AN ABSTRACT OF THE THESIS OF

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The benefits of physical activity (PA) are well established (USDDHS, 2008). Concern over the high rate of childhood obesity, however, has highlighted the emphasis of PA. Yet, children and adolescents are not obtaining the recommended amount of PA (CDC, 2011). Physical education (PE) has been recognized as an important source in increasing PA for youth (CDC, 2007). However, research has struggled to establish clear understanding about PE's contribution to the overall activity pattern of its students (Morgan, Beighle, & Pangrazi, 2007) as there has been a number of methodological problems with prior research. The purpose of this study was to examine PE's contribution on overall PA behavior of 34 third and fourth grade elementary students (mean age: 9.2; girls *n*=15) while addressing the limitations of prior studies through employing an accelerometer-based, multi-site research design. In accomplishing this purpose, Aim 1 examined PE's overall percentage contribution to overall PA while Aim 2 focused on investigating whether students compensate for missed PA opportunities on days in which they do not have PE. PA levels of 34 third

and fourth graders from two schools were measured by accelerometers over three data collection periods lasting five days each. At least two weeks separated each collection period. Accelerometers captured PA outcome variables of moderate-to-vigorous physical activity (MVPA), counts, and counts per minute (CPM) on PE days, non-PE days and weekend days. In answering Aim 1, descriptive statistics revealed that the average time spent daily in MVPA was 46.15 minutes (SD= 17.28) while PE accounted for 22.7% (SD= 8.5) of overall MVPA. PE also accounted for 15.12% (SD= 3.46) of overall average counts PA. In answering Aim 2, a one-way repeated measures MANCOVA revealed significant differences between type of day (PE, non-PE, and weekend) and PA levels (Wilks' λ=.64, p<.05; partial η^2 =.37), with gender and class set as covariates. However, follow-up univariate tests only indicated significant differences between MVPA and types of days, $F(2, 62) = 3.56$, p<.05, partial η^2 =.10. On average, the participants received 12 and 23 more minutes of MVPA on PE days than on non-PE days and weekend days, respectively (p<.01), suggesting that the students did not compensate for missed PA opportunities on days in which they did not have PE. Overall, PE was a major contributor of overall MVPA and PA (22.7% and 15%.12, respectively) which is substantial given the 30 minute length of PE classes. In addition, children did not make up MVPA on non-PE days or weekends further bolstering PE's importance in contributing to overall MVPA behavior. Cumulatively, these findings suggest that more PE classes should be added in order to increase overall PA levels instead of being systematically reduced. However, even with PE, students still did not obtain the recommended amount of MVPA, indicating that PE teachers need to do more to promote out of class PA.

Contribution of Physical Education to the Overall Physical Activity Behavior of Children

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Wesley J. Wilson, Author

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Chapter 1: Introduction

Physical activity's (PA) benefits are multidimensional including physiological, psychological, and academic domains (e.g. California Department of Education, 2005; Chomitz et al., 2009; Kwak et al., 2009; Myers et al., 2004; Thune & Furberg, 2001; USDDHS, 2008). Unfortunately, there are concerns about the low PA levels of youth in the United States. Only 28.7% of students surveyed through the Youth Risk Behavior Surveillance System reported participating in PA that increased their heart rates at least 60 minutes each day of the previous week, well below the targeted goal (Centers for Disease Control and Prevention [CDC], 2011). Contributing to these low levels of PA is the high amount of sedentary behavior—"screen time"—to which youth are exposed. For example, 31.1% and 32.4% of American youth reported playing video games and watching TV for three or more hours on an average school day, respectively (CDC, 2011). Due to these low levels and PA and high levels of sedentary behavior, efforts to increase PA have been emphasized by initiates such as NFL Play 60 and Lets Move!

Physical education (PE) is a plausible way to increase PA levels in the United States. Since a majority of youth enrolls in PE classes throughout their academic careers, PE can promote positive PA behaviors in students at a young age as they will be more likely to carry these habits into adulthood (Kulinna, Martin, Lai, Kliber, & Reed, 2003). In fact, the CDC (2014) recommends a "substantial percentage" of students' overall PA should be obtained largely in part to PE. In order to understand how PE contributes to overall, habitual PA, two approaches have been examined jointly: 1) overall percentage contribution and 2) the compensatory effect.

Overall percentage contribution describes the percentage of total PA that it accounted for by PE. Previous studies report that PE accounts for 8% to 18% of total daily PA as measured by pedometer step counts (Flohr et al., 2006; Tudor-Locke et al., 2006; Wegis, 2005). One study examined PE's contribution to total moderate-to-vigorous PA (MVPA) and found that 16.8% of MVPA was account for by PE (Meyer et al., 2011). The second approach to examining PE's contribution on overall PA behavior has been through the compensatory effect. This effect suggests that students will make up PA on days on which they do not have PE as a means to maintain balance of physical exertion, a principle based on Rowland's (1998) activitystat hypothesis, which posits the existence of a biological need for central nervous system stimulation (through energy expenditure) and a biological mechanism that seek energy homeostasis.

There are a number of previous PE contribution studies that have researched the compensatory effect that may exist in the PA behaviors of children. Several studies did not support the compensatory effect, suggesting that students do not make up PA on school days which PE is not offered (Alderman, Benham-Deal, Beighle, Erwin, & Olson, 2012; Meyer et al., 2011; Morgan et al., 2007). However, there is some evidence that suggests that children will compensate for less in-school PA (PE and recess) with more out-of-school PA, which supports the activitystat hypothesis (Frémeaux et al., 2011; Wilken et al., 2006). Further study of a potential compensatory effect is warranted based on the limitations of prior research, which will be discussed below.

While each of these overall percentage contribution and compensatory effect studies brings significant contribution and knowledge to PE's effect on PA behavior, there are a number of limitations. The first limitation is a sampling issues related to data collection. With the exception of Morgan et al. (2007) and Dale, Corbin, and Dale (2000), each PE contribution study started and ended data collection within two weeks. This only captures PE content within that two week frame. It is difficult to conclude that the PE classes offered in those two weeks are representative of a PE program as a whole, especially if only one PE unit is covered. It is important to capture PE content that is more representative of its PE program as recent research has indicated that content is one of the most influential contributors of PA levels (Jin & Yun, 2013). Therefore, data sampling should occur at multiple times to capture a more representative snapshot of a PE class.

Another sampling issue resides in the way that representative PA behavior is interpreted. Most PE contribution research use only school days (Monday through Friday) in its data analyses (e.g. Alderman et al., 2013; Dale et al., 2000; Meyer et al., 2011; Morgan et al., 2013; Tudor-Locke et al., 2006). Rowlands (2007) suggests that a weekend day should also be included in data analysis to accurately describe overall, habitual PA patterns. Through the addition of data collection on weekend days, PE contribution research will be better able to describe representative PA behavior.

The second limitation concerns measurement. Pedometers are commonly used in PA studies, notwithstanding many PE contribution studies (e.g. Alderman et al., 2012; Flohr et al., 2006; Morgan et al., 2007; Tudor-Locke et al., 2006; Wegis, 2005). While useful in some regards, pedometers do not capture all of the properties of PA, such as intensity. If the goal is to accurately measure the properties of PA behavior (such as intensity of movement and time spent in MVPA), different technology is needed. Accelerometry is one such technology that may help describe PA behavior more completely as they measure acceleration which then can be converted into PA intensity levels. There are relatively few accelerometer-based studies measuring PE's effect on PA behaviors (e.g. Dale et al., 2000; Meyer et al., 2011). Meyer et al.'s (2011) study was powered by a large sample size (*n*=676) and randomization, however, since this study occurred in a different continent and within a different population, therefore the results may not pertain to the United States. Dale et al.'s (2000) also utilized accelerometry and represents an important gain in knowledge in the PE contribution field; however, this study—like several others in the line of research—suffers from the methodology limitations discussed next.

Another measurement issue of previous PE contribution research is that the use of the devices (whether pedometer or accelerometer) may be prone to reactivity issues. Several pedometers studies have shown that increases in PA early on in data collection periods, which researchers attribute to reactivity (Ho et al., 2013; Ling, Masters, & McManus, 2011; Maloney, Corbin, & Le Masurier, 2004). A recent accelerometer-based reactivity study showed similar results, prompting the researchers to suggest that a one-day familiarization period should be used in school-age children research (Dössegger et al., 2014). A one-day familiarization has not been a part of previous PE contribution studies.

The third limitation resides in where the data is collected. Some of the aforementioned studies followed a single-site research design (e.g. Alderman et al., 2012; Dale et al., 2000; Wegis, 2005). Collecting data from only one school detracts from the representativeness and generalizability of the results. Wegis's (2005) work and Alderman et al.'s (2012) study occurred at one middle school while Dale et al. (2000) collected from one private elementary school. Results may be more useful if based on data from multiple sites.

Although past research has provided much insight on how PE contributes to children's overall PA behaviors, future research should address these limitations. New research should employ multiple data collection periods (with a familiarization period) and should take advantage of the use of accelerometer to more accurately capture the properties of a PE program and PA behaviors, respectively. Therefore, the primary purpose of this study was to utilize this improved methodology to examine the extent to which PE contributes to the overall PA behavior of 3rd and 4th grade elementary students through two approaches: 1) the overall percentage contribution and 2) the compensatory effect. In order to examine this purpose, two aims with nine specific research questions were studied.

Aim 1: To examine the overall percentage contribution of PE and recess on overall PA behavior.

Specific Question 1: What percentage of overall MVPA does PE account for?

Specific Question 2: What percentage of overall MVPA does recess account for?

Specific Question 3: What percentage of overall movement counts does PE account for?

Specific Question 4: What percentage of overall movement counts does recess account for?

Specific Question 5: What is the counts per minute (CPM) for PE in comparison to overall CPM?

Specific Question 6: What is the counts per minute (CPM) for recess in comparison to overall CPM?

Aim 2: To examine if a compensatory effect exists on non-PE days.

Specific Question 7: Is there a difference in MVPA between PE, non-PE, and weekend days?

Specific Question 8: Is there a difference in counts between PE, non-PE, and weekend days?

Specific Question 9: Is there a difference in CPM between PE, non-PE, and weekend days?

Assumptions

- Participants have worn the devices correctly and follow directions.
- Participants have worn accelerometers whenever they are awake, not bathing, and not swimming.
- The accelerometers accurately capture PA behaviors.
- Five days of at least 600 minutes of wear time each day (2 PE days, 2 non-PE school days, and 1 weekend day) represents habitual PA behavior.

Limitations

- The results of the study may be influenced by seasonal effects.
- External validity of the findings may be affected by the number of students who did not wear the accelerometers.
- Faulty devices made certain pieces of data unusable.

Delimitations

- The population of this study is delimited to students in 3rd and 4th grade.
- Participants are recruited from three surrounding communities of a small city in the Pacific Northwest.
- Participants were delimited to those enrolled in PE classes.

Operational Definitions:

Physical Activity—any bodily action that exerts energy as measured by Actigraph accelerometers.

Recess—daily, school-based time periods in which children are permitted to recreate.

Habitual Physical Activity—5 measured days of at least 600 minutes of accelerometer wear time (2 PE days, 2 non-PE school days, and 1 weekend day)

Chapter 2: Literature Review

In the wake of the obesity epidemic and generally sedentary lifestyles, the health and wellness of the nation has become a priority of the national agenda (U.S. Department of Health and Human Services [USDHHS], 2010b). Alarming trends of obesity in adults have been reported as nearly two-thirds of adults are overweight or obese (USDHHS, 2010b). Perhaps even more alarming is that one-third of children are overweight or obese while obese youth are 70% more likely to become obese adults (USDHHS, 2010b). This trend is likely in part due to increased sedentary behavior of the nation's youth as 31.1% and 32.4% of students reported playing video games and watching TV for three or more hours on an average school day, respectively (Centers for Disease Control and Prevention [CDC], 2011). To alter the trend of obesity and sedentary habits, physical activity (PA) has been pushed to the forefront of the national agenda (e.g. "Vision for a Healthy and Fit Nation", "Let's Move!" initiative). These plans and initiatives provide a clear message that more PA and less sedentary behavior are essential for the health of youth.

With this emphasis on PA, physical education (PE) can be one way to address the current health issues facing the nation's youth. PE has a unique opportunity to positively impact the physical activity habits and values of youth throughout their formative years. Therefore, the purpose of this literature review is to provide a background of knowledge of PA and PE's contribution to students' overall PA levels. For organizational purposes, this literature review is organized into several sections: (a) the importance of PA, (b) current PA status, (c) concerns with current research practice in PA, (d) PA measurement, (e) PA levels in the context of PE, and (f) PE contribution to overall PA.

The Importance of Physical Activity

The benefits of PA are well established. These benefits present themselves areas of physiological wellness (e.g. Myers et al., 2004; Thune & Furberg, 2001; USDDHS, 2008) as well as psychological and educational wellness (e.g. California Department of Education, 2005; Chomitz et al., 2009; Kwak et al., 2009; Stevens, 1988; Tiggemann & Williamson, 2000; USDDHS, 2008). Physiological benefits of PA have been evidenced extensively. Among the physical health-related benefits are decreases in many chronic conditions such as cardiovascular disease, diabetes, and obesity (USDDHS, 2008). For example, Myers et al. (2004) conducted a large study (n = 842) examining how PA patterns and fitness levels predicted all-cause mortality in men. Through exercise testing and a PA questionnaire, it was determined that both physical fitness and habitual PA were inversely related with all-cause mortality with fitness as the stronger predictor of mortality of the two. In addition, Thune and Furberg (2001) examined the dose-response effects of occupational PA and leisure time PA on cancer risk through their review of cancer risk observational studies. The authors concluded that there is evidence that supports a protective effect of PA on site-specific cancer risk in addition to a dose-response association between PA and breast cancer and colon cancer. Overall, it is important to note, is that the same benefits also extend to individuals with disabilities (Murphy & Carbone, 2008) and regular PA may also help against the decline of function (Durstine et al., 2000).

Beyond the physiological health-related benefits, psychological benefits such as decreased anxiety and stress and increased self-esteem have been supported by ample evidence (e.g. Stevens, 1988; USDDHS, 2008). For example, in a secondary analysis of surveys from the U.S. and Canada, Stevens (1988) provided evidence of a positive association between PA and general well-being, lower levels of anxiety and depression, and an increase in positive mood. This study was cross-sectional in nature and utilized self-report surveys. Also through a cross-sectional study, Tiggemann and Williamson (2000) looked further into exercise and its effects on body satisfaction and self-esteem in terms of gender and age. Positive relationships were found between body satisfaction and self-esteem and PA level in all groups except for young women.

Although fitness is not completely synonymous with PA, several studies also showed relationships between physical fitness and student achievement (e.g. California Department of Education, 2005; Chomitz et al., 2009; Kwak et al., 2009). Chomitz et al. (2009) conducted a cross-sectional study to examine the relationship between physical fitness and academic performance. Analyzing school data on standardized math and English tests along with fitness testing, the researchers concluded that as the odds of fitness tests passed increased, so did the odds of passing both the math and English. Strengths of this study include the controlling of possible extraneous variable such as ethnicity, gender, grade, and socioeconomical status. However, it should be noted that the direction of causation is not known. In a review of another related study, students who participated more physically fit not only performed better on standardized tests, but also had better school attendance, and fewer disciplinary issues (Marrow, Martin, Meredith, Welk, & Zhu, 2010). Addressing the specific construct of PA, a 2010 CDC report provided further evidence that PA can positively influence grades and standardized test scores (CDC, 2010). Furthermore, a meta-analysis of 44 studies conducted by Sibley and Etnier (2003) determined that there was an effect size of .32 suggesting that PA was related to improve cognitive functioning of children.

However, not all research has provided positive results of PA's effect on academic achievement (e.g. Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Sallis et al., 1999). Sallis et al. (1999) conducted a study examining exercise and academic achievement in elementary students (kindergarten through fifth grade) through a PE intervention. After the academic yearlong intervention, the results were inconclusive. Coe et al. (2006) examined sixth graders throughout a four-month PE intervention and found no effect between PA and academic achievement. Furthermore, according to an extensive review by Tomporowski and colleagues (2008), over half of the studies conducted in this area were inconclusive.

Clearly, the many physical health benefits of PA are backed by "incontrovertible evidence" (Warburton, Nicol, & Bredin, 2006, p. 807) while research is accumulating in support of psychological and academic areas. In the face of crises such as obesity and sedentary lifestyle, these benefits can be received through regular participation in PA.

Current Physical Activity Status

Before being able to describe the current PA level of the nation, one must operationally define the construct. PA can be described as any bodily action that exerts energy. Now the crucial question is, are Americans, and specifically children, getting enough PA to reap the health benefits and what constitutes as “enough”? In an attempt to clarify the second question, the U.S. Department of Health and Human Services issued the first federal physical activity guidelines for Americans (USDDHS, 2008). For adults, the guidelines recommend at least 150 minutes a week of moderate-intensity or 75 minutes a week of vigorous-intensity aerobic PA in addition to moderate-vigorous muscle-strengthening at least twice a week. To answer the first question, only 18.2% of adults met both of these recommended guidelines (USDHHS, 2010a). Children should spend at least 60 minutes in daily PA while including at least three days of moderate-vigorous activity a week (USDDHS, 2008). Unfortunately, only 28.7% of students surveyed through the Youth Risk Behavior Surveillance System (YRBS) reported participating in PA that increased their heart rates at least 60 minutes each day of the previous week (CDC, 2011). Inactivity is perhaps the more critical issue in children and adolescence than in adults, largely because youth establish values and habits toward PA during these formative years. As such, it is crucial that youth learn to become more physically active while they are young so they will be more likely to continue being active as they become adults (Kulinna, Martin, Lai, Kliber, & Reed, 2003). Pate and colleagues (2002) conducted an accelerometer-based study on a random sample of youth (n = 375), grades 1-12, to examine to what extent they achieved the Healthy People 2010 PA goals (USDHHS, 2000). They found that over 90% of the students met Objective 22.6 of engaging in moderate PA for at least 30 minutes at least five or more days a week. However, only 3% of students achieved Objective 22.7 of engaging in vigorous PA for at least 20 minutes at least three days a week, an obvious deficient from the national goals at that time.

Cumulatively, current research has demonstrated that there are deficiencies in the level and type of PA, with a small number of youth meeting the guidelines for every component of fitness. This suggests a continued effort beyond federal guidelines and national initiatives. Quality PE programs and trained PE teachers can serve as an important source to help youth in the participation in and the learning of PA.

Concerns with Current Research Practice in Physical Activity

There has been criticism of public health surveillance systems such as YRBS, the National Health Interview Survey, and the National Health and Nutrition Examination Survey in measuring PA levels, as they rely on self-report data (Pate et al., 2002). Recall bias may provide misleading results from which inappropriate conclusions may be derived.

To somewhat alleviate this concern, numerous studies have been conducted with the use of pedometers, devices which can provide quantitative PA data through step count. A recent school-based intervention study examined peer-modeling and pedometer goals (meeting goals resulted in rewards) on children's step count (Hardman, Horn, & Lowe, 2011). The researchers found that students (ages 7-11) in the intervention group yielded a significantly higher step count than in the groups without peer-modeling and specific pedometer goals. Pedometers were also used as indicators of PA in Wegis' (2005) study. The devices were used to measure PE's contribution to the overall PA of adolescents. However, pedometers do not capture all aspects of physical activity—such as intensity—and for this reason, recent studies are utilizing more advanced devices to obtain a clearer picture of PA among youth (Romanzini, Petroski, & Reichert, 2011). One such device used in measuring PA is the increasingly popular accelerometer.

Physical Activity Measurement: Accelerometry

The use of accelerometers has become "the preferred choice for continuous, unobtrusive and reliable method in human movement detection and monitoring" (Godfrey, Conway, Meagher, & ÓLaighin, 2008, pp. 1369). Accelerometers are unique in that they can measure acceleration through the forces acting upon it that can be used to measure intensity of movement (Schutz, Weinsier, & Hunter, 2001). Due to their widespread use, several different types of accelerometers have been created. The three main types of accelerometers are piezoelectric, piezoresistive, and differentiable capacitor accelerometers (Godfrey et al., 2008).

Some devices, such as made through Actigraph (Actigraph, LLC, Pensacola, FL) and Actical (Mini-Mitter, Bend, OR), measure the displacement of piezoelectric elements in the accelerometer to assess the acting forces (Godfrey et al., 2008; Kristensen, 1999). For piezoresistive accelerometers, such as activPAL Professional (PAL Technologies, Arlington, VA), uses the changes in the electrical resistance of its polysilicon springs to detect and measure acceleration forces. These devices are helpful for obtaining data at low frequencies (Godfrey et al., 2008). Differentiable capacitor accelerometers use a capacitor that contains a moving mass that is connected to fixed eternal plates and applied acceleration will unbalance this capacitor (Godfrey et al., 2008).

All of these types of accelerometers follow the same basic principle of spring-mass system (Mathie, Coster, Lovell, & Celler, 2004). In the device, there is a mass connected to a spring (which in turn is connected to the base). When acceleration occurs, the mass extends the spring and displacement is measured. In both piezoelectric and spring mass devices, displacement is then converted to G-force and then translated to PA counts (Godfrey et al., 2008). Research has suggested that there is a lack of compelling evidence to select one type of accelerometer over another in terms of validity and reliability (Trost, McIver, & Pate, 2005).

Accelerometer-based PA studies are becoming more and more popular (Rowlands, Eston, & Ingledew, 1999; Ward et al., 2005). However, although many see accelerometry as an "objective" measurement of PA, especially when compared to "subjective" self-report measures, there is still some debate. Kayes and McPhereson (2010) make the argument that often the "objective" measure is too quickly accepted and seen as superior in relation to more subjective measures. However, the authors address the necessity of making the decision based on the measure fitting the purpose instead of deferring to the most "objective" measure immediately. Despite this stance, accelerometry is still widely used for assessing PA.

Prior to using these devices, researchers are prompted with several important questions. At what sampling interval should the device be set to? How long is it necessary for a subject to wear it to obtain an accurate account of PA behavior? How does one make accelerometer outputs (counts) meaningful?

The sampling interval, or epoch, marks how often data is recorded by the device. The lower the epoch (e.g. 1 second epoch), the more representative the data is of the actual movement. A researcher must set the epoch based upon the duration of data collection due to device memory constraints. Devices such as the ActiGraph GT1M have enough memory to collect data at 1 second epochs for approximately six days (Rowland, 2007). Rowland (2007) concluded that having the capacity for short epochs (1-15 seconds) is important for the research of children due to their short bursts of rapidly changing physical activity.

The next question involves the length that the subjects must wear the devices to capture PA patterns. For children, 4-5 days of monitoring are needed for children while 8-9 days are required in adolescents (Trost, Pate, Freedson, Sallis, & Taylor, 2000). The criteria for what constitutes a day have not been commonly agreed upon with wear time ranging from 8 hours (Eiberg et al., 2005) of activity per day to 10 hours (Anderson et al., 2005).

Finally, conversion consideration in regards to accelerometer output must be discussed. There are many different cutoff count thresholds to indicate categories of PA intensity: sedentary, light, moderate, vigorous. For children and adolescents, the following thresholds are used (see Table 1 below).

Table 1. Accelerometer Thresholds for Children and Adolescents

Source	Study Characteristics	Results
Vanhelst et al. (2011)	Sample: n=40 (age 10–16); Activities: rest, reading, playing video games, tabletop games, pickup football, walking (1.5 and 3 km/h), running (4 and 6 km/h). Criterion: indirect calorimetry.	SED=0-400 c・min LITE=401-1900 c・min MOD=1901-3918 c・min VIG>3918 c・min

Table 1. Accelerometer Thresholds for Children and Adolescents (continued)

Source	Study Characteristics	Results
Evenson et al. (2008)	Sample: n=33 (age 5–8); Activities: sitting, watching a DVD, coloring, walking (2 and 3 mph), climbing stairs, dribbling a basketball, pedaling, jumping jacks, running (4 mph). Criterion: indirect calorimetry.	SED=0-25 c · 15s LITE=26-573 c · 15s MOD=574-1002 c · 15s VIG≥1003 c · 15s
Mattocks et al (2007).	Sample: n=163 (age 12); Activities: rest, playing video games, walking (slow and fast) and jogging at own pace, hopscotch. Criterion: indirect calorimetry. Method: regression model	MOD=3581-6129 c · min VIG≥6130 c · min
Treuth et al. (2004)	Sample: n=74 (age 13–14); Activities: rest, watching TV, playing computer games, sweeping, walking (2.5 and 3.5 mph), step aerobics, outdoors bicycling (12 mph), shooting baskets, climbing stairs, running (5 mph). Criterion: indirect calorimetry. Method: false-positives/false-negatives	SED=0-50 c · 30s LITE=51-1499 c · 30s MOD=1500-2600 c · 30s VIG>2600 c · 30s
Puyau et al. (2002)	Sample: n=26 (age 6–16); Activities: playing video games, coloring, playing with toys, warm-up exercises,walking (2.5 and 3.5 or 4 mph), martial arts, various games, running (4, 5, or 6 mph). Criterion: room calorimetry. Method: regression model	SED=0-800 c · min LITE=800-3199 c · min MOD=3200-8199 c · min VIG≥8200 c · min

Table adapted from Romanzini, Petroski, & Reichert (2011)

Physical Activity in Physical Education

PE has an important position as it can contribute to the overall PA levels of the children it serves, especially since it is a part of every child's educational experience. As an indication of its major role, the Centers for Disease Control and Prevention (CDC) has provided guidelines for in regards to PA in PE. Guideline 4 stipulates that a comprehensive physical activity program should be implemented with quality PE as the cornerstone (CDC, 2014). However, while these guidelines are important steps in the recognition of PE, it did not clearly stay the level of PA for which PE should strive.

Healthy People 2010 (USDDHS, 2000) provided a more specific goal by stating that 50% of children's PE experience should be spent in PA. To reflect this high importance on PA, almost all levels of schooling (98% of elementary, middle, and high schools) include objectives pertaining to regular participation in in PA (Burgeson et al., 2001). However, despite being a target outcome of many PE programs, within the past 15 years, PE has struggled to meet the mark of 50% of class time spent in moderate-to-vigorous PA (Dauenhauer & Keating, 2011; McKenzie et al., 1996; Stone, McKenzie, Welk, & Booth, 1998). McKenzie et al. (1996) recognized the challenge of meeting the standard of 50% of moderate-to-vigorous PA (MVPA) and conducted a study implementing the Child and Adolescent Trial for Cardiovascular Health (CATCH) program for elementary children. The CATCH program is multifaceted and is composed of different strategies to increase child health and PA levels in areas such as diet, PA interventions, and abstaining from smoking. As part of the program, CATCH PE sought to increase MVPA behaviors in the students by encouraging being physically active both in PE and outside of school as well. Results indicated that such a targeted approach successfully increased the percent of MVPA to 51.9% of time spent in MVPA, just above the mark set by Healthy People 2010 (USDDHS, 2000) while the students in the control group only achieved 42.35%.

Fairclough and Stratton (2005) used heart rate (via short-range radio telemetry as an instrument) to measure the amount of MVPA and vigorous PA (VPA) during high school PE classes (*n*=122). Students only reached MVPA for 34.3% and VPA for 8.3% of the time during class. It is interesting to note that the high ability students where more physically active than the moderate and low ability students. The authors concluded that PE may make bigger contributions to students' PA levels if the lessons are specifically designed around MVPA goal.

Much like in the case of McKenzie et al. (1996), there has been some evidence that quality PE programs and teachers can increase PA levels (McKenzie et al., 2004; Sallis et al. 1997), however generally low PA continues to be an issue. This may be a possible indication as to why the Healthy People 2020 initiative (USDHHS, 2010a) has excluded the goal for 50% activity time in is current iteration. However, in 2010, the CDC recommended that 50% MVPA in PE is an indicator for quality PE (USDHHS, 2010d).

This same dilemma, if not to a greater extent, also exists in the adapted PE (APE) classes as students with disabilities (SWD) experience lower levels of cardiovascular fitness and muscular endurance (Murphy & Carbone, 2008). One study suggests that 47% of children received less than three hours of PA weekly

(Yazdani, Yee, & Chung 2013), well below the federal recommendation. Furthermore, the opportunities for SWD to engage in PA both inside and outside of school are limited (Newacheck et al., 1998). Burgeson et al. (2001) concluded that only 56.8% of states and 57.2% of districts require schools to provided modified facilities for SWD in regular PE which may further discourage full participation in PA.

Physical Education's Contribution to Overall Physical Activity

According to the CDC, a "substantial percentage" of students' overall PA can be obtained largely in part to PE (CDC, 2014). Many studies over the last 15 years were conducted to see how much PE was actually contributing to this "substantial percentage" with a majority employing the use of pedometers as a way to measure student PA. Wegis (2005), for example, conducted a study of 48 middle school students to examine the PE's level of contribution to overall student PA from how many classes. Using pedometers to measure PA, the researchers found that 17% of students' total daily steps were attributable to PE. Flohr, Todd, and Tudor-Locke (2006) used pedometers to determine the PA behaviors of 7^{th} graders (*n*=44) over two straight weeks in both PE and afterschool activities (team and individual sports) programs. The researchers found that PE contributed 18% of overall PA while the afterschool activity program contributed 47% during school days, although the steps per minute were much higher in PE than in the afterschool programs (45.5 steps/min and 13.1 steps/min, respectively). Tudor-Locke and colleagues (2006) similarly used pedometers to measure 6^{th} graders' PA from four different classes in one school (*n*=81). Data was collected Monday through Wednesday for two weeks. The students were asked to keep track of their steps at various points of the day (e.g. start of the day, end of the school day) and record it in a log. They concluded that PE accounted for 8-11% of daily PA which was similar to recess contribution (8-9%) but below lunchtime PA (15-16%). Nearly half of daily steps occurred after school hours. Dauenhauer and Keating (2011) examined the PA behaviors of African American and Hispanic adolescents (*n*=71) in and outside of PE. While finding that more PA (i.e. more steps) occurred during PE classes, the step count was still low in PE (M= 771.04, M= 1296.08) for the 30 minute and 60 minute classes, respectively. Morgan, Beighle, and Pangrazi (2007) investigated the PA contribution of PE in 1st through 6th graders in 2 public schools (*n*=485). Data was collected over 64 PE classes (30 and 34 classes in schools 1 and 2, respectively). In particular, the researchers were interested in any compensatory relationship between PE and PA. The researchers examined three groups of students—least, moderately, and most active—and found that students accumulated 1,700, 1,100, and 2,500 more steps/day, respectively. However, no compensatory effect was observed. Alderman and colleagues (2012) examined the PE contribution to overall PA in middle school students (*n*=279). Data was collected for five consecutive school days (with at least two days of PE). The results showed that boys were three times more likely and girls were two times more likely to achieve the recommended daily step count on days in which they had PE. Much as in the case of Morgan et al. (2007), this suggests that there is no compensatory effect—students are not "making up" the extra PA on days in which they do not have PE—which provides more evidence that PE can indeed contribute meaningfully to students' daily PA levels.

There have been a few studies that have used devices other than pedometers to measure PE's contribution of overall PA. In a European study, Meyer et al. (2011) used accelerometers to determine PE's effect on the overall PA levels of students in first and fifth grade (*n*=781) from 59 randomly selected classes. The researchers used 2000 or more counts per minute to indicate that a child was achieving MVPA. It was found that children were engaged in MVPA only 32.8% of the total class time, however, PE accounted for 16.8% of total daily MVPA. Also using accelerometers, an American study (Dale, Corbin, & Dale, 2000), examined 3rd and 4th graders (*n*=76) from one private elementary school. Data was randomly collected on four nonconsecutive days with two of those days being "active" (outdoor recess and PE) and two being "non-active" (computer recess and no PE) over a 14-week period. On active days, PE and recess provided the top contribution to overall PA level (1,050 counts/min) and no compensatory effect was seen on the non-active days.

While important work has been conducted in the area of PE contribution to overall PA behavior, there are several ways in which we could improve our understanding. Bar a few studies (e.g. Dale et al., 2000; Meyer et al., 2011), most studies on the topic rely on the use of pedometers to collect data. While certainly a good step in exploring PE's contribution, accelerometers should be used as they can measure the intensity of the students' movement and not just step count. Another area that should be address is the length of data collection. Many of the studies perform data collection within in two consecutive weeks. This becomes an issue when one considers the nature of the PE. Often PE units run two weeks or more. This may make any data collected from this timeframe prone to misrepresentation of the PE program as a whole. This is an important point because recent research has indicated that lesson content is one of the most influential contributors to PA during PE class (Jin & Yun, 2013). Therefore data collection should either be expanded for a much longer duration or should occur at multiple times with enough time in between to prevent misrepresentation. The only study that was found meeting these criteria was the influential work of Dale, Corbin, and Dale (2000). However, this study was conducted at one site, a private elementary school, which also may affect the level of generalizability. Most of research is conducted only at one site so this line may be improved by implementing a multi-site research design.

Chapter 3: Materials and Methods

Participants

Thirty-four students participated in this study from four different classrooms in two different schools, each school with one PE teacher. The schools came from one district in the Northwest United States. Of the participants, eight were in third grade and 26 were in fourth grade. There were 19 boys and 15 girls with the mean age of 9.2 years. A majority of participants were Caucasian (77%), followed by Hispanic (10%), multiethnic (7%), American Indian (3%), and African American (2%). Table 2 shows more detailed information about the participants. Prior to each participant's enrollment in the study, informed consent and assent were collected from the parents/guardians and child, respectively. All study protocol and materials were approved by the university's institutional review board.

Table 2. Participant's detailed demographic information

	Total Sample (SD)	Third (SD)	Fourth (SD)
n	34	8	26
Age (years)	9.21 (.66)	8.50 (.53)	9.46 (.51)
Weight (lbs)	83.97 (19.91)	77.05 (19.27)	86.49 (19.97)
Height (in)	55.35 (4.02)	53.57 (3.41)	56.04 (4.17)
BMI	19.37 (4.96)	18.81 (3.31)	19.59 (5.53)

Instrument

Physical activity data was collected through the use of Actigraph (Actigraph, LLC, Pensacola, FL) accelerometers. The use of accelerometers is "the preferred choice for continuous, unobtrusive and reliable method in human movement detection and monitoring” (Godfrey, Conway, Meagher, & ÓLaighin, 2008, pp. 1369), making the devices an important tool to measure PA. It works by detecting the displacement of piezoelectric elements to measure the acting forces and then expresses these data in counts, which then can be interpreted as varying levels of intensity. This ability to capture the intensity of movement sets accelerometry apart from other methods of data collection of physical activity, such as pedometers, which only measures step count.

Seventy-three different accelerometers (eight GT3X and 65 GT1M models) were used throughout the duration of the study to measure PA behaviors of the 34 students. The research practice of interchangeably using these particular devices has been supported by a recent study (Robusto & Trost, 2012). In addition, the Actigraph devices were worn on a belt over the right hip. The accelerometers for the present study were set to a 15-second epoch, which is aligned with Rowlands’ (2007) recommendation for children.

Procedures

Participants were asked to wear the devices for five consecutive days, on three separate occasions throughout the semester, with at least two weeks in between each occasion. Of each five day period, three complete days of data were collected, as data was not collected on the day participants received the accelerometers (i.e. the first day) and the day on which the devices were returned (i.e. the last day). For this reason, the three separate data collections yielded nine complete days, which included PE days, non-PE school days, and weekend days. However, if the end of the five day period fell on a weekend and the participant wore the device on the extra days, then more than nine days of data were used in analyses.

As an example of a possible data collection period, assume the participants started wearing the devices on Monday. They would continue to wear the accelerometers until Friday, the end of the five day occasion. Using the same example, any data recorded on the first and last day (Monday and Friday, respectively) were not used in data analysis for three reasons. First, the first day was not used as it was meant to be a "familiarization period" to help address reactivity issues. Second, in order to describe accurate habitual PA behavior, the researchers wanted to capture PA obtained during the children's morning routines, from getting dressed to transport to school. Since the participants did not have the option to wear the devices on Monday morning prior to arriving at school, that day's data could not be used in analyses. Third, the final day (i.e. Friday) was not analyzed as the devices were returned to researchers at school, prior to the full completion of the day. On the basis of the three aforementioned reasons, a complete measured day was constituted by at least 10 hours of cumulative wear time with the opportunity for data collection from right when the participants awake, until they go to bed (i.e. Tuesday, Wednesday, and Thursday from the previous example).

Prior to each data collection occasion, participants received a brief overview about wearing their accelerometers—"activity belts". They were instructed to wear it all day long, for five consecutive days, only taking it off when they were sleeping, bathing, or swimming. They were also reminded to wear it securely over their right hip. To ensure understanding, the researchers demonstrated proper placement and allowed time for the participants to practice. To increase the quality of data collection, several measures were in place. First, all participants were provided with colorful reminders (Appendix A) to help them remember to wear the accelerometer belts every day. Researchers recommended that these reminders be placed in well-traveled areas such as the bathroom and the kitchen. Second, researchers attended many of the PE classes to serve as an additional reminder to wear the devices and to troubleshoot any issues that may arise. At the end of each five-day collection occasion, the researcher collected the devices from the participants.

Having multiple data collection periods allowed the researchers to be more confident that the PE lesson content and resulting PA that are captured are more representative of the overall PE program. To help accurately capture lesson content, the researchers attended many PE classes to monitor the lesson and take notes. In addition, the PE teachers were asked to fill out a short PE content record to describe their lessons. Please see the PE content record template in Appendix B. These notes allowed the researchers to have a better understanding of the PA during PE class time. Specific PE content during data collection is discussed in the next section.

Physical Education Content

PE teachers were asked to complete a brief PE content record form after each lesson taught during data collection. This record served as a checklist that covered two main questions: what was taught and how was it taught? In describing their content ("what was taught"), PE teachers chose from following items: object control skills, locomotor skills, dance, gymnastics, and fitness. In rare instances that the content did not fit in one of these topics, teachers added an item that better described that day's lesson content. In some cases, teachers selected two content areas; these combinations formed new items (e.g. fitness/object control lesson focus). When describing how the lesson was presented ("how it was taught"), teachers chose from three items: 1) instruction accounted for a majority of lesson time, 2) instruction and practice/game play each accounted for about half the lesson, and 3) practice/game play accounted for a majority of the lesson time. Tables 3 and 4 summarize the results.

Table 3. PE content: What was taught?

"What was taught?"	
Content Area	# of lessons (%)
object control skills	7 (~24%)
locomotor skills	0 (0%)
dance	0 (0%)
gymnastics	0 (0%)
fitness	13 (~49%)
object control/dance	1 (~3%)
object control/fitness	6 (~21%)
cooperative games*	2 (~7%)

*Added by teacher

Table 4. PE content: How was it taught?

"How was it taught?"	
	# of lessons (%)
Instruction accounted for a majority of lesson time	0 (0%)
Instruction and practice/game play each accounted for about half the lesson	4 (14%)
practice/game play accounted for a majority of the lesson time	25 (86%)

Data Reduction

The Actilife 6 software (Actigraph, LLC, Pensacola, FL) was used in the reduction of data. PA variables were accelerometer counts and counts per minute (CPM), as well as time spent in moderate to vigorous physical activity (MVPA) based on Evenson et al.'s (2008) cutoffs, which are recommended by Trost and colleagues (2011) to estimate time spent in sedentary, light, moderate, and vigorous PA for both children and adolescents. The PA variables during PE and recess were calculated by use of ActiLife 6's filter function. Times and days of PE and recess were obtained from classroom teachers and then were filtered out and analyzed separately from the total daily PA. The PE and recess filters were derived from their regularly scheduled 30 minutes and 30-35 minutes timeframes, respectively.

Although at least nine days of data were collected for each participant, the lack of compliance of wearing the accelerometers necessitated the use of fewer days for a participant's data to be considered for analysis. For this reason, overall PA was estimated with data from five measured days based on Trost et al.'s (2000) recommendation that four to five days of monitoring are needed to capture habitual

PA patterns of children. In addition, one of the five days was required to come from the weekend as the inclusion of a weekend day has been recommended to better describe habitual PA behavior (Rowlands, 2007). Even with the reduction of needed measured days, only 34 of the initial 96 recruited participants yielded usable data.

As mentioned earlier, a measured day required at least 10 hours of accumulated wear time (Anderson, Hagstromer, & Yngve, 2005). To determine the amount of time the accelerometers were worn, a time wear validation algorithm (Troiano et al., 2008) was used to analyze patterns of the data. Participants' average wear times are provided in the description of specific data reduction techniques used for each aim below.

In describing PE's overall percentage contribution to overall PA of Aim 1, the four measured school days were composed of two PE days and two non-PE days with the fifth day being from the weekend, as this selection of days is representative of a typical school week for the participants (i.e. student have two to three PE days a week or two to three non-PE days a week). PE, non-PE, and weekend days were randomly selected from each participant's available data set. Two variables—total counts and time spent in MVPA—were then averaged among the five days to describe overall, habitual PA behavior. To find PE's overall percentage contribution, these two variables from overall PA were divided by the average PE counts and PE time spent in MVPA from all available PE data. For example, although only two random PE days were used in finding the overall PA, all PE data was averaged and divided from the overall PA, which in many cases was three, four, or five PE classes. This approach was used as it better accounts for the PE programs as a whole since PE data from different weeks and/or months were included. In the same way as PE, recess's contribution to overall PA was found by dividing all available recess data from the overall PA (in both counts and MVPA). In addition, to help better understand the overall percentage contribution of PE and recess to overall, habitual PA, the total CPM of the five randomly selected days and total PE and recess CPM (again, from all available data) were also averaged. Participants recorded an average daily wear time of over 14.03 hours (842 minutes/day, SD= 101.3) for Aim 1.

For Aim 2, the examination of a potential compensatory effect, the data were only used in analyses if the participant recorded two measured PE days and non-PE days, along with a measured weekend day. Total counts, MVPA, and CPM were averaged by type of day using all available PE, non-PE, and weekend days so that differences could be examined. For example, if a participant recorded four PE days, three non-PE days, and two weekend days, then four, three, two days of data would be averaged for PE, non-PE, and weekend days, respectively. Participants recorded an average daily wear time of over 14.17 hours (850 minutes/day, SD= 118.4) for Aim 2.

Data Analysis

To answer the aims of the study the following analyses will be conducted for each specific question:

To address Aim 1, descriptive statistics including the means and confidence intervals were calculated to estimate the percentage of PE contribution to overall PA in regards to counts and MVPA in a general PE setting, as well as CPM.

In addressing Aim 2, a one-way repeated measures MANCOVA was employed. The dependent variables were counts of PA, time spent in MVPA, and CPM. The independent variable was the different types of days with multiple levels of PE days, non-PE school days, and weekend days. Class and gender were set as covariates. The Bonferroni correction was used in the analysis for post-hoc analysis. All statistical analyses were conducted through SPSS Statistics 21 software and significant levels were set at .05.

Chapter 4: Results

What is physical education's contribution to overall physical activity behavior?

The mean daily time spent in MVPA among the participants was 46.15 minutes. When examining PE's overall percentage contribution to MVPA behavior, it was found that PE contributed about 22.7% (9.39 min) of the overall time spent in MVPA whereas recess contributed about 18% (7.93 min). With PE being 30 minutes in duration, students spent about 31% of their PE time for MVPA. Data for the MVPA contribution of PE are provided in Table 5. PE contributed about 22.7% (9.39 min) of the overall time spent in MVPA whereas recess contributed about 18% (7.93 min).

Table 5. Moderate-Vigorous Physical Activity (MVPA) in minutes

	Mean MVPA (min)		95 % CI
	M	SD	
Average Total MVPA_5 days	46.15	17.28	40.13 - 52.18
Average PE MVPA	9.40	1.89	8.74 - 10.06
PE % of MVPA	22.70	8.50	19.74 - 25.67
Average Recess MVPA	7.93	2.32	7.12 - 8.74
Recess % of MVPA	18.15	5.01	16.40 - 19.90

Counts were examined as a representation of total PA, rather than simply MVPA. Table 6 displays the raw PA data in counts. The mean counts total was 368,997 counts per day. PE accounted for 15.1% (54,357 counts) of the total daily counts whereas recess accounted for only 12.7% (46,409 counts). PE classes lasted for 30 minutes across all participants while daily recess time varied from class to class, from 30 to 35 minutes per day. To add more meaning, Table 6 also reflects PA through average CPM for habitual PA behavior over the five days, PE classes, and recess. The habitual PA behavior of the participants yielded an average 444 CPM while spiking to an average of 1811.91 and 1410.48 CPM during PE and recess, respectively.

Table 6. Total Counts and Average CPM for Total, PE, and recess

	Total Counts		95 % CI
	M	SD	
Average Total Counts_5 days	368997.26	71583.42	344020.62 - 393973.90
Average PE Counts	54357.41	10401.93	50728.00 - 57986.81
PE % of Counts	15.12	3.46	13.91 - 16.32
Average Recess Counts	46408.63	10711.77	42671.11 - 50146.14
Recess % of Counts	12.77	2.77	11.81 - 13.74
Total CPM avg_5days	444.00	101.25	408.67 - 479.33
PE CPM avg	1811.91	346.73	1690.93 - 1932.89
Recess CPM avg	1410.48	362.95	1283.84 - 1537.12

Is there a compensatory effect on days in which there is no PE?

Descriptive statistics revealed that average MVPA among PE, non-PE, and weekend days was 55.8 (SD= 17.2), 43.8 (SD= 18.4), and 32.4 minutes (SD= 19.0), respectively. PE day average counts (419,260, SD= 91022) were higher than that of non-PE days and weekends (361,547, SD= 91542 and 301,625, SD= 120662, respectively). In addition, PE days accounted for an average of 490 CPM (SD= 111) while non-PE days and weekend days accounted for 425 CPM (SD= 129) and 373 CPM (SD= 156), respectively.

Through inferential statistics, a one-way repeated measures MANCOVA revealed significant differences between the different types of days (Wilks' λ=.64, $p<.05$; partial η^2 =.37) with class and gender set as covariates. Follow up, univariate tests indicated a significant difference in MVPA between the days, $F(2, 62) = 3.56$, $p<.05$, partial η^2 =.10, although no significance was found in counts, $F(2, 62) = 1.46$, p>.05, partial η^2 =.05 or in CPM $F(2, 62) = 1.06$, p>.05, partial η^2 = .03.

Table 7 displays the Bonferroni pairwise comparison for MVPA while Table 8 displays the same for counts and CPM. Class and gender served as covariates. On PE days, participants received an average of 12 minutes and 23 minutes more of MVPA when compared to non-PE days and weekend days, respectively. Non-PE school days also provided participants with 11 minutes more of MVPA than on weekend days. It is interesting that although there is no overall significant difference in the F-test, there was significance in the difference in counts as well as CPM. Participants gained an average of 57,712 more counts on PE days than on non-PE days. In addition, there was an average increase of 117,635 counts between PE days and weekend days. However, there was no significance when non-PE days were compared to weekend days in terms of counts. The analysis of CPM revealed that there was significant difference between PE days' CPM and non-PE and weekend days, with an average of 64 and 117 CPM more, respectively. These results indicate that there is no compensatory effect of PA on days in which children do not have PE.

Table 7. Comparison Between Day Types (MVPA)

Variable	Day Type	Day Type	Mean Difference (min)	95% CI for Difference	
				Lower Bound	Upper Bound
MVPA	NPE	PE	-12.04**	-20.85	-3.22
		WE	11.32**	2.41	20.23
	PE	NPE	12.04**	3.22	20.85
		WE	23.35**	15.61	31.09
	WE	NPE	-11.32**	-20.23	-2.41
		PE	-23.35**	-31.09	-15.61

NPE=Non-PE days; PE=PE days; WE=Weekend days, ** <.01, * <.05

Table 8. Comparison Between Day Types (Counts and CPM)

Variable	Day Type	Day Type	Mean Difference (min)	95% CI for Difference	
				Lower Bound	Upper Bound
Counts	NPE	PE	-57712.68**	-102312.02	-13113.33
		WE	59922.51	-1504.37	121349.39
	PE	NPE	57712.68**	13113.33	102312.02
		WE	117635.19**	66496.94	168773.44
	WE	NPE	-59922.51	-121349.39	1504.37
		PE	-117635.19**	-168773.44	-66496.94
CPM	NPE	PE	-64.91*	-121.94	-7.88
		WE	52.06	-33.55	137.67
	PE	NPE	64.91*	7.88	121.94
		WE	117.00**	52.79	181.15
	WE	NPE	-52.06	-137.67	33.55
		PE	-116.971**	-181.15	-52.79

NPE=Non-PE days; PE=PE days; WE=Weekend days, ** <.01, * <.05

Chapter 5: Discussion

The purpose of the present study was to investigate PE's contribution to the overall PA behaviors of third and fourth graders while correcting methodological issues of previous work. This was accomplished through an examination of PE's overall percentage contribution to habitual PA and through any potential compensatory effects that may exist. There were two key findings of the present study.

Overall, the first finding suggests that PE is a major contributor to overall PA. PE's overall percentage contribution revealed that 22.7% (~9.4 minutes) of overall MVPA and 15.1% of total PA (as measured through counts) within a 30 minute class—a relatively short timeframe. With the participants achieving an average of only 46 minutes of MVPA daily, well under the *2008 Physical Activity Guidelines* of 60 minutes (USDDHS, 2008), 30 minute PE classes become that much more important in promoting recommend levels of PA. However, the Institute of Medicine (2013) recently reported that PE has been systematically reduced from public schools by 44% of school administrators in favor of increasing time in mathematics and reading. PE classes are being eliminated when they should, in fact, be added.

It should be noted that the first key finding was similar to previous studies that measured PE's contributions on levels of total PA. Pedometer studies reported that PE accounted for 8 – 18% of overall total PA (Flohr et al., 2006; Tudor-Locke et al., 2006; Wegis, 2005). However, the present study's results yielded a higher overall percentage contribution of overall MVPA (22.7%) than Meyer et al.'s (2011) accelerometer study (17%), which may be explained by methodological differences.

Although the purpose of this study was not to directly compare levels of PA to previous studies, the researchers can feel more confident of the accuracy of the data as it is supported by prior research.

In addition, PE's major overall percentage contribution to children's overall PA behaviors made sense when the researchers examined the PE content records. Many of the lessons focused on fitness (49%) with most being described as including a majority of time spent in practice/game play (86%). The PE content record allowed for better understanding of how type of lesson and instruction could impact PE MVPA, counts, and CPM.

The present study's second key finding was that no compensatory effect existed, indicating that children did not "make-up" for PA they missed on days that they did not have PE, which is supported by past research (Alderman et al., 2012; Dale et al., 2000; Meyer et al., 2011; Morgan et al., 2007). Results suggested that there is significant difference on levels of time spent in MVPA behaviors between PE days and non-PE days (55.8 to 43.8 minutes, respectively). Considering the amount of time spent in MVPA was much higher on PE days than on other school days, it provides yet more evidence against the reduction of PE classes. The issue becomes more poignant as there is even a greater difference in MVPA levels between PE days and weekend days (55.8 to 32.4 minutes, respectively), further emphasizing the importance of PE's contribution.

While the absence of a compensatory effect further bolsters PE's importance as school-based PA, it should be noted that even with PE classes, students still received less than the recommended 60 minutes of MVPA. This suggests that PE teachers need to increase their efforts in promoting PA outside of PE classes, much in alignment with the National PE Standard 3 of achieving and maintaining a health-enhancing level of PA (Society of Health and Physical Educators [SHAPE], 2014). While it may be true that quality PE can increase PA levels (McKenzie et al., 2004), it is important to remember that through PE, physically literate students must also have the skills required to participate in different physical activities as well as be able to apply knowledge of movement concepts and strategies (SHAPE, 2014). Focusing solely on increasing PA during PE may detract from the other important facets of PE such as skill and strategy development. Under these circumstances, it is imperative that PE teachers promote movement, especially MVPA, to every student in order increase daily MVPA to recommended levels.

Other interesting findings include the MVPA difference between recess and PE. PE accounted for a higher percentage of MVPA (22.7%) than recess (18.1%), even though many of participants had 35 minutes of recess compared to 30 minutes of PE. This result makes sense when one examines the average CPM of PE and recess (1,811.91 CPM and 1,410.48 CPM, respectively). This provides PE programs with yet more credibility in the effort to increase the PA of youth. However, it is worth noting that this result differs from the recent research of Gao and colleagues (2014). Their findings suggest that recess results in higher levels of PA than in PE, although it is not possible to directly compare results as examining for statistical differences between PE and recess PA was beyond the scope of the present study.

The present study design has improved on past research methodology. Multiple data collection periods over the course of two months allows for more representative PE data. The addition of a weekend days in the analyses allows for a better account of habitual PA behavior while a “familiarization day” prior to each data collection period helps address reactivity issues. The use of accelerometry permits a more complete examination of the true properties of movement. Finally, in order to obtain more meaningful and representative data, recruitment occurred at multiple sites while three data collection periods over the course of seven weeks were used to capture a better sample of PE content. Cumulatively, these improvements enabled the researchers to be confident in describing PE’s contribution to children’s overall PA behaviors through two major findings.

There are a few limitations of the present study. First, weather was not taken into account. It is possible that temperature and precipitation may have altered the habitual PA. To counter this possibility the research design called for multiple data collection periods covering the course of six to seven weeks. Ideally, the breadth of available days to draw data helps mitigate any changes in habitual PA behavior.

Secondly, there is a noted concern with compliance issues (Rowlands, 2007). Non-adherence to wearing protocol may bias results. Only 34 out of 96 participants had usable data, a 35% compliance rate. Even with reminders and the oft presence of the researchers, collecting five usable days over the three collection periods proved difficult. To help collect higher quality data, the first day the devices were passed out could have been used in the data analyses, because most often the belts were given to the participants in the very beginning of school (as with Dale et al., 2000 & Meyer et al. 2011). However, the data collected would miss out in the morning activities of the participants, which could greatly alter the perception of their habitual PA, especially if they walk to school. Based on this reasoning, the study was designed so that the second day of data collection would be the first day of analyzable data, even though it reduced the amount of usable data.

Despite these limitations, the results from the present study emphasize the importance of PE as a major contributor of PA, through merit of its overall percentage contribution to overall PA behavior and the absence of a compensatory effect in elementary children. For this reason, it is crucial that PE not be viewed as a dispensable elective in elementary schools, but rather as a core component of children's educational experience.

Chapter 6: Conclusion

Evidence that emphasizes the importance of PE continues to grow. PE provides a substantial percentage of MVPA and total PA in a relatively short timeframe and as such, should be offered more to children elementary school, not less. Although PE plays a major role in PA behavior, PE teachers should strive to promote PA outside of their PE classes, whether it be through ideas such as assigning "homework", the use of activity journals, leisure activities, or sports programs. Future research should focus on how PE teachers' efforts to increase extracurricular PA impact children's behaviors.

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Appendices

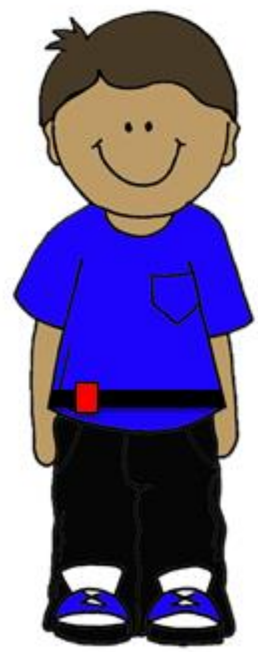
Appendix A


Wear your
activity belt
today!


Wear your
activity belt
today!

¡Lleve su cinturón de actividad hoy!

¡Lleve su cinturón de actividad hoy!



Appendix B

PE Content Record

Teacher:_________________ Date:_____________

Class:___________________

PE Class Day (please circle): **M Tu W Th F**

Class Time:______ am/pm

1. What best describes what was taught during today's lesson (check one)?

____Object control skills (e.g. throwing, catching, kicking)

____Locomotor Skills (hopping, skipping, running)

____Dance

____Gymnastics

____Fitness (e.g. fitness stations, chase/flee games)

2. What best describes today's lesson (check one)?

____Instruction accounted for a majority of lesson time

____Instruction and practice/game play each accounted for about half the lesson

____Practice/game play accounted for a majority of the lesson time

PE Content Record

Teacher:_________________ Date:_____________

Class:___________________

PE Class Day (please circle): **M Tu W Th F**

Class Time:______ am/pm

1. What best describes what was taught during today's lesson (check one)?

____Object control skills (e.g. throwing, catching, kicking)

____Locomotor Skills (hopping, skipping, running)

____Dance

____Gymnastics

____Fitness (e.g. fitness stations, chase/flee games)

2. What best describes today's lesson (check one)?

____Instruction accounted for a majority of lesson time

____Instruction and practice/game play each accounted for about half the lesson

____Practice/game play accounted for a majority of the lesson time

Appendix C

Institutional Review Board
Office of Research Integrity | Oregon State University
B308 Kerr Administration Building, Corvallis, OR 97331-2140
Telephone (541) 737-8008
irb@oregonstate.edu | http://oregonstate.edu/irb/

STUDY ID 5925

Notification Type	**APPROVED**		
Date of Notification	12/27/2013		
Study Title	Physical Education's Contribution to Daily Physical Activity in Children		
Principal Investigator	Joonkoo Yun		
Study Team Members	Wesley Wilson, Ryan Willoughby, Laurel Paige Perilli		
Submission Type	Initial Application		
Level	Expedited	Category(ies)	6, 7
Number of Participants	200 *Do not exceed this number without prior IRB approval*		
Waiver(s)	None		
Risk Level for Children	§46.404 minimal risk		
Funding Source	Internal: School of Biological and Population Health Sciences	Proposal #	N/A
PI on Grant or Contract	N/A		

The above referenced study was reviewed and approved by the OSU Institutional Review Board (IRB).

Approval Date: 12/27/2013
Expiration Date: 12/26/2014

Annual continuing review applications are due at least 30 days prior to expiration date

Documents included in this review:

- ☒ Protocol
- ☒ Consent forms
- ☒ Assent forms
- ☐ Alternative consent
- ☒ Letters of support
- ☒ Recruiting tools
- ☒ Test instruments
- ☐ Attachment A: Radiation
- ☐ Alternative assent
- ☐ Project revision(s)
- ☐ External IRB approvals
- ☒ Translated documents
- ☐ Attachment B: Human materials
- ☐ Grant/contract
- ☐ Other:

Comments:

Principal Investigator responsibilities for fulfilling the requirements of approval:

- All study team members should be kept informed of the status of the research.
- Any changes to the research must be submitted to the IRB for review and approval prior to the activation of the changes. **This includes, but is not limited to, increasing the number of subjects to be enrolled.**
- Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.
- Only consent forms with a valid approval stamp may be presented to participants.
- Submit a continuing review application or final report to the IRB for review at least four weeks prior to the expiration date. Failure to submit a continuing review application prior to the expiration date will result in termination of the research, discontinuation of enrolled participants, and the submission of a new application to the IRB.

Appendix D

OSU Oregon State University
School of Biological and Population Health Sciences
Oregon State University, 203C Women's Building, Corvallis, Oregon 97331
Tel 541-737-8584 | **Fax** 541-737-6914 |

CONSENT FORM

Project Title:	Physical education's contribution to daily physical activity in children
Principal Investigator:	Joonkoo Yun
Student Researcher:	Wesley J. Wilson, Ryan Willoughby, Laurel Paige Perilli
Sponsor:	School of Biological and Population Health Sciences
Version Date:	**12/26/2013**

1. WHAT IS THE PURPOSE OF THIS FORM?

This form contains information you will need to help you decide whether your child will be in this research study or not. Please read the form carefully and if you have questions, please contact a researcher, Wesley Wilson, at wilsonwe@onid.orst.edu or 317-771-2031.

2. WHY IS THIS RESEARCH STUDY BEING DONE?

Childhood obesity is a national concern as one-third of youth is overweight or obese. These children are 70% more likely to become obese adults. The lack of physical activity (PA) is a large factor of this problem. Physical education (PE) is a good way to increase PA for children. However, there is a question of how much PE contributes to PA levels. The purpose of this study is to see how PEaffects its students' daily PA. Up to 200 students may be invited to take part in this study. The results of the study are intended for degree completion of the student researcher, presentation at a professional meeting, and publication in a research journal.

3. WHY IS MY CHILD BEING INVITED TO TAKE PART IN THIS STUDY?

Your child is being invited to take part in this study because he/she is a student in grades 3 through 5 who attends a weekly PE class.

4. WHAT WILL HAPPEN IF MY CHILD TAKES PART IN THIS RESEARCH STUDY?

Your child will wear a small activity monitor around the waist. This device will record his/her activity at three separate times. At each of these times, your child will wear the monitor for 5 days in a row. For example, your child may be asked to wear an activity monitor on Monday, October 28th for 5 days in a row. Then, your child may be asked to wear the activity monitor again on Wednesday, November 13th for another 5 days in a row. On the third time, we may ask your child to wear the monitor on Tuesday, December 3rd for 5 more days. Your child will be asked to wear the activity monitor all day (even at school) except when sleeping, swimming, and bathing.

Storage and Future use of data or samples: Information collected for this study is confidential. Only members of the research team will have access to identifiable information. The information that you and your child provide may be helpful for our future research. With your permission, we would like to keep your information to use in the future. Once the study is complete, the linked list of codes and identifiers will be destroyed. At this time, information cannot be removed from the researcher's database.

<u>Optional</u> future use of data

Because it is not possible for us to know what studies may be a part of our future work, we ask that you give permission now for us to use your child's personal information without being contacted about each future study. If you agree now to future use of data collected in this study, but decide in the future that you would like to have your child's data removed from research database, please contact Joonkoo Yun at 541-737-8584 or jk.yun@oregonstate.edu.

______You may store information about me and my child for use in future studies.
Initials

______ You may <u>not</u> store information about me and my child for use in future studies.
Initials

Study Results: It is expected that results from this study will be shared at conferences and through scientific journals.

5. WHAT ARE THE RISKS AND POSSIBLE DISCOMFORTS OF THIS STUDY?

There are no likely risks involved in this study. If for some reason the activity monitor causes the children any discomfort, or you desire to remove it, then the parents and/or child can take the device off at any point.

6. WHAT ARE THE BENEFITS OF THIS STUDY?

This study is not designed to benefit your child directly.

7. WILL I BE PAID FOR BEING IN THIS STUDY?

You and your child will not be paid for being in this research study; however your child will get to select a small gift for participating.

8. WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law. Research records will be stored securely and only researchers will have access to the records. Federal regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. Some of these records could contain information that personally identifies your child. If the results of this project are published your child's identity will not be made public.

To help ensure confidentiality, we will keep any identifiable information about you and your child in a stored securely in the Adapted Physical Activity Lab at Oregon State University.

However, there is a chance that we could accidentally disclose information that identifies you or your child.

9. WHAT OTHER CHOICES DO I HAVE IF I DO NOT TAKE PART IN THIS STUDY?

Participation in this study is voluntary. If you decide that your child will participate, you and/or your child are free to withdraw at any time without penalty. You and your child will not be treated differently if you decide to stop taking part in the study. If you or your child chooses to withdraw from this project before it ends, the researchers may keep information collected about your child and this information may be included in study reports.

10. WHO DO I CONTACT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact: Dr. Joonkoo Yun at 541-737-8584 or jk.yun@oregonstate.edu or Wesley Wilson at wilsonwe@onid.orst.edu or 317-771-2031.

If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at 541-737-8008 or by email at IRB@oregonstate.edu.

11. ASSENT STATEMENT

Written assent will be obtained from your child at school prior to his or her participation in the study. During this time, your child will be able to discuss any questions about the study with the researcher.

12. WHAT DOES MY SIGNATURE ON THIS CONSENT FORM MEAN?

Your signature indicates that you are granting your child permission to participate in this study. You will receive a copy of this form.

Do not sign after the expiration date: 12/26/2014

Participating Child's name (printed): ______________________________

Parent/Guardian's name (printed): ______________________________

______________________________ ______________________
(Signature of Parent/Guardian) (Date)

______________________________ ______________________
(Signature of Person Obtaining Consent) (Date)

School of Biological and Population Health Sciences
Oregon State University, 203C Women's Building, Corvallis, Oregon 97331
Tel 541-737-8584 | **Fax** 541-737-6914 |

FORMULARIO DE CONSENTIMIENTO

Project Title:	Contribución de la educación física a la actividad física diaria en los niños
Principal Investigator:	Joonkoo Yun
Student Researcher:	Wesley J. Wilson, Ryan Willoughby, Laurel Paige Perilli
Sponsor:	Escuela de Biología y Ciencias de la Salud Población
Version Date:	**12/26/2013**

1. ¿CUÁL ES EL PROPÓSITO DE ESTE FORMULARIO?

Este formulario contiene información que usted necesita para ayudarle a decidir si su hijo(a) estará en este estudio de investigación o no. Por favor, lea el formulario con cuidado y si tiene alguna pregunta, póngase en contacto con un investigador, Wesley Wilson al wilsonwe@onid.orst.edu o 317-771-2031.

2. ¿POR QUÉ ES ESTE ESTUDIO DE INVESTIGACIÓN QUE SE ESTÁ REALIZANDO?

La obesidad es un problema nacional, como un tercio de los jóvenes tienen sobrepeso o son obesos. Estos niños son 70% más de probabilidades de ser adultos obesos. La falta de actividad física (AF) es un factor que contribuye a este problema. Educación física (EF) es una manera buena para aumentar la AF para los niños. Sin embargo, hay una cuestión de cuánto EF contribuye a la AF de los alumnos. El propósito de este estudio es ver comó EF contribuye a niveles de la AF. Un máximo de 200 participantes podrán ser invitados a tomar parte en este estudio. Los resultados del estudio están destinados a grado realización del estudiante investigador, presentación en una reunión profesional, y publicación en una revista de investigación.

3. ¿POR QUÉ MI HIJO(A) ES INVITADO A TOMAR PARTE EN ESTE ESTUDIO?

Su niño(a) está invitado a participar en este estudio porque es un estudiante en los grados 3 a 5 y participa en clase de educación física.

4. ¿QUÉ PASARÁ SI EL NIÑO TOMA PARTE EN ESTE ESTUDIO DE INVESTIGACIÓN?

Su niño(a) llevará un monitor pequeño de actividad alrededor de la cintura. Este monitor se registre su actividad física en tres ocasiones distintas, durante 5 días consecutivos. Por ejemplo, es posible que su hijo(a) se le pedirá llevar un monitor de actividad el lunes, 28 Octubre para 5 días consecutivos. Entonces, su hijo(a) se le pedirá llevar el monitor de actividad otra vez el miércoles, 13 noviembre de 5 días consecutivos. Por último, en la tercera ocasión, nos puede pedir a su niño(a) a llevar el monitor de actividad el martes 3 diciembre de 5 días más. Su hijo(a) se le pedirá llevar el monitor de actividad todo el día (incluso tiempo en la escuela) excepto cuando al nadar, bañarse, o dormir.

Almacenamiento y uso futuro de datos o muestras: Información recogida por este estudio es confidencial.Sólo los miembros del equipo de investigación tendrá acceso a información personal. Es posible que la información de usted y su niño(a) podría ser útil para nuestros futuros trabajos de investigación. Con su permiso que nos gustaría mantener la información para utilizar en el futuro. Cuando se haya completado el estudio, la lista de los códigos y los identificadores serán destruidas. En este momento, la información no puede ser eliminado de la base de datos del investigador.

Opcional uso futuro de los datos:

Porque no es posible para nosotros conocer los estudios puede ser una parte de nuestro trabajo en el futuro, nosotros pedimos que se le da permiso ahora para nosotros para utilizar su información personal de su niño(a) sin ser contactado para cada estudio en el futuro. Si usted está de acuerdo ahora del futuro uso de los datos recogidos en este estudio, pero decide en el futuro que usted desea que los datos de su niño(a) son eliminados de la base de datos, póngase en contacto con Joonkoo Yun en 541-737-8584 o jk.yun@oregonstate.edu.

______ Usted puede almacenar información sobre mi hijo(a) para su uso en estudios futuros.
Iniciales

______ Usted **no** puede almacenar información sobre mi hijo(a) para su uso en estudios futuros.
Iniciales

Resultados del estudio: Es de esperar que los resultados de este estudio será compartida en conferencias y revistas científicas.

5. ¿CUÁLES SON LOS RIESGOS Y LAS POSIBLES MOLESTIAS DE ESTE ESTUDIO?

No hay riesgos previsibles involucrados en este estudio. Si por alguna razón el monitor de actividad hace que el niño de cualquier molestia, o el deseo de eliminarla, los padres y/o niño(a) puede quitar el dispositivo en cualquier momento.

6. ¿CUÁLES SON LAS VENTAJAS DE ESTE ESTUDIO?

Este estudio no está diseñado para beneficiar al niño directamente.

7. ¿ME PAGARÁ POR ESTAR EN ESTE ESTUDIO?

Usted y su niño(a) no será pagado por estar en este estudio de investigación; sin embargo, su hijo(a) recibirá obsequio pequeño por su participación.

8. ¿QUIÉN VERÁ LA INFORMACIÓN QUE NOSOTROS DAMOS?

La información que usted proporciona durante el estudio de investigación se mantendrá en secreto a la medida permitida por la ley. Documentación de la investigación se almacenará de forma segura y sólo los investigadores tendrán acceso a los registros. Agencias reguladoras del Gobierno Federal y la Junta de Revisión Institucional (un comité que revisa y aprueba los estudios de investigación) de Oregon State University pueden inspeccionar y copiar los registros relativos a la investigación. Algunos de estos registros pueden contener información que lo identifique personalmente su hijo(a). Si los resultados de este proyecto se han publicado la identidad del niño no se hará público.

Para ayudar a garantizar la confidencialidad, mantendremos información identificable sobre usted y a su hijo(a) en una almacena de forma segura en la Adapted Physical Activity Lab en Oregon State University. Sin embargo, hay una posibilidad que accidentalmente nosotros podríamos revelar información que identifica a usted o su hijo(a).

9. ¿QUÉ OTRAS OPCIONES TENGO SI NO VOY A PARTICIPAR EN ESTE ESTUDIO?

Participación en este estudio es voluntaria. Si decide que su hijo(a) va a participar, usted y/o su hijo(a) tienen la libertad de retirarse en cualquier momento sin ningún tipo de penalización. Usted y su niño(a) no será tratado de manera diferente si usted decide dejar del estudio. Si usted o su niño(a) elige a retirarse de este proyecto antes de que termine, los investigadores pueden mantener la información recogida sobre su hijo(a) y esta información puede ser incluida en los informes de estudios.

10. ¿A QUIÉN CONTACTO SI TENGO PREGUNTAS?

Si usted tiene alguna pregunta sobre este proyecto de investigación, por favor póngase en contacto con el Dr. Joonkoo Yun en 541-737-8584 o jk.yun@oregonstate.edu o Wesley Wilson en wilsonwe@onid.orst.edu o 317-771-2031.

Si usted tiene preguntas sobre sus derechos o bienestar como un participante, por favor póngase en contacto con la Oficina de Junta de Revisión Institucional de Oregon State Unversity, en 541-737-8008 o por correo electrónico a IRB@oregonstate.edu.

11. DECLARACIÓN DEL ASENTIMIENTO

Lo haremos obtenido asentimiento escrito de su hijo(a) en la escuela antes de su participación en el estudio. Durante este tiempo, su hijo será capaz de discutir cualquier pregunta sobre el estudio con el investigador.

12. ¿QUÉ MI FIRMA EN ESTE FORMULARIO DE CONSENTIMIENTO SIGNIFICA?

Su firma indica que da su permiso a su niño(a) a participar en este estudio. Usted recibirá una copia de este formulario.

No firmar después de la fecha de caducidad: 12/26/2014

Nombre del participante del niño (impreso): ____

Nombre de Padres/Tutores (impreso): ____

____ ______________________________
(Firma de Padres/Tutores) (Fecha)

____ ______________________________
(Firma de la persona que recibe consentimiento) (Fecha)

School of Biological and Population Health Sciences
Oregon State University, 203C Women's Building, Corvallis, Oregon 97331
Tel 541-737-8584 | Fax 541-737-6914 |

ASSENT FORM

Project Title: Physical education's contribution to daily physical activity in children
Principal Investigator: Joonkoo Yun
Student Researcher(s): Wesley J. Wilson, Ryan Willoughby, Laurel Paige Perilli
Sponsor: School of Biological and Population Health Sciences

We are asking you whether you want to be in a research study. Research is a way to test new ideas and learn new things. You do not have to be in the study if you do not want to. If you chose to be in the study, you can change your mind later.

Ask questions if there is something that you do not understand. After all of your questions have been answered, you can decide if you want to be in this study or not.

This study is about how physically active you are both in and outside of physical education.

We are asking you if you want to be in this study because you are in grades 3 through 5 at this school. If you take part in this study, we will ask you to wear an activity monitor around your waist on three separate occasions with each occasion lasting 5 days. An activity monitor is a small computer, about the size of a stamp, and it tells us how often you are doing activities like walking and playing sports. You will wear this activity monitor all day long. You will only take it off when you bathe, swim, or while you are sleeping.

Some things that might happen to you if you are in this study are no different than what happens to you on a normal day. We will write a report when the study is over, but we will not use your name in the report.

If you want to be in the study, sign your name on the line below.

Participant's Name (printed): ____

______________________________ ______________________________
(Signature of Participant) (Date)

______________________________ ______________________________
(Signature of Person Obtaining Assent) (Date)

School of Biological and Population Health Sciences
Oregon State University, 203C Women's Building, Corvallis, Oregon 97331
Tel 541-737-8584 | Fax 541-737-6914 |

FORMA DEL ASENTIMIENTO

Project Title: Contribución de la educación física a la actividad física diaria en los niños
Principal Investigator: Joonkoo Yun
Student Researcher(s): Wesley J. Wilson, Ryan Willoughby, Laurel Paige Perilli
Sponsor: Escuela de Biología y Ciencias de la Salud Población

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Le pedimos que si desea estar en un estudio de investigación. Investigación es una forma de poner a prueba nuevas ideas y aprender cosas nuevas. Usted no tiene que estar en el estudio, si no lo desea. Si eliges en el estudio, usted puede cambiar de opinión más adelante.

Puede pedir preguntas si hay algo que usted no entienda. Después de que todas las preguntas han sido contestadas, que usted puede decidir si desea estar en el estudio o no.

Este estudio es sobre su nivel de actividad física en la educación física y el resto del día.

Le pedimos que si quieres estar en este estudio porque está en los grados 3 a 5 en la escuela. Si usted toma parte en este estudio, le pediremos que se debe usar un monitor de actividad alrededor de la cintura en tres ocasiones distintas con una duración de 5 días para cada ocasión. Un monitor de actividad es un ordenador pequeño, del tamaño de un sello, y nos dice con qué frequencía usted está haciendo actividades como caminando y practicando los deportes. Llevará este monitor de actividad durante todo el día. Usted sólo tendrá que desactivar cuando está bañando, nadando, o mientras usted está durmiendo.

Algunas de las cosas que podría suceder a usted, si usted en este estudio no son diferentes de lo que le sucede a usted en un día normal. Vamos a escribir un informe al fín del estudio, pero no vamos a utilizar su nombre en el informe.

Si lo que quieres es estar en el estudio, firmando con su nombre en la línea de abajo.

Nombre del participante (impreso): ____

________________________________ ________________________
(Firma del Participante) (Fecha)

________________________________ ________________________
(Firma de la persona que recibe asentimiento) (Fecha)

Appendix E

Physical education's contribution to daily physical activity in children

Seeking research participants:
Children with and without disability in grades 3-5

The aim of this study is to understand how physical education contributes to children's daily physical activity

For more information please contact:

JK Yun, PhD (principal investigator)
Jk.yun@oregonstate.edu or
541-737-8584
School of Biological & Population Health Sciences
Movement Studies in Disability

Contribución de la educación física a la actividad física diaria en niño(a)s

Buscando los participantes para la investigación:
Los niño(a)s con y sin discapacidad
En los grados 3-5

El objetivo de este estudio es entender cómo la educación física contribuye a la actividad física diaria de los niño(a)s

Para obtener más información, póngase en contacto:
JK Yun, PhD (investigador principal)
Jk.yun@oregonstate.edu o
541-737-8584
Escuela de Biológicos y Ciencias de la Salud Población
Estudios del movimiento en discapacidad