup> If the data were unusual or missing, researchers used the survey and questioned the child to determine causes (ie, rode a horse, took the pedometer off after school) for variability in the data.

During the week of physical activity data collection, student height and weight were assessed using a standardized protocol. Prior to data collection, each scale was calibrated for accuracy and a tape measure was fastened to the wall. To ensure accuracy, a yardstick also was used to double-check the tape placement. Students were instructed to remove their shoes and "stand tall" in front of the tape measurer with their heels against the wall.

Mean and standard deviations were calculated by group and gender, for steps and BMI values. Students missing more than two days of data were eliminated from the analysis as follows: No PLAY, No PE (3%), PLAY, No PE (1%), No PLAY, PE (6%), and PLAY, PE (2%). Reported step counts represent mean daily step counts. BMI values were calculated using the formula presented previously. One-way ANOVAs with a .05 level of significance were employed using Tukey post hoc procedures for follow-up analysis as necessary.

## RESULTS

Table 2 contains mean and standard deviation values for pedometer steps and BMI by group and gender. Values for steps are higher than those reported in another study using a



similar population.<sup>21</sup> Results showed boys higher than girls in steps and lower in BMI values. Similarly, groups participating in PLAY (PLAY & PE, and PLAY Only) accumulated more steps and recorded lower BMI values.

One-way analysis of variance (ANOVA) was conducted to evaluate the relationship between the groups and steps and BMI. The group factor included four levels: PLAY & PE, PLAY Only, PE Only, and No Treatment. The ANOVA was significant [ $F(2, 605) = 3.552, p = .014$ ]. Tukey post

hoc tests revealed significant differences in favor of the PLAY groups between the No Treatment and PLAY & PE groups and between the No Treatment and PLAY Only groups. When groups were analyzed by gender, one-way ANOVAs showed significant differences for girls [ $F(3, 314) = 5.36, p < .001$ ]. Follow-up analyses using Tukey's post hoc tests indicated significant step mean differences for No Treatment and PLAY & PE groups and for No Treatment and PE groups. Table 3 contains the significant differences by group for step counts.

Differences in BMI by group were examined using a one-way ANOVA with BMI as the dependent variable and group as the independent variable. No significant differences were found.

## DISCUSSION

This study evaluated effectiveness of the PLAY intervention in promoting lifestyle physical activity, and examined the influence of different physical activity levels on BMI. Findings provide insight into the usefulness of physical activity interventions such as PLAY.

Results indicated the treatment was effective at increasing the physical activity level of children, especially girls. These findings have interesting implications, particularly for increasing the physical activity level of girls. Girls in the PE & PLAY and PE Only groups scored significantly higher in physical activity than girls in the No Treatment group. Though not significant, girls in the PLAY Only group demonstrated higher physical activity levels than girls in the No Treatment group. The most active girls had both PE and PLAY. In fourth grade at least, girls benefited from having both experiences.

No significant differences in steps were observed for boys across treatment groups. Descriptive statistics showed boys in all groups near or above 13,000 steps per day on average. In a descriptive study with no intervention, Vincent and Pangrazi<sup>21</sup> used a similar data collection protocol as used in this study. They found 10-year-old boys took

Table 2  
Means and Standard Deviations by Groups

	Steps		BMI	
	Mean	Standard Deviation	Mean	Standard Deviation
<b>PLAY &amp; PE</b>				
Girls	12,222	3,665.1	18.64	4.03
Boys	13,287	3,937.0	19.12	4.27
All	12,763	3,832.7	18.89	4.15
<b>PLAY ONLY</b>				
Girls	11,429	3,295.8	18.74	4.25
Boys	13,758	4,364.5	18.76	3.26
All	12,598	4,026.0	18.76	3.78
<b>PE ONLY</b>				
Girls	11,899	3,562.3	19.59	4.31
Boys	12,951	4,223.4	19.10	4.64
All	12,401	3,919.5	19.35	4.47
<b>No Treatment</b>				
Girls	9,945	3,416.2	20.35	5.51
Boys	13,050	4,756.0	19.30	4.02
All	11,180	4,261.9	19.92	4.96

Table 3  
Significant Differences for Step Counts Between Groups

Group	Mean	Standard Deviation	Mean Difference	Significance
<b>All Students</b>				
PLAY & PE	12,763	3,833	1,583	.010 <sup>2</sup>
No Treatment	11,180	4,262		
PLAY Only	12,598	4,026	1,418	.035 <sup>1</sup>
No Treatment	11,180	4,262		
<b>Girls</b>				
PLAY & PE	12,222	3,665	2,277	.001 <sup>3</sup>
No Treatment	9,945	3,416		
PE Only	11,899	3,562	1,954	.006 <sup>2</sup>
No Treatment	9,945	3,416		

<sup>1</sup>  $p < .05$ ; <sup>2</sup>  $p < .01$ ; <sup>3</sup>  $p < .001$

an average of 12,546 steps per day, 500 steps less than the average for the No Treatment group in this study, suggesting that randomly selected boys in this study already were highly active (or unknowingly motivated) prior to the intervention. The lives of elementary-aged children are highly structured with little time for physical activity, particularly during school. Given the relatively high physical activity levels of boys, much of their discretionary time may already be spent in a physically active manner. Thus, there may not be enough time in a typical day to be more active. For this reason, the effect of PLAY on boys may not be as large as for girls, who are less active as a group.

BMI data showed no significant differences between groups, likely due to the relatively brief length of the intervention. Some effective interventions for obese children lasted longer.<sup>6,22</sup> PLAY is intended for use through grades four to six, so conducting the intervention over a number of years might affect weight management. Again, only fourth graders participated in this study to ensure all participants had no previous exposure to PLAY.

Findings from this study suggest interventions such as PLAY potentially can increase the physical activity level of children. School health programs, by implementing a simple 15-minute activity break that emphasizes physical activity and encouraging students to monitor their own physical activity, can positively influence the health of students. ■

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