

The Impact of Classroom Activity Breaks on the School-Day Physical Activity of Rural Children

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ABSTRACT

International Journal of Exercise Science 6(2) : 134-143, 2013. Schools have been identified as a central element in a system that ensures that children participate in enough physical activity to develop healthy lifestyles. Even with this recommendation, many school-based physical activity opportunities are being eliminated/minimized (i.e. physical education (PE), recess). With children spending much of their time at school, other supplemental physical activity opportunities are essential. One such opportunity is through classroom teacher led activity breaks. Very little evidence exists identifying the impact of classroom activity breaks on the daily physical activity patterns of children. Therefore, the purpose of this paper was to determine the impact of classroom teacher led activity breaks on the step counts and moderate-to-vigorous physical activity (MVPA) of 4th grade children at school. Participants in this pilot study included a 4th grade class (N=18; aged 9.2±.4 years; mostly Caucasian (n=14); BMI=19.9±2.8) in a rural school district in the Northeast US. Children wore the NL-1000 piezoelectric pedometer for 2-weeks (a baseline week and an activity break week) during the winter of 2012. Activity breaks were created by the teacher/students to give them ownership in the program (activities included numerous classroom games and walking activities). At baseline, children averaged 4806±639 steps and 17.7±2.8 minutes of MVPA/day. During implementation of the physical activity breaks, children significantly increased both their steps (p<.01; 5651±627; Δ=845) and MVPA (p<.01; 22.3±3.5; Δ=4.6 minutes). Findings suggest that classroom activity breaks have the potential to increase children's daily physical activity patterns at school. Future studies are needed with a larger and more diverse population to support these findings.

KEY WORDS: Pedometer, youth, physical education, accelerometer, school, health

INTRODUCTION

Physical activity has been identified by many researchers as an important component of a healthy lifestyle with both short-term and long-term benefits. The United States Department of Health and Human Services [USDHHS] (26) has

reported that all persons, no matter age or gender, can benefit from moderate and regular physical activity. Typically, children are more active than adults. However, many children are still not getting an adequate amount of activity time (22). It is important for children to participate in regular physical activity

because it contributes significantly to their physical (13) and psychological (19) development while also developing a habit that if carried into and throughout adulthood will help them maintain health and wellness. Recent studies have also shown that physical activity improves cognitive function and alertness (6) which is especially beneficial to children, who are trying to perform well academically.

Experts have begun to explore physical activity as a way to improve classroom performance (6). Studies that look at physical activity in the classroom often find that students demonstrate increased alertness, attentiveness, and willingness to learn after participating in physical activity. Physiologically, there is evidence that suggests physical activity may impact arousal through neurohormonal mechanisms, potentially improving attention in the classroom (23). Teachers from the Southwest US (8) reported that physical activity in the classroom gave students something to be excited about, and students who didn't always participate in class activities enjoyed it. Teachers said it helped give the students something to look forward to when they were bored or anxious working on other academic subjects. Many teachers saw a distinct increase in attentiveness after physical activity, and used it to wake students up or take a break to refresh the students for more reading and math (8). The Take 10! Program (14) has also had success in minimizing off-task and inattentive behaviors.

There currently exists a contradiction in society - more people are looking to physical activity as a means of improving health, but participation in PE is decreasing

(23). The Centers for Disease Control and Prevention [CDC] (5) recommends that children get at least 60 minutes of physical activity each day. However, only 4% of elementary schools, 8% of middle schools, and 2% of high schools required daily PE in 2006. Beyond PE, students are not getting much physical activity. Only 57% of elementary schools require daily recess, another opportunity for activity. Fewer schools provide the opportunity for physical activity breaks within the classroom, as just 16% of elementary schools, 10% of middle schools, and 4% of high schools implemented this opportunity (5). Clearly, schools are not providing enough physical activity opportunities.

With the CDC recommending that children get 60 minutes per day of physical activity, we must consider where this can and should occur. The USDHHS (26) reports that schools should make serious efforts to provide daily PE to students at every grade level. The American Heart Association [AHA] identifies schools as a "central element in a community system that ensures that students participate in enough physical activity to develop healthy lifestyles" (22). Even with this advice, school districts are not complying. PE programs are being cut and most aren't offered daily, so children do not get 60 minutes each day through PE (21). With the emphasis on standardized testing, many physical activity opportunities are getting cut, and "only 8 % of elementary schools provide daily or the weekly equivalent of 150 minutes of physical activity" (24). In combination with quality PE programs, integrating movement activities into classroom lessons can help students increase their daily activity levels (21). Kibbie and colleagues (14) noted that

schools provide the opportunity to reach a large number of students through numerous avenues, including PE, recess, classroom physical activity, and activities before and after school.

Several studies have begun to implement and objectively evaluate the impact of externally created classroom activity programs on the activity patterns of children. The length and frequency of physical activity varied with each program. For example, the Promoting Lifetime Activity for Youth (PLAY) program included four weeks of teacher led 15 minute activity breaks followed by 8 weeks of regular encouragement for students to accumulate 30 minutes of activity at least 5 days per week and daily record keeping of their physical activity (20). Researchers found that students in the PLAY program averaged noticeably more steps (12,598-12,763) than their counterparts in the no treatment group (11,180).

Liu and colleagues (15) looked at the Happy 10 program, where Chinese students in grades 1-5 participated in a 10 minute physical activity session at least once each day. The energy expenditure and physical activity time of students participating in Happy 10 increased, while the expenditures and physical activity of students in the control group decreased. The students in the Happy 10 group expended 15.0 kcal kg⁻¹ each day before the intervention and 18.2 kcal kg⁻¹ during the intervention. Similarly, physical activity time increased from 2.8 to 3.3 hours in the intervention group.

Similarly, in 2004, Stewart and colleagues (24) looked at the intensity of the exercise and energy expenditure resulting from

participation in Take 10!; a program that is designed to implement 10 minutes of structured activity periodically during the school day. Children averaged 743-1022 steps and 25-37 kilocalories burned during the program activities each day. Exercise intensity remained at similar levels at each grade level, around 6 METs. The study surmised that with increased energy expenditure through the Take 10! program, students will increase their kilocalorie burn totals a small amount each day, summing to a solid weekly amount, which may lower their risk of obesity and help meet daily activity recommendations (24).

A New Jersey study (7) looked at activity breaks through Fit Bits, a 6 week program developed to provide classroom (grades 4-6) teachers with 10-15 minute activity breaks that also involved learning, often about health and nutritional concepts. The study showed a minor increase in average overall steps by all participating students, but the largest improvement was seen in the 4th graders, who increased their weekly average from 19,482 to 26,057. The steps of 5th graders increased less drastically, from 17,255 to 18,086, while 6th graders actually decreased their step count from 21,453 to 19,825 (7).

Most recently, the Physical Activity across Curriculum [PAAC] (10) program which involved making academic lessons more physically active was evaluated. Results showed significantly higher levels of physical activity in students who participated in the PAAC program than those in the control group. Activity levels of PAAC students were 12% higher on weekdays and 27% more MVPA was experienced. PAAC students reached an average of 800 accelerometer counts/min,

and those in the control group reached 738 per minute (10).

Each of these aforementioned classroom based activity programs has had a positive impact of children's daily activity. However, all of these programs provided the activities for the teachers, allowing for little ownership from teachers and their students. With PE programs, recess and activity time being cut in favor of academic lessons, and many children not getting the physical activity they need to reach and maintain a healthy level of fitness, the purpose of this study was to investigate the impact of classroom physical activity breaks that were designed by the teachers/students on the overall activity levels of children at school. A secondary purpose of the study was to look at physical activity levels in specific groups of students (i.e. BMI Weight Category, Gender) and on different days (i.e. PE and non-PE days).

METHODS

Participants

This pilot study included 21 children (18 had complete data; both baseline and intervention data) from a rural area in Western New York. The community is home to 6,056 people with a median household income of \$35,576 (25). The participant group consisted of 11 boys and 7 girls aged 9.2 ± 4 years of age with 78% of participants identified as Caucasian. School level data indicated that 46% of children were on free or reduced lunch. The average BMI of the participants was 19.9 ± 2.8 . According to the CDC (18) growth charts, eleven students were classified as either overweight or obese. The University Institutional Review Board, school

principal, and classroom teacher approved all procedures. Parents of each student completed a written informed consent form and completed a basic demographic survey. Students also signed a written assent form agreeing to participate in the study.

The teacher and class used in this study were recruited based upon their previous use of activity breaks. The teacher/students had already developed and implemented activity breaks into the classroom, so they were part of their daily routine and familiar to the student participants. Specific activity breaks performed during this study included (but were not limited to) jumping jacks, spelling jacks, walking breaks, and outdoor/classroom games. Activity breaks were generally 10 minutes (ranged from 5-15 minutes) in length and were implemented 1-3 times/day.

Protocol

Instruments: The New Lifestyles NL-1000 (New Lifestyles, Lee Summit, MO) piezoelectric pedometer (sometimes referred to as an accelerometer) was used for this study. The NL-1000 has been demonstrated as an accurate measure of both step count and length of time spent in MVPA in the pediatric population (11).

Data collection: Prior to data collection, the researchers went to the school to provide a pedometer orientation and allow for practice time to wear the instruments. They also measured the weight (SECA digital Scale; Hanover, MD) and height (SECA stadiometer, Hanover, MD) of each student. The weight of the students was measured in kilograms (kg), height in meters (m), and BMI was calculated using the formula kg/m^2 . The participants in the study wore the pedometers during the school day (8:00

AM-3:00 PM) for two separate school weeks (Monday-Friday). The first week served as a baseline (no activity breaks) week. The second week of data collection included classroom physical activity breaks. Both weeks of data collection took place during the winter of 2012 to ensure consistency of weather and activities. During the data collection period, the teacher assisted students in putting on and removing the instruments at the beginning and end of the school day, collecting them in a basket for the overnight period. The NL-1000 has a seven-day memory recall which allowed for data recording to take place at the end of each week, thus minimizing school day interruptions. The researchers were in constant contact with the teacher to ensure compliance and deal with any issues that might arise. Step counts and minutes of MVPA for each participant and each day were recorded. Days on which the students participated in PE class (two days each week) were noted. The data was immediately entered into a Microsoft Excel spreadsheet for further review and analysis.

Statistical Analysis

The data were analyzed using both the Excel spreadsheet and SPSS 19.0 (IBM, Armonk, NY) statistical software. Means and standard deviations for steps and MVPA time, both individually and class-wide were calculated. T-tests and ANOVA's were utilized to examine differences (by gender and BMI categories) in the number of steps and the length of time spent in MVPA between weeks (baseline and during-implementation of activity breaks). Step counts and MVPA time on PE days and on non-PE days were also examined.

RESULTS

At baseline, students averaged 4806 ± 639 steps and 17.7 ± 2.8 minutes of MVPA each day. During the intervention, students increased both of these, taking an average of 5651 ± 627 ; $\Delta = +845$ steps each day with 22.3 ± 3.5 ; $\Delta = +4.6$ minutes of MVPA. The t test results found that the increases seen in both variables were significant (steps; $t(16) = -7.7$, $p < .01$; MVPA; $t(16) = -6.7$, $p < .01$).

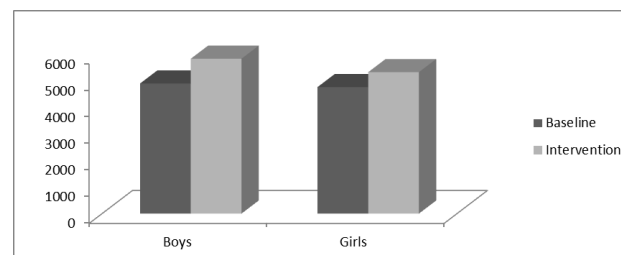


Figure 1. Step counts at baseline and intervention by gender.

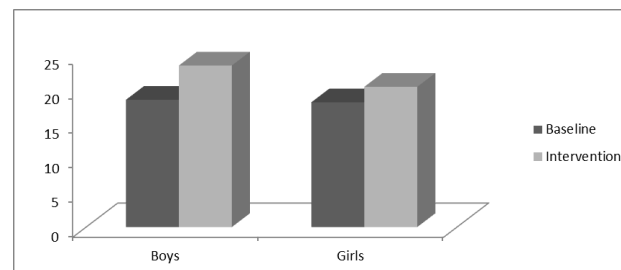


Figure 2. MVPA at baseline and during intervention by gender.

Figure 1 illustrates the step counts of boys and girls at baseline and during intervention and Figure 2 shows their time spent in MVPA each week. While the boys were slightly more active, a separate t test showed no significant difference in step counts or MVPA between genders. Boys, however, had a slightly sharper increase from baseline to intervention in both steps and MVPA time than girls. Boys increased their steps by $\Delta = +924$ steps and their MVPA by $\Delta = +5.0$ minutes. The girls

increased their step count by $\Delta = +562$, and MVPA by $\Delta = +2.2$.

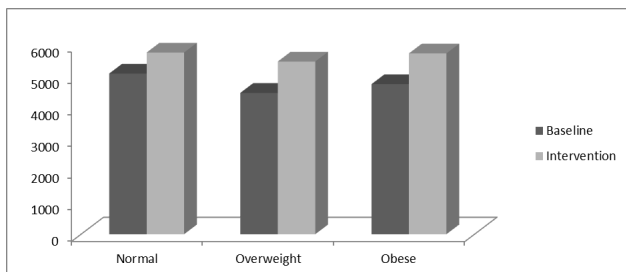


Figure 3. Steps at baseline and during intervention by BMI category.

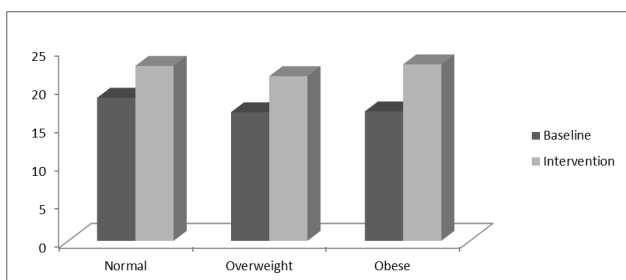


Figure 4. MVPA at baseline and during intervention by BMI category.

Figures 3 and 4 illustrate how students of different BMI categories were impacted by the intervention, in both step counts and MVPA time, respectively. Analyses indicated that all three weight groups increased their step counts and MVPA. Normal weight children increased their steps by 668 and MVPA by 4.2 minutes, overweight children increased their steps and MVPA by 995 and 4.7 minutes, respectively. Obese children had the greatest increase with their steps increasing by 997 and MVPA by 6.2 minutes. ANOVA tests revealed that the difference in steps and MVPA time among students of different BMI categories was not significant. A secondary finding of the study revealed a significantly higher amount of physical activity on PE class days than non-PE days. Across both weeks students averaged 4631 ± 632 steps and 17.5 ± 3.1 minutes of time spent in MVPA on non-PE days. These

numbers both increased on PE days. Students averaged 6158 ± 685 steps and 24.2 ± 3.4 minutes of MVPA time on those days, increases of $\Delta = +1527$ steps and $\Delta = +6.7$ minutes. Through t tests, the increases in these two physical activity measurements were both significant ($t(17) = 10.2$; $p < .01$; steps; $t(17) = 9.9$; $p < .01$; MVPA).

DISCUSSION

The significant increase in physical activity from baseline to the intervention shows that classroom activity breaks can have a positive impact on the total physical activity levels of children at school. The classroom teacher was able to increase the school day physical activity of boys by 19% and girls by 12%, contributing an extra 5 minutes to their daily MVPA. This significant increase seen in a small sample size showed that it is possible to increase the physical activity of children with classroom activity breaks.

This finding promotes the idea that when classroom teachers commit to having a role in the daily activity patterns of children, their influence has great potential. Recently, society has become more focused on fighting the obesity epidemic, and there have been several programs designed to get kids more active (such as “Let’s Move in School” and “NFL Play 60”). Changing the physical activity patterns of students by creating opportunities in the classroom is a relatively new target area. Classroom teachers are often only focused on teaching their students the academic knowledge they need to pass state tests, and may feel they do not have time for activity breaks. Previous research has demonstrated the positive influence of classroom activity on behavior and attentiveness (6, 8, 23). The

activity breaks utilized in this study were short in time (5-15 minutes), and were effective in increasing student physical activity levels. If research done on a larger scale finds similar results, classroom teachers can be confident knowing that they can increase the physical activity levels of their students, even in a short period of time each day while also helping with classroom behavior and alertness.

Gender Differences

In this study, children living in rural Western New York averaged 4,902 (boys) and 4,773 (girls) steps/day prior to the intervention. Boys accumulated an average of 5,826 steps and girls 5,335 during the intervention. The boys and girls in this study during the intervention averaged a greater number of steps when compared to other US children. For example Southwest US children accumulated between 3,800-5,042 and 2,900-4,124 steps/day for boys and girls, respectively (3, 17). In Kentucky (1), elementary aged boys, took an average of 3,995 steps per day and girls 2,976 steps. American Indian children in the Southwest US averaged between 4,237-4,779 (boys) steps and 4,027-4,042 (girls) (2, 12). When compared with international students, the students in this study were less active. For example children in Cyprus (16) and New Zealand (9) accumulated between 6,779-7,594 (boys) and 5,078-6,070 (girls) steps each day at school. Although the current sample lags behind international children, it is promising that with the activity breaks, the current sample of children accumulated more physical activity than other age- and gender-matched US children.

In most studies (i.e. 1, 3), the results have shown that boys were significantly more active than girls, including during the

school day. Although not significant the current study showed boys to be slightly more active than girls. The boys also saw a greater increase between baseline and intervention, and although this was not significant, it shows that generally speaking the intervention had a greater impact on boys than it had on girls. If similar findings are replicated in a larger study, researchers could examine how different types of activity breaks impact the physical activity levels of boys and girls, and search for a way to allow girls to be as active as boys through these activity breaks.

The difference in results across BMI categories was not significant, although there were some notable findings. Previous research that has examined the physical activity levels among children with different BMI levels suggests that obese children accumulate the least amount of activity, followed by the overweight children. Children in the normal range often accumulate the most physical activity each day (3, 4).

In this study, the obese students saw the greatest increase in their step counts and MVPA. This result suggests that the obese students were most impacted by the classroom physical activity breaks, which is important because they are often the most in need of extra physical activity. All children were encouraged to participate in the activity breaks and the activities did not allow for more athletic or more competitive children to dominate/take over as the activities allowed for all students to be active casually and socially. Traditionally, in PE and recess, the normal weight children will have greater physical activity levels (3). The fact that the obese and overweight children saw the greatest

increases is of great importance and another reason why appropriate classroom teacher led activity may be important. All students need physical activity, but the obese and overweight students typically need the extra activity the most. It is important that activity breaks in the classroom succeed in providing all students extra physical activity, not just the normal weight students. Classroom physical activity breaks are usually non-competitive and individually-based in nature, so they may provide equal opportunity for all students.

This study also considered the difference in physical activity on PE days and on non-PE days. Several other studies have found PE to effectively increase step accumulation in boys and girls. In the Southwest US boys took 1,409 more steps and girls took 1,011 extra steps on PE days (4). Children in a recent study (2) found that PE contributed nearly 25% of the daily physical activity of a high risk population of children.

These numbers are similar to the numbers found in this current study, where students accumulated an additional 1,527 steps on PE days, as well as an extra 6.7 minutes of MVPA, both of which were significant increases. These increases were also greater than those seen as a result of the classroom activity breaks. These results reveal that PE remains an important part of increasing the physical activity levels of children. The activity breaks provided were effective, but did not replace the extra steps and MVPA time students received during PE. Regardless of which school based physical activity programming is implemented, it should include and be centered on a sound and developmentally appropriate PE program. Most classroom activity break

programs are designed to get kids moving, but not to teach them how to move and the importance of physical activity. PE is designed to do both of these things in addition to providing physical activity opportunities for students. Further research in this area could also be used to advocate for daily PE in schools, as opposed to one or two days per week or not at all. While small, this study shows that PE is not replaced by activity breaks and that it is an important component of the school curriculum.

There were several limitations to this study. First, it was a pilot study with a small participant pool. The study began with 21 students and ended with 18. While we can learn from the results of this study, similar research must be done on a larger scale before generalizations can be made about the results. The study was also done at one school, in one area of the U.S., in one classroom. Performing a similar study in a wider variety of schools and regions would provide data that can be used to make general conclusions about the impact of classroom physical activity on overall physical activity across the country. Lastly, utilizing BMI has its limitations; we believe future work using more representative measures of body fat percentage (i.e. Skin-fold Thickness) may allow for improved conclusions about classroom activity and its impact on the physical activity of overweight/obese children.

This study only examined physical activity before and during the intervention. Future research could include other measurements, including on-task behavior pre/post-activity, academic success post-activity, and the long term impact on childhood obesity. Each of these are areas

of high interest to many in the fields of education and health care as we search for ways to improve academic performance while providing enough physical activity to prevent obesity and develop students into healthy adults.

Researchers could also look in more depth at the specific physical activities performed, and look at which provided the most activity. There are many types of physical activity breaks that can be implemented, such as walking breaks, aerobic exercises, and general movement around the classroom while practicing spelling or math. If researchers paid attention to which ones provide the most physical activity, the effectiveness could be evaluated and those that are most useful could be more widely disseminated. It may also be important to ask the students and/or teachers which activities worked the best in their classroom and which were most enjoyable. Researchers could also look at which activity breaks are most impactful for different groups of students based on gender, ethnicity, or BMI category. This data could be used to ensure that all students in the class are receiving the benefits from the physical activity breaks.

This pilot study provided useful information on the impact of classroom activity breaks on physical activity levels of children at school. Although it was small, it shows promise for classroom physical activity as an effective way to help students increase their physical activity.

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