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Original Research

How Feedback and Goal-Setting Impact Children's Recess Physical Activity

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ABSTRACT

International Journal of Exercise Science 9(4): 497-506, 2016. In recent years, schools desire to promote physical activity (PA) for their students but are restricted due to resources being expended in other areas of their curriculum, including standardized testing preparation. Recess/lunch periods have potential to contribute important amounts of PA to youth's overall levels. Interventions to maximize PA during recess are warranted. The purpose of this study was to demonstrate the impact of feedback and goal-setting on students' PA during recess. A sample of 136 (67 females, 69 males) 4th and 5th grade students in the Southeast United States wore unsealed Walk4Life pedometers during recess for one month. Steps, activity time, participant demographics, and weather were recorded daily. Participants engaged in three conditions during recess: baseline, feedback, and goal-setting. Findings indicated that boys were more active than the girls and the 4th grade participants were more active than the 5th grade participants. Results suggest that the goal setting condition was effective in increasing the percentage of time in PA during an unstructured recess period; however, it did not significantly increase participants' steps per minute levels at recess. Goal-setting with children can be an effective intervention to increase physical activity during recess.

KEY WORDS: elementary, school, research, pedometers

INTRODUCTION

For over a decade, leading public health, medical and educational organizations have publicized youth physical activity (PA) recommendations, indicating that children should accrue a minimum of 60 minutes per day of PA on all or most days of the week (18, 27, 29). While youth are more active than adults, a considerable number of young people are not meeting recommended levels, with a reported 23 percent of children not engaging in any free-time PA (29).

Because of the substantial amount of time youth spend at school, many agencies and organizations are calling upon schools to take stronger leadership roles in the promotion and education of PA among their students (18, 27, 29). Recess, defined as time scheduled outside of class that allows students to engage in physical and social activities of their choice (2), is typically being provided in schools (3, 22). Thus, maximizing student PA during this already provided time, minimizing impact on academic time, is advocated. Generally, a

"free choice" time period, recess provides children with autonomy to be self-directed in their activities and activity levels (20) and has been suggested to foster motivation towards engagement in increased levels of movement (31). Recess's unstructured composition offers children the ability to behave freely in their activities and would serve as an ideal environment to use goal setting to further increase their PA levels (31).

The Institute of Medicine (11) recommends that schools at every level should aim to provide students with at least half the total, or 30 minutes, of PA every school day. On the basis of the literature and as stated by the National Association of Sport and Physical Education (15), school recess should also be provided at least once daily, for 20 minutes. Thus, school officials should attempt for all students to accumulate at least 30 minutes of PA during the school day, with at least 20 minutes of opportunity coming from the recess time. A variety of interventions have been shown to be effective in increasing children's PA during recess (10). The most effective interventions include providing added equipment, painting PA markings on the blacktop, teacher involvement in promoting PA during recess, and a combination of strategies (8). Two strategies which have not been used as interventions to increase PA levels during recess are feedback and goal-setting. One study using feedback as a PA intervention showed children accumulated significantly more school PA when provided with feedback and tips, or knowledge regarding ways to boost activity (5). Results showed that 3rd-6th grade students in the United Kingdom accumulated significantly more school-day steps per minute when given feedback and information on how to increase steps at school. However, this particular strategy has not been measured to determine the impact on PA during recess.

A goal, defined as "that which one wants to accomplish; it concerns a valued, future end state" (12), does not provide instant results (13), nor instantly establishes motivational drive in an individual. Rather, it directs one's attention, effort and action to the outcome-related actions (13).

Feedback is the knowledge one acquires about their personal status of their selected goal and is a significant part of goal-setting (13, 23). With a pedometer, feedback can be described as seeing the number of steps accrued as it is worn. Without feedback, there is no response regarding goal achievement provided, and goal-setting becomes less effective (13, 18, 26). Goal specificity and goal difficulty are important components of goal-setting. Goal specificity is establishing a clear aim or target and motivates a higher performance. This is in contrast to individuals who do not use standards and simply "do their best." Goal difficulty relates to challenging, yet achievable goals. Goals that are too simple lead to boredom, whereas those that are too difficult result in failure or giving up. Three studies with children examined various goal conditions in goal-setting theory, all of which had consistent findings of increased task performance outcomes (7, 14, 32). Goal-setting is effective for increasing behavior performance outcomes and has not yet been used as a means to increase children's PA levels in a recess setting (1).

The purpose of this study was to determine the impact of goal-setting (with specific, challenging, yet attainable goals) on

children's PA steps per minute at recess and percent of time in PA during recess. Given the previous literature on children's behavior and goal-setting, it was hypothesized that participants would achieve more steps per minute and higher percentage of time in PA during recess under the goal-setting condition compared to the baseline and feedback conditions.

METHODS

Participants

Participants were 136 children (*n*=67 girls) from five 4th grade classes and four 5th grade classes at one suburban elementary school in the southeast US. The average age of participants was 9.48 years (SD= 2.51). Makeup was primarily White (83.5%), with 3.6% African American, 2.2% Asian, 2.9% Hispanic, and 5.8% classified as Other (Table 1) and was representative of the school. Height/weight were collected without shoes, using a calibrated scale and stadiometer. BMI was calculated using the CDC percentage calculator for child and teens. Institutional Review Board approval as well as informed parental consent/child assent were obtained prior to data collection. None of the students who agreed to participate had any physical disabilities preventing them from engaging in physical activity at recess.

The school offered regularly scheduled, unstructured recess periods, that allowed children to play freely. All classes of similar grade levels shared the same recess periods. The five 4th grade classes participated in a 20-minute scheduled recess together for an average length of 19.81 minutes (SD=1.68). The four 5th grade classes also participated in a scheduled 20-minute recess as a group for an average length of 14.63 minutes (SD=0.35). The recess periods that were evaluated in this study began immediately after the lunch period. The length of the recess period was quantified as the time students walked outside of the school to the time students walked back inside the school.

Table 1. Participant characteristics.

Variable	N	M	SD	%
Age	136	9.48	2.51	-
Grade				
4th	77	-	-	55.40
5th	62	-	-	44.60
Height (in)	136	55.46	3.00	-
Weight (lbs)	136	81.43	21.27	-
BMI	136	18.42	3.65	
Race				
White	116			83.50
Afr. Amer.	5	-	-	3.60
Asian	3	-	-	2.20
Hispanic	4	-	-	2.90
Other	8	-	-	5.80
Gender				
Male	69	-	-	50.74
Female	67	-	-	49.26

Protocol

Participant PA was obtained using Walk4Life MLS-2505 pedometers (Plainfield, IL), which are affordable, practical, unobtrusive and accurate tools of measurement in children and adults (4). This specific pedometer has a built in three-second reset delay to reduce the likelihood of accidental resets, a noteworthy issue when collecting data in children with unsealed pedometers (16). In order to validate the instruments used within the study, a walking test was completed on all units before initiation of data collection. No more than a 2% error was allowed on the walking tests (30).

Reactivity occurs when children alter their PA behaviors due to their knowledge of being monitored with pedometers (16). When pedometers are unsealed they offer students' immediate and continuous measures of PA, and can act as an environmental cue to be active (5). Unsealed pedometers have been suggested to be methods of visual feedback, which research suggests can encourage and motivate individuals' PA actions (24). Yet, overall literature suggests that pedometers are not sufficient as motivational tools, unless used in combination with a record keeping or self-management technique, such as goal-setting (5, 17, 28). A number of studies have indicated that reactivity does not exist in children wearing unsealed pedometers; thus, no measures were taken to seal pedometers (5, 16).

A total of four school weeks (Monday-Friday) of data collection occurred in October, during a climate that was conducive to outdoor recess data collection. None of the days afforded inclement weather. The playground area included a large, open field, with a surrounding walking track and four areas for Tetherball. Perimeter shade from surrounding trees offered sitting areas to students and teachers. Next to the Tetherball area, a large concrete space included two basketball hoops, with markings for Four Square and Hopscotch, however it was used on a daily basis for kickball. Each classroom had typical playground equipment, including footballs, basketballs, playground balls, and soccer balls. No physical or environmental modifications were made to the school's recess environment. The classroom teachers acted as recess monitors, maintaining the student-teacher ratio that was equivalent to the classroom setting (e.g, 1:25-1:27). They were asked to maintain their usual habits during recess so as not to encourage the participants to be active any more than they normally would.

Each participant had his/her own labeled pedometer, which was applied at the "pedometer checkpoint," located at the entrance/exit area to the playground. Researchers assisted all participants with applying their pedometers immediately upon entrance to the playground and exit back to their classroom.

All participants engaged in three conditions during the four-week period: Week 1 = baseline, Week 2 = feedback, Week 3 = baseline, and Week 4 = goal-setting. Baseline condition (Weeks 1 and 3) measured PA levels without feedback or goal-setting. Students were instructed not to look at their pedometers during this condition. To sustain a long-term improvement in PA levels, Sidman (25) suggests goal selection processes be based upon progression from a collection of baseline data; with this in mind, baseline data were collected intermittently between the other two conditions.

The feedback (Week 2) condition measured PA levels and provided PA feedback to the students by having them look at their step counts and activity time following recess. The last condition (Week 4), goal-setting, provided participants with a goal of increasing their baseline PA step counts by 10% because increasing activity may be challenging, yet achievable (17). To account for students receiving unequal amounts of recess time, steps per minute was calculated.

To become interested in accomplishing set goals, participants needed to understand the purpose of increasing their PA at recess (26). One researcher educated the students, prior to setting goals, about the significance of achieving maximum PA during their daily recess periods. The participants were presented with their baseline step counts from Week 3 because the researchers felt this would provide the most accurate measure of PA (to wash out any reactivity from the first week). The researcher then gave them their goal of increasing those by 10%. Each student's goal was written on a sticker that was placed on the outside of their pedometer during Week 4 (goal-setting) as a reminder. Due to the age and developmental levels of the participants, it was determined that researcher-set goals, as opposed to student-set goals, would be most appropriate.

Statistical Analysis

Descriptive statistics were computed to determine average PA intensity (calculated using steps per activity time at recess, herein referred to as steps per minute) and percent time spent in PA for all four weeks. Two repeated measures analyses of variance (RM ANOVAs) were conducted to assess PA steps per minute by grade level and condition and percent of recess time spent in PA by grade level and condition. All analyses were conducted using SPSS version 19.0 and statistical significance was set to $p < .05$.

RESULTS

Participants engaged in three conditions over four weeks: Week 1 = baseline, Week 2 = feedback, Week 3 = baseline, and Week 4 = goal-setting. Descriptive statistics revealed minimal change in PA steps per minute by condition, digressing from an average of 101.94 steps per minute (SD = 16.45) in Week 1 (baseline), to 99.96 steps per minute (SD = 15.79) in Week 2 (feedback). Within Week 3 (baseline), the average steps were 101.65 per minute (SD = 16.46), to 100.68 steps per minute (SD = 14.55) in the following Week 4 (goal-setting). When examined by percent of recess time spent in PA, there was more variation. In Week 1, participants were active 65.64% of recess (SD = 0.17). Activity decreased to 62.90% (SD = 0.18) of active recess time in Week 2 (feedback), and also dropped in Week 3 (baseline) to 61.41% (SD = 0.19). There was an increase in percent of recess time spent in PA in Week 4 (goal-setting) to 67.54% (SD = 0.16) (See Figure 1).

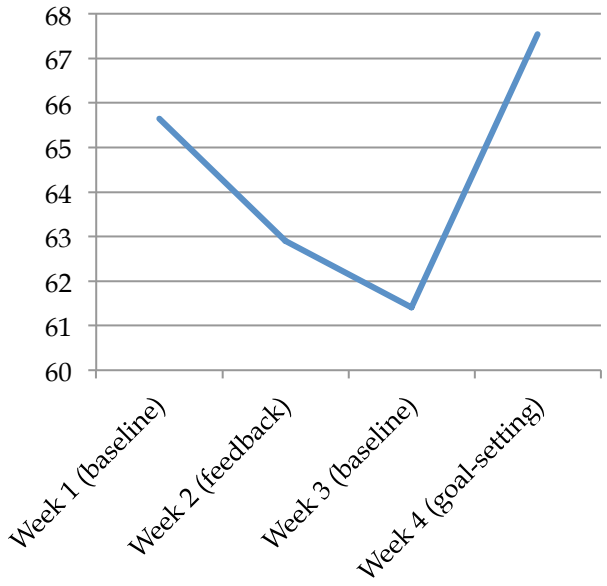

Figure 1. Percent of recess time spent in physical activity over four conditions.

No significant differences were evident among all four conditions, or time points [$F(3,414) = 1.10$, $p = .35$]. Means and standard deviations for PA steps per minute at recess by grade and gender are reported in Table 2. No significant group or condition differences were evidenced for the 4th grade participants' PA steps per

Table 2. Physical activity steps per minute at recess by gender and grade for all conditions.

Variable	Week 1: Baseline	Week 2: Feedback	Week 3: Baseline	Week 4: Goal-setting
All	101.94 ± 16.45	99.96 ± 15.79	101.65 ± 16.46	100.68 ± 14.55
Boys	104.96 ± 2.25	103.09 ± 2.04	105.45 ± 2.02	102.17 ± 1.85
Girls	98.47 ± 1.64	96.23 ± 1.71	97.44 ± 1.89	98.75 ± 1.68
4th	104 ± 17.64	102.57 ± 15.65	102.59 ± 16.76	105.02 ± 14.45
5th	99.4 ± 14.57	96.72 ± 15.47[a]	100.49 ± 16.15[a]	95.29 ± 12.87

[a]Indicates significant difference between similar letters within each dependent variable ($p < .01$).

Table 3. Percent of Time in Physical Activity (activity time/total recess time) by Gender and Grade for All Conditions

Variable	Week 1: Baseline	Week 2: Feedback	Week 3: Baseline	Week 4: Goal-setting
All (%)	65.64 ± 17.01	62.9 ± 18.04[a,b]	63.37 ± 18.67[a]	67.54 ± 15.78[b]
Boys (%)	68.1 ± 2.2	67.6 ± 2.1	66.6 ± 2.3	72.6 ± 1.9
Girls (%)	63 ± 1.80[a,b]	58.4 ± 2.10[a]	57.1 ± 2.10[b,c]	63.1 ± 1.70[c]
4th (%)	72.15 ± 15.62[a,b]	68.21 ± 16.94[a,c]	60.61 ± 18.96[b,c,d]	68.78 ± 14.27[d]
5th (%)	57.55 ± 15.19[a]	56.3 ± 17.28[b,c]	62.41 ± 18.39[b]	66.01 ± 17.46[a,c]

[a,b,c,d] Indicates significant difference between similar letters within each dependent variable ($p < .01$).

minute at recess [$F(3,228) = 1.04$, $p = .38$]. However, a significant difference was found for 5th grade participants' PA steps per minute at recess [$F(3,183) = 3.52$, $p = .02$]. Bonferroni Post Hoc analysis revealed significantly higher PA steps per minute at recess amounts at Week 3 (baseline) compared to Week 2 (feedback) ($p = .01$). No other significant differences among time points were found.

Gender differences were examined with no significant differences found for PA steps per minute at recess among all four conditions [$F(3,204) = 1.33$, $p = .27$].

To examine the percentage of time during recess spent in PA, a 2 x 4 (Grade and Condition) RM ANOVA was conducted. Means and standard deviations for PA percentage by grade and gender are reported in Table 3. Results revealed a significant PA time effect [$F(3,414) = 7.67$, $p = .01$]. A Bonferroni post hoc analysis indicated a significant group difference in percentage of time during recess between Week 2 (feedback) and Week 4 (goal-setting) ($p = .01$) as well as between Weeks 3 (baseline) and 4 (goal-setting) ($p = .01$).

A significant difference was found for 4th grade participants' percentage of time spent in PA [$F(3,228) = 16.64$, $p = .01$]. Bonferroni Post Hoc analysis revealed significantly greater time spent in PA at Week 1 (baseline) compared to Week 2 (feedback) ($p = .02$), Week 1 (baseline) compared to Week 3 (baseline) ($p = .01$), Week 2 (feedback) compared to Week 3 (baseline) ($p = .01$), and Week 4 (goal-setting)

compared to Week 3 (baseline) (p = .01). A significant difference was also found for 5th grade participants' percentage of time spent in PA [F(3,183) = 7.02, p = .01]. Bonferroni Post Hoc analysis revealed significantly greater time spent in PA at Week 1 (baseline) compared to Week 4 (goal-setting) (p = .01), Week 2 (feedback) compared to Week 3 (baseline) (p = .01), and Week 4 (goal-setting) compared to Week 2 (feedback) (p = .01).

Potential gender differences in percentage of time spent in recess PA were examined using a 2 x 4 (Gender and Condition) RM ANOVA. Results revealed significant condition, or time, effects for boys [F(3,204) = 3.08, p = .03] and girls [F(3,198) = 5.8, p = .01]. A Bonferroni post hoc analysis revealed boys had a significant difference in percentage of time in PA only between Week 3 (baseline) and Week 4 (goal-setting) (p = .01), whereas the Bonferroni post hoc analysis for girls exhibited a significant difference in percentage of time in PA between Week 1 (baseline) and Week 2 (feedback) (p =.01), Week 1 (baseline) and Week 3 (baseline) (p = .02), and Week 3 (baseline) and Week 4 (goal-setting) (p = .02).

DISCUSSION

As a whole, the goal-setting intervention appeared to be effective for increasing the percentage of time students spent in PA at recess, but not for PA steps per minute at recess. Participants spent the highest percentage of time active during the goal-setting week (Week 4), followed by the first baseline week (Week 1), feedback week (Week 2) and the second baseline week (Week 3). Although it may seem contradictory that the baseline week PA (Week 1) was higher than the feedback week (Week 2), this may be due to the novelty of wearing pedometers at recess. Research suggests reactivity does not exist (16), yet these numbers suggest motivation may have been a factor at the onset of the study, as the second baseline week (i.e., no feedback or goal-setting interventions) dipped below either intervention week. The PA steps per minute at recess remained steady, ranging from 99.96 to 101.94 steps per minutes of activity during recess. These were the highest during the first baseline week (Week 1) and were the lowest during feedback week (Week 2).

Boys and younger children accumulated the highest PA during recess. However, there were very few statistically significant differences by gender or grade level for any of the four conditions. As suggested by other researchers (6) and practitioners, recess interventions designed to increase the amount of PA girls accumulate would be beneficial. With this particular sample, the only significant differences occurred for percent of time in PA at recess. For girls, both feedback and goal-setting were associated with a higher percent of time in PA than during the second baseline week. For boys, percent of time in PA during the goal-setting week was significantly higher than the second baseline week. This suggests that goal-setting was effective in increasing participant PA during recess, but not necessarily the rate or intensity level of their PA.

The average percent of recess time students spent in PA during the feedback and goal-setting weeks met or exceeded the amounts provided in recess review by Ridgers and colleagues (21). The current findings suggested that the students increased their

PA during the goal-setting week as compared to the baseline and feedback condition weeks, with the activity time improving from 61.41% in Week 2 (feedback condition) to 67.54% in Week 4 (goal-setting). Despite no significant PA steps per minute at recess effects, the increase in percent time in PA during goal-setting week suggested that rather than increasing PA steps per minute over a shorter time point, students extended their PA over longer bouts of time. Goal-setting for the children in this study was an effective recess intervention because the students increased their PA in steps during the week the students were setting the goals to increase their PA.

The study was limited by the sample size and short duration of the intervention. Although a small effect was evident, a longer intervention period would provide a clearer picture of long-term outcomes. Additionally, the 4th grade class received extra recess time (5.18 minutes) compared to the 5th grade class. This may have impacted their steps per minute at recess, as some research suggests providing short sessions of PA time in more frequent bouts (e.g., two 10-minute recess breaks as opposed to one 20-minute recess break) may garner more PA (19). Despite these limitations, this was the first study to examine goal-setting and its effects on elementary students' PA during recess.

This study demonstrated that a cost-effective, user-friendly intervention has the propensity increase the PA levels of children during recess. Specifically, helping students set goals may be an effective strategy, as it appeared that feedback from pedometers alone was not sufficient. Pedometers can be used as means for students to measure their PA at recess and make decisions to reach their goals. A future study in which participants were allowed to select the type and/or frequency of feedback they received might shed light on self-directed physical activity during recess. Providing teachers and/or recess monitors with strategies to help students set appropriate goals (10% is advocated, but might be too high for some who are already highly active) is advocated. A goal of 10% increase in PA was utilized in this study, based on Pangrazi and colleagues' (17) suggestion. However, this hard fast goal may need to be reconsidered, as given the relatively short period of time allotted for recess, a ceiling effect may occur. Those with higher baseline PA levels would have a higher goal than those with less baseline PA, making their goals more difficult to attain. For instance, if one student walked 1800 steps in 15 minutes while another walked 1000, the first student's goal would be 1980 steps while the second student's goal would be 1100. If time were not a factor, these seem attainable. However, the gap between high and low active students would widen using this system. One possible tactic for increasing PA might be to allow students to self-control their feedback, meaning they are provided feedback (via pedometer step counts or activity time) whenever they requested it. This has been shown to work with motor learning (9). Future research related to the most appropriate means for setting goals for recess PA and frequency of feedback is warranted.

Easy-to-implement strategies such as goal-setting utilized in this study can be implemented to increase elementary students' PA at recess. Even though the NASPE (15) recommends that all

elementary school students have at least 20 minutes of recess each day, students with less time spent at recess can still show significant increases in PA if provided an attainable goal.

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