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The relationship between pedometer step counts and intermittent recess breaks for elementary students

Physical activity (PA) contributes to the overall well-being of a child and is noted as an integral component to improving the health of our future generation (Biddle, Mutrie & Gorely, 2015). While current national PA guidelines assert that children should obtain 60 minutes of PA each day, the Institute of Medicine [IOM] (2013) contends that 30 of the 60 minutes should occur during the school day. Despite this notion, the trajectory of PA in the form of physical education, free play, and recess at school has slowly diminished over the past two decades (IOM, 2013). It is estimated that over half of elementary school children (ages 6-11) in the United States do not meet the recommended 60 minutes of daily PA (Colley et al., 2011; Hallal et al., 2012) and approximately 23.8% are considered obese (Skinner & Skelton, 2014). However, it is important to note that participating in PA has the potential to decrease the onset of many prevalent chronic diseases for children, such as diabetes, cardiovascular disease, and asthma. A growing body of evidence also suggests that children who are physically active tend to lead physically active lifestyles as adults, perform better academically, and have decreased mental health issues (Chaddock, Kramer, Hillman & Pontifex, 2011; Fedewa & Ahn 2014; Rauner, Walters, Avery & Wanswer, 2013; Roberts, Freed & McCarthy, 2015).

Decline of Physical Activity at Home and School

The benefits of PA at a young age are irrefutable (IOM, 2013). However, childhood during the past several decades has transitioned from play time that resided solely outside to one that encourages sedentary behaviours inside. The emergence of technology, a decline in neighborhood safety, increased urban living, and the ability to access almost anything from home has contributed to this paradigm shift (Ewing, Meakings, Hamidi & Nelson, 2014; Rosen et al., 2014). Schools have also perpetuated an environment that de-emphasizes outside play, PA, and in some instances, even physical education (Slater, Nicholson, Chriqui, Turner & Chaloupka, 2012).

Paucity of Consistent Recess

One reason for a de-emphasis on physical activity and reduction in recess is the unsurmountable pressure for schools to perform well on standardized testing and a limited number of states requiring allocated time for recess. Currently, only eight states (16%) require recess by law, and the consistency in effective implementation is not discernible within the research (National Association for Sport and Physical Education [NASPE], 2016). Additionally, a majority of states only mandate physical education, while minutes for daily or weekly PA are not always required.

Playground safety and behavioural issues have also precipitated a decline in recess (Beighle, 2006). However, this can easily be addressed with access to proper equipment, accessible playground design, and supervisory staff who consistently interact with children during periods of recess (Huberty, Beets, Beighle & Saint-Maurice, 2014). The Centers for Disease Control and Prevention (CDC) and SHAPE America even

developed a free *Strategies for Recess in Schools* document that outlines how to effectively implement recess (CDC, 2017).

Although the consensus remains, that there is a need for PA, policies regarding recess length and/or timing of recess have not been firmly instated across the United States. Thus inconsistencies persist. For example, recess periods may only be provided 20 minutes a day at one school, while another school may provide students with 60 minutes per day. In some schools, children may receive no recess whatsoever. Meanwhile, in other countries such as Japan, school children are afforded the opportunity to take a break once an hour. The justification for a break every hour is that the attention span is thought to wander every 40-50 minutes (Beresin, 2016). While scheduling PA in this manner is traditional in some European and Asian countries, the United States has yet to adopt the philosophy of providing recess breaks throughout the school day for all children.

A Case for Recess

Despite the aforementioned reasons that have generated a decline in recess, it remains an essential component of the school day and provides an environment wherein students can obtain quality levels of PA (Massey, Stellino, Claassen, Dykstra & Henning, 2018). The current body of evidence most commonly correlates physical education and physical fitness with academic, social, emotional, and physical benefits (IOM, 2013). However, recess presents its own set of distinctive benefits. As a pause from the scheduled academic day, recess provides children with an unstructured period of time to rest, play, socialize, move, and imagine (National Association of Early Childhood Specialists in State Departments of Education, 2002).

Physical benefits of recess

The current body of literature contends that recess has a significant impact on a child's overall physical development (Esteban-Cornejo et al., 2017; Van Der Neit et al., 2017). One study completed a systematic review and found that playground had a significant impact on students' PA levels (Escalante, Garcia-Hermoso, Backx & Saavedra, 2014). Recess also provides children with opportunities to practice motor skills. Even small bouts of movement during recess can offset sedentary time at school and home to assist children in achieving the recommended 60 minutes of daily physical activity. This standard is strongly supported by the American Academy of Pediatrics policy and has been noted as an antidote to obesity (CDC, 2008; NASPE, 2008).

Social-emotional benefits of recess.

Although the physical benefits of recess are perhaps the most documented, recess has the multifaceted potential to affect the whole child in ways that exceed physical benefits alone (Ramstetter, Murray, & Garner, 2010). In direct contrast to classroom activities in which children cannot make the choice to withdraw from an activity, at recess, children are free to join in or leave play situations according to their own discretion. This "open setting" that children encounter at recess allows them to engage in diverse and abundant social interactions that they might not experience otherwise (Jarrett, 2002, p. 3). Subsequently, recess provides time for children to "develop social skills that are not acquired in the more structured classroom environment" (Ramstetter, Murray & Garner, 2010, p. 519).

Cognitive benefits of recess.

Research also suggests that social interactions at recess have important cognitive implications (Pellegrini & Smith, 1993). Recess provides students a break from the rigorous academic schedule of a typical school day, which subsequently has the ability to affect students' focus, attention, and overall classroom behaviour (Donnelly & Lambourne, 2011).

Elementary students in Shanghai, China receive daily recess time that amounts to almost 40% of an entire school day. Even though these students are afforded more time away from academic work, their ability to perform well on academic tasks has not declined. In fact, these are some of the world's highest achieving students, receiving top honours in multiple areas on the Program for International Student Assessment (Chang & Coward, 2015).

Single vs. Intermittent Recess Periods

While the body of evidence on recess indicates positive implications for children, a majority of research on recess and its role in children acquiring daily PA has focused on singular recess periods. Thus, there is a lack of research addressing the quantity of recess — both in duration and number of periods — and its effect on children's PA levels. To counter this issue, a

recent study based on the Finnish education system aimed to increase overall recess time in four 15-minute intervals during the school day while simultaneously focusing on character development to address an increase in bullying behaviours. This program entitled LiiNK (Let's inspire innovation 'N Kids) increased overall daily recess to 60 minutes, embedded character lessons into daily curriculum, and required training for teachers who wished to implement the program. 405 children in grades K-2 participated in the study. With a buy-in rate of 92% from teachers, results indicated that off-task behaviours decreased significantly and attention, based on listening skills, slightly improved with multiple recess periods allocated during the school day (Rhea & Rivchun, 2018). While this study implemented incremental recess breaks throughout the day for children to examine classroom behaviours, it did not address children's PA levels.

Study Aims

For some children, school may provide the only opportunity to participate in PA. Thus, schools should continually evaluate ways to effectively provide and promote PA to aid in reversing the trajectory of physical inactivity. One way this can be accomplished in the school setting is through strategic planning of recess, which entails a re-evaluation of allocated time during the school day. For example, one 30-minute recess period may be divided into two 15-minute periods to allow for a break at different times of the day. Or, an additional recess period may be added during a transitional time of the school day. While research consistently indicates the contributions recess makes toward increasing children's PA levels (Bleeker, Burdumy & Fortson, 2015; Huberty et al., 2014) a deficiency in the literature still remains on the impact that adding multiple intermittent recess periods into the school day can have on children's PA levels.

Considering that the current body of research reveals a majority of children do not meet the recommended daily PA guidelines, there is a definitive need to address the impact of allocating more than one traditional recess period during the school day on students' PA levels. Thus, this study sought to answer the following research question: What is the relationship between students' step counts and intermittent recess periods during the school day?

Methods

Participants and Setting

The present study utilized a quasi-experimental design comprised of a single intervention group (n = 17). Participants were third-grade students at a school in Northwest Mississippi and were acquired through a convenience sample, as the researcher mentored the students' teacher and had a pre-existing relationship with the teacher. Twenty-four students were in the original study sample. However, three students were excluded from the study because they transferred to different schools and four students' data were withdrawn from the study due to low attendance. 53% of the participants were female and 48% percent were male. Demographics of the participants were 45% White, 30% Hispanic, 20% African American, and 5% Asian.

Procedures and Instrumentation

Approval to conduct the study was received by the University's Institutional Review Board. Teacher and parental consent, and children's assent were also obtained. An additional 20-minute recess period was also approved by the school's principal and built into morning transitions between mathematics and English language arts.

Baseline data were collected for all participants via pedometers for six weeks (November 5, 2017 - December 19, 2017) from 7:45 a.m.- 12:45 p.m. — approximately 21% of a 24 hour day — with a daily 20-minute recess. During the intervention phase of the study, step counts were collected for an additional six weeks (January 16, 2018 - February 23, 2018) within the same time period with two 20-minute recess periods — one in the morning and one in the afternoon. The teacher required students to write down their individual steps at the end of each day in a daily step count worksheet.

Prior to the intervention phase of the study, the classroom teacher was trained on correct positioning of the pedometer — directly at the hip bone and in line with the kneecap. The researcher visited the third-grade classroom to provide a 'how to' session where students were taught how to wear, set and reset the pedometers. While much research has focused on the use of accelerometers to measure PA,

pedometers have become much more prevalent in PA research (McNamara, Hudson & Taylor, 2010). The Gopher FITstep Pro was utilized within this study to measure participants' daily step counts. Selection of the pedometer was based upon its level of accuracy even when not in the exact upright position (Gopher, 2015). This particular pedometer also has a delayed counting feature, which does not enable step count inflation.

Data Analysis

Step counts for each participant were calculated and documented daily in a *My Daily Step Count* worksheet (See Figure 1). A worksheet was provided for the first six weeks (one 20-minute recess period) and a new one for the second six weeks (two 20-minute recess periods). At the end of each week, students totalled their weekly step counts. When all data were collected by the researcher from the teacher, each participant's overall daily step count was totalled both prior to (baseline) and after the additional 20-minute period of recess (intervention). A mean daily step count was derived without the additional recess period and with the additional recess period for each participant. The pair of mean step counts for each participant were then put into SPSS and a dependent paired *t*-test was conducted to determine if the additional twenty-minute recess period significantly increased students' average daily step count.

Results

Findings revealed that all participants' average mean step counts increased with an additional 20-minute period of recess added to the school day (See Table 1). The overall mean increase in daily step count from baseline to intervention was 792.2 steps. Prior to testing for statistical significance between the two data sets, a Shapiro-Wilk normality test (Shapiro & Wilk, 1965) indicated that the data were normally distributed ($p > .05$). A dependent paired *t*-test was then conducted to compare the daily step count mean of third-grade students with a 20-minute daily recess period and then again with two 20-minute recess periods. Findings revealed that there was a statistically significant difference in the daily mean step count with a 20-minute recess (M = 3399.47, SD = 503.76) compared to students' daily step counts with two 20-minutes recess periods (M = 4191.65, SD = 1079.84); $t(16) = 3.96$, $p < .05$ (See Table 2) during the school day.

Discussion

The current body of evidence has addressed the benefits of recess for children in the school setting. However, most studies in the United States have only examined recess and its benefits from the context of one traditional recess period during the school day. Much less attention has been paid to the effect of an additional and/or multiple recess periods embedded into the school day, particularly in relationship to students' PA levels. While some countries already embed 15-minute physical activity breaks every hour during the school day, this practice is not commonplace in the United States. On the contrary, the mindset of schools to focus solely on improving academic achievement has perpetuated a decrease in time allocated for recess during the school day.

Findings from this study imply that a shift in mindset from only one recess period during the school day to implementing two intermittent recess periods during the day may provide the opportunity for students to receive at least half of the recommended 60 minutes of daily PA. Furthermore, implementing an additional recess period yielded a significant increase in students' step counts. In alignment with previous research that contends recess accounts for 17% - 44% of a child's step counts during the school day (Erwin et al., 2012), this study revealed a 23% increase in step counts from baseline to intervention. This is critical to the discussion of increasing children's PA at school, as many children do not receive daily physical education, may be limited in the PA they experience in the classroom, and/or do not receive any PA at home.

This study also adds to the breadth of research that aims to increase children's PA levels through recess in order to deter the impending trajectory of decreased PA opportunities in schools. The idea and structure of multiple recess periods, as opposed to the traditional single recess period provides a new way for school district leaders, administrators, teachers, and parents to examine the allocation of time for PA across the school day and its effect on students' well-being. While the benefits of recess are not a novel idea in the literature, shifting the paradigm to include multiple recess periods throughout the day proved to have positive PA outcomes for all children in this study.

Although positive results arose from this study, limitations include timing of recess periods during the study. Furthermore, while recess periods were consistent in time and duration throughout the study — one in the morning and one in the afternoon — the researcher did not have control over when the recess periods began and ended. Recess periods were also unstructured, yet supervised. This may have played a role in a decrease or increase of step counts. Future research may seek to examine the impact of more than two recess periods or how small incremental recess periods throughout the day affect children's overall physical activity levels. Different grade levels, geographic regions, and times of the year may also be examined.

Conclusion

Children in the United States spend almost half of their waking hours in a school environment. Thus, schools provide a unique platform from which to address the health of our future generation. However, pressures to improve academic achievement have precipitated increased instructional time during the school day. Subsequently, time allocated for PA has decreased or diminished altogether. A reduction in allocated time for PA may prove to be counterproductive to not only developing positive physical and social-emotional health behaviours, but also to increasing academic achievement. Thus, schools must develop a balance that supports all of a child's developmental domains. Part of the physical domain must be fostered during play at recess. As we move further into the twenty-first century and the childhood full of free play that once existed begins to fade, it is imperative to keep in mind the physical, social-emotional, and cognitive benefits that recess provides. When schools begin to develop strategies that facilitate the aforementioned benefits, a paradigm shift may occur alongside a generation of healthier children.

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Table 1 Students' Daily Mean Step Counts

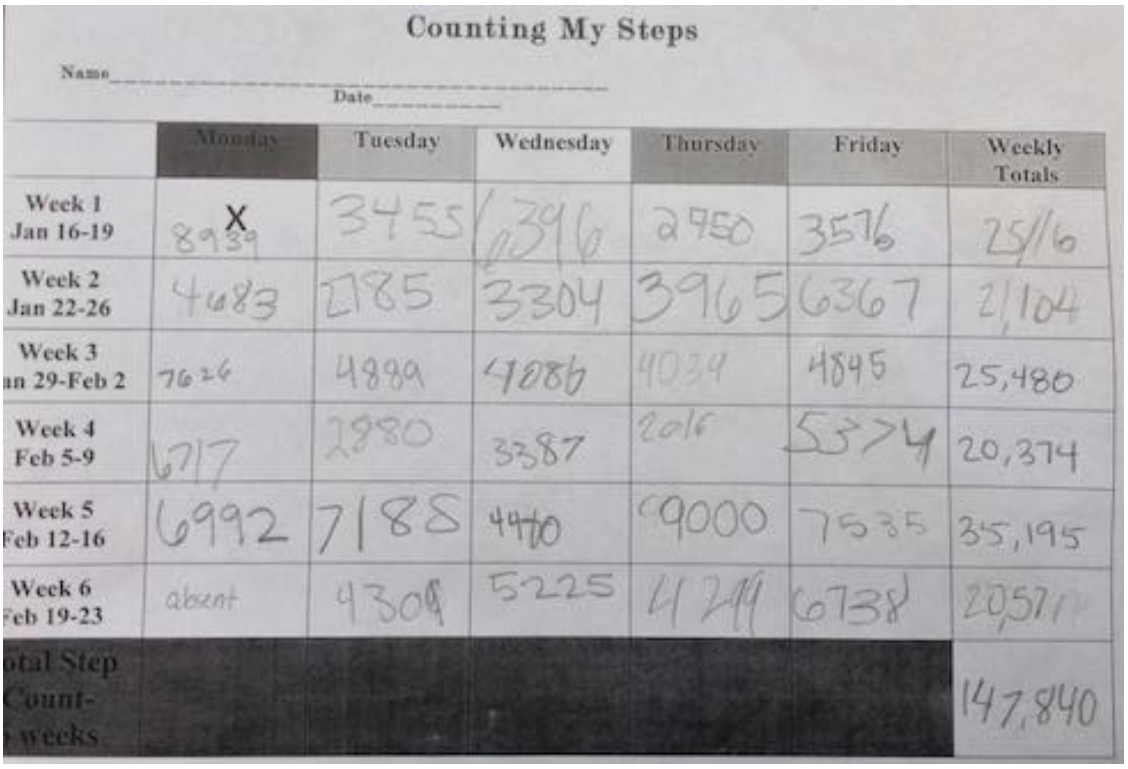
Student	Baseline	Intervention	Difference
S1	3875	4797	922
S2	3423	4148	725
S3	3531	4174	643
S4	3333	3786	453
S5	2278	3158	880
S6	3600	4448	848
S7	2895	3735	840
S8	4066	4866	800
S9	3908	4566	658
S10	3082	3640	558
S11	3233	4405	1172
S12	3238	3834	596
S13	3050	4238	1188
S14	3860	4796	936
S15	3240	4439	1199
S16	2893	3540	647
S17	4286	5213	1027
Group Mean	3399.4	4191.6	792.2

Table 2 Results of Dependent Paired *t*-Test for Students' Daily Mean Step Counts

	20- Minute Recess Period		Two 20-minute Recess Periods			95% CI for Mean Difference			
Step Counts	M	SD	M	SD	n		r	t	df
	3399.47	503.76	4191.65	1079.84	18	-1215.63, -368.72	.68*	3.96	16

* $p < .05$

Figure 1 — Daily step count chart completed by third grade students during baseline and intervention



Counting My Steps

Name_____ Date_____

	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Totals
Week 1 Jan 16-19	X 8939	3455	396	2950	3576	25/6
Week 2 Jan 22-26	4683	2185	3304	3965	6367	21,104
Week 3 an 29-Feb 2	7626	4889	4086	4034	4895	25,480
Week 4 Feb 5-9	6717	2980	3387	2016	5374	20,374
Week 5 Feb 12-16	6992	7188	4470	9000	7535	35,195
Week 6 Feb 19-23	absent	4309	5225	4211	6738	20,571
otal Step Count- weeks						147,840