Our nation’s schools are in a key position to promote regular physical activity through participation in quality physical education programs (Sallis & McKenzie, 1991). The ultimate long-term demonstration of each program’s impact is the students’ maintenance of an active lifestyle. Physical educators are consistently attempting to find different ways to promote lifetime physical activity within their programs. The pedometer is a useful, inexpensive, objective, and reliable measurement tool that may be used to promote and monitor physical activity. The purpose of this study was to evaluate the total daily physical activity levels of middle school students, and the contribution of physical education lessons. Physical activity levels of 48 middle school students were measured using pedometers during physical education as well as outside of class over a period of ten school days. A secondary focus was to evaluate the degree to which physical activity levels differed across
selected student characteristics (i.e., gender and body composition). The mean number of steps taken by the students was 12,993 per day, and 2,244 per day in physical education. A Pearson correlation was run to determine if there was a relationship between the time factor and the step factor. The correlation between the two was .99, providing further evidence that either time or steps can be used when measuring physical activity levels. A 2 x 2 (BMI x Gender) MANOVA was conducted on the mean number of steps taken during the day and the time spent in physical activity during the day. The results of the MANOVA indicated significant main effects for gender, $F(2, 43) = 6.73, p<.05$, and BMI, $F(2, 43) = 4.69, p<.05$, but no significant interaction between the two. In tests of between-subjects effects, both BMI and gender had significant effects on steps ($p=.006, p=.004$) and time ($p=.014, p=.001$), respectively. During the study, the students wore the pedometers sealed for the first five days, and unsealed for the last five days. A two-tailed, paired $t$-test was used to assess if there were any differences between the groups. Neither step counts, $t(8) = .75, p>.05$, nor time, $t(8) = .49, p>.05$, were significantly different between the sealed and unsealed days. Physical education did provide a considerable amount of physical activity for the students (17% of their daily step totals). Our findings also reconfirm, using different methods, what other studies have reported regarding the differences between physical activity levels of males versus females, and ‘healthy’ versus ‘at risk’ populations.
Physical Education's Contribution to the Total Daily Physical Activity Levels of Middle School Students

by
Heidi M. Wegis

A THESIS submitted to Oregon State University

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APPROVED:

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Chair of the Department of Exercise and Sports Science

Redacted for Privacy

Dean of the Graduate School

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Heidi M. Wegis, Author
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Physical Education's Contribution to the Total Daily Physical Activity Levels of Middle School Students

Introduction

Our nation's schools are in a key position to promote regular physical activity through participation in quality physical education programs (Sallis & McKenzie, 1991) based on national content standards (National Association for Sport and Physical Education [NASPE], 2004a). These content standards provide a foundation for the design and implementation of a quality physical education program, from kindergarten through grade 12. These quality programs are designed to develop health-related fitness, physical competence and confidence, and students' knowledge in relation to physical fitness. One of the key long-term outcomes of physical education programs is to have students develop and maintain a physically active lifestyle. Physical educators are consistently attempting to find different ways to promote lifetime physical activity within their programs. The pedometer is a useful, inexpensive, objective, and reliable measurement tool that may be used to promote and monitor physical activity.

The Center for Disease Control and Prevention ([CDC], 1997) presented a set of guidelines for school and community health programs to promote physical activity participation. Many other government and health promotion agencies (e.g., National Institutes of Health [NIH], United States Department of Health and Human Services [USDHHS], The President's Council on Physical Fitness and Sport) have presented similar information, with the ultimate recommendation being to increase physical activity levels of children and youth. Consequences of physical inactivity have been at the forefront of recent surges in advocating for quality physical education programs.
Regular physical activity reduces the risk of chronic illness and increases overall wellness (American Heart Association, 1992; USDHHS, 1996, 2000).

Exercise behavior patterns are established during childhood and adolescence. Therefore, if we are to reverse the trend toward increased physical inactivity and obesity, it is critical that children and youth become more physically active and maintain those levels as they grow into adults (Kulinna, Martin, Lai, Kliber & Reed, 2003). Published guidelines suggest that children and youth need at least 60 minutes of accumulated physical activity on all or most days of the week (Corbin & Pangrazi, 2003; Sallis & Patrick, 1994; NASPE, 2004b). Observational studies have shown that children engage in start-stop activity throughout the day, half of which is sedentary activity (Corbin & Pangrazi, 1998; Council on Physical Education for Children [COPEC], 2004; Steinbeck, 2001; Bailey, Olson, et al, 1995).

Other than the Healthy People 2010 (USDHHS, 2000) national health objectives specific to physical education, there are no standards for how many minutes students should spend being physically active during physical education classes. There are also few data regarding how the amount of physical activity received in physical education relates to the total activity levels during the day (McKenzie, 2001). Despite these shortcomings in the research, the CDC (1997) recommended that all students in grades K-12 be provided a comprehensive, daily physical education. The Healthy People 2010 document added to that recommendation by stating that at least 50% of class time should be in physical activity (USDHHS, 2000). Meeting these recommended objectives would assure that students get a substantial percentage of the daily total physical activity recommendation (USDHHS, 2000; Sallis, & Patrick,
However, recent studies have shown that many schools have reduced allocated curriculum time in physical education (e.g., Burgeson, Wechsler, Brener, Young, & Spain, 2001; NASPE, 2001). According to Burgeson, et al., (2001), the percentage of schools that require physical education in each grade declines from 50% in grades 1 through 5, to 25% in grade 8, to 5% in grade 12. Furthermore, numerous other studies using direct observation at elementary and middle school levels have shown that physical activity levels in physical education classes fall well short of the HP 2010 objectives (McKenzie, Nader, et al., 1996; Stone, McKenzie, Welk, & Booth, 1998) providing little physical activity time (Simons-Morton, Taylor, Snider, Huang, & Fulton, 1994; Simons-Morton, Eitel, & Small, 1999).

Despite the findings that the amount of physical activity in physical education classes falls short of the suggested levels, researchers have provided good evidence that quality programs can lead to increases in physical activity in physical education classes (Simons-Morton, Parcel, Baranowski, Forthofer, & O’Hara, 1991; Sallis & McKenzie, 1997; McKenzie, Sallis, et al., 2004). Not only does physical education provide children with a significant portion of the physical activity recommended, it also helps students develop the knowledge and skills needed for the development of lifelong physical activity (CDC, 1997; Sallis & McKenzie, 1991; USDHHS, 1996).

One goal of physical education should be to promote physical activity in youth and ultimately throughout life (Corbin, 2002; CDC, 1997; NASPE, 1995; USDHHS, 1991, 2000). It has been suggested that students who participate in physical activity during their physical education will compensate by reducing their after-school activity levels (Rowland, 1998). However, Dale (1999) presented findings that the activity
performed during physical education does not reduce after-school activity levels. On the contrary, it was shown to positively contribute to the overall activity during the day. In a subsequent study involving 76 nine-year old children, accelerometers, instruments that measure acceleration in a single plane, were used to assess the influence of an experiment protocol on the children’s day. On days when the children worked on computers during their breaks and had no physical education classes, their after-school physical activity was significantly lower than on days when children participated in breaks outside and had physical education (Dale, Corbin, & Dale, 2000). Using the Self-Administered Physical Activity Checklist, Myers, Strickmiller, Webber, and Berenson (1996) found that although most physical activity occurred after school, children who reported no physical education class during school had less physical activity overall.

Mediating Variables That Affect Physical Activity Levels in Youth

Differences have been reported between physical activity patterns, gender, and body composition. During adolescence, gender differences in the amount of physical activity accrued during the day become more evident. Studies consistently show that males participate in more total and vigorous daily physical activity than females (USDHHS, 1996; McKenzie et al., 1995; Caspersen, Pereira, & Curran, 2000; Hovell, Sallis, Kolody, & McKenzie, 1999; Trost, Pate, Sallis, et al., 2002; Raustorp, Pangrazi, Stahle, 2004; Myers, Strikmiller, Webber, Berenson, 1996; Wilde, Corbin, Le Masurier, 2004). The relationship between physical activity levels and the percentage of body fat shows a decrease in the amount of physical activity among children who are overweight (Steinbeck, 2001; Berkey et al., 2000). Bar-Or and
Baranowski (1994) also reported that obese children tend to be less physically active than non-obese children. However, Ward and Evans (1995) reported that when total energy expenditure is measured, there appears to be little to no difference between the two populations.

Assessment of Physical Activity

Historically, when school physical education programs have been asked to demonstrate their progress toward desired outcomes, fitness testing has been the most common form of showing impact. However, a recent shift in ideas is changing the emphasis from physical fitness to physical activity. The goal is now to demonstrate that physical education is helping children to develop a healthy lifestyle. Physical educators must try to provide evidence that their students are becoming more active during both physical education class and beyond. Corbin, Pangrazi, & Welk (1994) specify that the total amount of physical activity should be considered when implementing and evaluating physical education programs. Therefore, measuring the accumulated physical activity of students throughout the day using pedometers is a way to assess progression toward the health guidelines.

One of the overarching goals behind the physical activity promotion movement is to reach the point where once adolescents reach adulthood, they will be able to enhance their quality of life through physical activity. In order to determine if the quality of life has been improved, measurement techniques must be created to track physical activity levels and health patterns. Valid and reliable measurement tools and procedures are needed in order to collect accurate data (Kohl, Fulton, & Caspersen, 2000). Current measurement techniques being used by physical education instructors
include direct observation, heart-rate monitoring, accelerometry and the use of pedometers (Welk, 2002; Beighle, Pangrazi, & Vincent, 2001). Self-report questionnaires are another tool used to assess physical activity. Self-report questionnaires offer a subjective tool for measuring physical activity. Researchers and practitioners are becoming more interested in using objective measurement tools, including pedometers (Tudor-Locke & Myers, 2001; Rowlands, Eston, & Ingledew, 1997).

The main use of the pedometer is to help the students monitor their daily activity levels and to set goals. Yamanouchi, Shinozaki, and Chikada (1995) reported 10,000 steps as the target goal for individuals to meet the national health recommendations for adults. Welk et al. (2000) provided evidence that aligns with this recommendation. However, other studies have suggested this may not be an appropriate goal for everyone (e.g., Wilde, Sidman, and Corbin, 2001). Learning to set goals, based on individual differences and different circumstances, is a beneficial tool that will promote higher levels of performance and responsibility.

Tudor-Locke and Myers (2001) presented methods and protocols for collecting pedometer data in order to ensure the consistent use of pedometers and accurately interpret and compare results. The authors provide a description of the options available for using the pedometers, including choice of metric, length of monitoring frame, data recording, and collection procedures. They also reviewed 32 published studies, using cross-sectional, observational, and intervention procedures, to compare results assessing ambulatory activity patterns. These findings reveal expected values
for 8-10-year-old children to be 12,000-16,000 steps/day, and 7,000-13,000 steps/day for relatively healthy young adults.

The range of steps during a 30-minute physical education lesson has been shown to vary from 1,200 to 2,000, depending on the age-level and lesson (Keating, 2001). This is approximately 9-15% of the estimated daily step totals reported by Tudor-Locke and Meyers (2001) for healthy young adults. Scruggs, Beveridge, & Watson (2003) reported it would be reasonable to expect approximately 1,800 steps from elementary school children (grades 1-2) during a 30-minute physical education class. Currently, there is no study that has a target range for the number of steps taken by students in middle school physical education classes. Using the finding, and a minimum standard of 11,000 steps/day (President’s Council on Physical Fitness and Sport, 2002) for children, physical education would contribute approximately 16% of a child’s total daily steps. We can expect this number to decrease as children age (Goran, Gower, Nagy, & Johnson, 1998; Hovell, Sallis, Kolody, & McKenzie, 1999).

The monitoring frame mentioned above refers to the minimum amount of time (generally expressed in number of days) participants should wear the pedometer. Results of several studies have shown that approximately three to five days of monitoring is sufficient to assess the usual physical activity of children in grades 1-6, and eight to nine days of monitoring would be needed for adolescents. These results indicated that children in grades 1-6 have less day-to-day variability in their moderate-to-vigorous physical activity patterns (Gretebeck & Montoye, 1992; Trost, Pate, Freedsom, Sallis, & Taylor, 2000; Vincent & Pangrazi, 2002).
Another concern revolves around the possible reactivity of children wearing the pedometers. Data can be recorded by the research practitioner or by students. Either way, participants may alter their behavior patterns because they are aware of the monitoring. Vincent and Pangrazi (2002) completed a study to determine reactivity in elementary school children. The pedometers were sealed and worn for eight days, and no reactivity was found. Sealing the pedometers may help prevent reactivity from occurring because the participants will not be aware of their activity levels. Ozdoba, Corbin, and Le Masurier (2004) did a follow-up on the Vincent and Pangrazi study by looking at the amount of reactivity with unsealed pedometers and the occurrence of lost data because of accidental or intentional resets. The results of their study indicate that reactivity does not occur when monitoring children’s physical activity with unsealed pedometers. However, they also reported an increase in the amount of unusable data when the pedometers were unsealed, leading to the recommendation that for research purposes, it may be best to use sealed pedometers.

Pedometers can be used to motivate and promote physical activity as they provide immediate feedback to individuals regarding their current activity. Pedometers can also encourage parents to get involved in physical activity along with their children. Being able to monitor and track one’s own physical activity levels can provide some motivation for utilizing the pedometer. Pedometers can be used to assess, promote and teach physical activity in numerous settings (Tudor-Locke & Bassett, 2004). The use of this tool allows physical educators to determine how much physical activity the students are getting.
Therefore, the primary purposes of this study were to evaluate (a) the total daily physical activity (PA) levels of middle school students, (b) physical education’s contribution to the daily PA total over ten school days, and (c) differences in PA levels according to gender and BMI. Secondary goals of the study were to evaluate (a) the correlation between two different indicators of physical activity (i.e., step counts and time spent in physical activity) as measured by pedometers and (b) whether students’ physical activity levels would be different depending on whether the pedometers were sealed.
Methods

Participants

Following approval by the Institutional Review Board at a northwestern University, students (N=48) enrolled in eighth grade physical education at a nearby middle school were recruited for participation in this study. Researchers addressed all eighth grade physical education classes at the middle school using a pre-written script (see Appendix D). Students were asked to volunteer to participate in the study. Participant population was not restricted to any gender or ethnic groups.

To be included in the data analysis of this study, students had to participate at least eight of the ten days that data were collected. The number of eighth-grade students who completed at least eight days was 48. Of this sample, 42% were male, and 58% were female. The ethnic characteristics of this sample were as follows: 88% white, 6% Asian, 4% had a combination of ethnicities, and 2% Hispanic/Latino. Of the study’s population, 67% lived in households with income levels over $50,000. The demographics of this study reflect the general population of the school, in both ethnicities and income level.

Participants were placed into one of the following two BMI categories: healthy and at-risk. These categories are based on the Centers for Disease Control BMI classification (CDC, 2000). ‘Healthy’ individuals are those students who, on a BMI-for-age chart, are located in the >5th to <85th percentile. ‘At-risk’ individuals are those students who are located in the =5th to =85th percentile. Individuals in the =5th percentile are underweight, and individuals in the =85th percentile are either overweight or at risk for being overweight.
Data Collection

Walk-4-Life Pedometers (Model LS-2525) were provided to each of the participants. This model has multiple features, including step count, mileage conversion, exercise time, caloric burn counter, and a standard clock. It also comes with the delayed reset button, making it difficult to accidentally reset the pedometer. A pedometer is a reliable device to collect data on physical activity on two key variables: “Step count” and “time spent in PA.” It hooks on the waistband of the participants’ pants or shorts and measures vertical movement.

Pedometers measure ambulatory physical activity (walking and running) by detecting the vertical changes in movement produced by each step. The pedometer provides immediate feedback regarding activity levels. The accuracy and reliability of the pedometer has been demonstrated in numerous studies, making it an acceptable measurement device for children, adolescents and adults (Eston, Rowlands, & Ingledew, 1998; Kilanowski, Consalvi, & Epstein, 1999; Beighle & Pangrazi, unpublished).

Procedures

Prior to the first week of data collection, the students were given an orientation to the use of pedometers. The correct placement and use were demonstrated and they were allowed to practice proper placement. The students were also given the opportunity to perform a walking test and check the accuracy of the pedometer. At this time, the interested students were asked to fill out consent forms and questionnaires, and given parental consent forms to take home. Only students who returned signed parental consent forms prior to the start of data collection were
allowed to participate. Each student was assigned a number that corresponded to the number on his or her pedometer. During the first week of data collection, each student’s height and weight was taken, so each student’s Body Mass Index (BMI) could be determined. BMI was employed as the indicator of body fatness.

Students were also given a survey regarding their gender and past and present physical activity habits. The students’ parents were also given a survey regarding socioeconomic status, ethnicity, and their own physical activity habits (see Appendix F). Each day during the study, students were asked to complete a Previous Day’s Activity (PDA) sheet (see Appendix H), designed to provide information on the type of activities performed outside of class. This was done primarily to determine whether the corresponding pedometer values were either exceedingly high or low compared to the counts from previous days, whether the pedometer might have a malfunction, confirm that they wore the pedometer the entire time and to report the kinds of activity they did the previous day.

The students were given their sealed pedometers on a day when their physical education classes were completing an in-class test. Students were encouraged to maintain their normal activity patterns. They were asked to wear the pedometer for the rest of the day until they went to bed. The next morning, the students were to put the pedometer back on and wear it until they returned to physical education. Upon arrival in the gym, the students returned their pedometers prior to dressing down, filled out a Previous Day’s Activity (PDA) sheet, and then proceeded to the locker room to change into activity clothing. During this time, data on “step counts” and “time spent in PA” were collected from the pedometers. Unsealed pedometers were then returned
to students prior to the start of class. At the end of class, students returned the
pedometers, and data were recorded while the students changed into their regular
clothes. The pedometers were then sealed with cable ties and returned to the students
before they left. This process was repeated on Thursday of week one.

On Friday, the students were asked to wear the pedometer to school, leave the
pedometer in the container, fill out a PDA sheet, and proceed to change for physical
education. Data were recorded, but the pedometer was not returned to the student. This
process was repeated for week two, with the exception of the pedometers being
returned unsealed following the fifth day of data collection. The pedometers were not
sealed for the remainder of the study. A detailed protocol can be found in Appendix I.

Data Analysis
Data were analyzed using the STATA statistical software (StataCorp, 2003) and SPSS
11.0 statistical software (Green & Salkind, 2003). Descriptive statistics providing
means and standard deviations were performed on step counts taken following
physical education lessons, and for the entire day. The same descriptive data were
generated for “time spent in PA.” A 2x2 (BMI x Gender) multivariate analysis of
variance (MANOVA) was conducted to test the strength of the evidence for all
comparisons (physical activity levels, gender, and BMI). A Pearson correlation was
run to determine if there was any relationship between the time and step count factors.
Finally, a paired t-test was used to assess step count differences between sealed and
unsealed days.
Results

Participant Characteristics

Data on students' height, weight, and BMI are provided in Table 1. Males had greater variation in height (male SD 3.64, female SD 2.42) and weight (male SD 34.23, female SD 24.42), but were almost equal to the females in BMI classification (male SD 4.22, female SD 4.02).

Based on the Centers for Disease Control BMI classifications (CDC, 2000), of the participants in this study, 29% were classified as either "overweight" or "at risk for overweight." In the remainder of this paper, individuals in these categories will be referred to as "at risk." Eight females and six males were classified in this category. These findings are in line with the findings from the CDC, females typically have a higher percentage of overweight individuals than males.

Table 1. Physical Characteristics of Participants.

<table>
<thead>
<tr>
<th></th>
<th>Females (n=28)</th>
<th>Males (n=20)</th>
<th>All (n=48)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Height (in.)</td>
<td>63.8</td>
<td>2.42</td>
<td>66.55</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>124.48</td>
<td>24.42</td>
<td>139.05</td>
</tr>
<tr>
<td>BMI ([weight/height^2]*703)</td>
<td>21.51</td>
<td>4.02</td>
<td>21.93</td>
</tr>
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</table>

Students' Physical Activity Levels in Step Counts

The average number of steps taken per day by the students over the entire ten-day period was 12,993. The average number of steps taken per day by the students
during their physical education class was 2,244. This represents approximately 17% of their daily step totals. Figure 1 shows the average number of steps taken each day for the entire group, also depicting the change from sealed versus unsealed pedometers. Figure 2 shows the average number of steps taken each day in physical education class for the entire group. Figure 3 shows the average number of steps taken per day by each gender, and Figure 4 depicts the average number of steps taken each day in physical education class for each gender. The vertical bars in the graphs represent standard deviations depicting confidence intervals.

![Graph](image)

Figure 1. Mean number of steps taken per day. The vertical line between days 5 and 6 indicates the split between the sealed pedometer days and the unsealed pedometer days.
Figure 2. Mean number of steps taken per day in physical education class.

Figure 3. Gender differences in the mean number of steps taken per day.
Figure 4. Gender differences in the mean number of steps taken per day in physical education.

*Relationship of Step Counts in Physical Education with Daily Total Step Counts*

The means and standard deviations of the number of steps taken per day and in physical education, by gender and BMI status are shown in Table 2.
Table 2. Mean and Standard Deviation of the Average Number of Steps per Day and in Physical Education for Gender and BMI Status.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Day</th>
<th>PE Class</th>
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<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14525</td>
<td>3827</td>
</tr>
<tr>
<td>Female</td>
<td>11355</td>
<td>2420</td>
</tr>
<tr>
<td>BMI Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy</td>
<td>13390</td>
<td>3409</td>
</tr>
<tr>
<td>At Risk</td>
<td>10940</td>
<td>2916</td>
</tr>
</tbody>
</table>

A one-way analysis of variance showed a significant difference in the mean number of steps taken per day between males and females ($p=.001$). A two-way analysis of variance showed a significant difference between the mean number of total steps per day and BMI status ($p=0.02$), $F(1,46) = 5.54$, $p<.05$, but no significant interaction between the mean number of steps taken in PE and BMI status ($p=0.17$), $F(1,46) = 1.96$. This is demonstrated in Figures 5 and 6.

A 2 x 2 (BMI x Gender) MANOVA was conducted on the mean number of steps taken during the day and the time spent in physical activity during the day. The results of the MANOVA indicated significant main effects for gender, $F(2,43) = 6.73$, $p <.05$, and BMI, $F(2,43) = 4.69$, $p<.05$, but no significant interaction between the two. In tests of between-subjects effects, both BMI (favoring healthy body composition) and
gender (favoring boys) had significant effects on steps ($p=.006$, $p=.004$) and time ($p=.014$, $p=.001$), respectively. The BMI status box plots in Figure 7 make clear the difference among means.

Figure 5. Two-way analysis of variance depicting a significant difference between the mean number of total steps per day and BMI status

Figure 6. Two-way analysis of variance depicting no significant difference between the mean number of steps taken in PE and BMI status
Students' "Time Spent" in Physical Activity

On average, students spent approximately 21 minutes involved in physical activity during their physical education class. Males (22.8 minutes) were active for longer periods of time than females (19.7 minutes). This is over the amount of time recommended by the Healthy People 2010 document (50% of class time). Officially, each class period was 46 minutes in length. However, the students did not wear the pedometers at the beginning and the end of class when they were changing clothes. During those times, data were recorded from the pedometers prior to returning it to the students. Consequently, students actually wore the pedometers for approximately 36 minutes. Thus, on average, students were active approximately 60% of the class time. Over the entire day, students were active an average of 135 minutes. This is well over the recommended 60 minutes of physical activity (Corbin & Pangrazi, 2003; Sallis & Patrick, 1994; National Association for Sport and Physical Education, 2004b). From a
time perspective, physical education provided approximately 15.6% of the students’ physical activity. A Pearson correlation was run to determine if there was a relationship between the time and step factors. The correlation between the two was .99, providing further evidence that either time or steps can be used when measuring physical activity levels. Table 3 provides the descriptive statistics for the amount of
time spent in physical activity throughout the day for participants of each gender and BMI category.

Table 3. Descriptive statistics for gender and BMI category indicating amount of time spent physically active throughout the day.

<table>
<thead>
<tr>
<th>BMI</th>
<th>Gender</th>
<th>Mean (minutes)</th>
<th>Standard Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>Male</td>
<td>166.27</td>
<td>36.59</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>124.75</td>
<td>21.86</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>141.85</td>
<td>35.12</td>
<td>34</td>
</tr>
<tr>
<td>At-Risk</td>
<td>Male</td>
<td>132.47</td>
<td>33.13</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>110.61</td>
<td>26.9</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>119.9</td>
<td>30.63</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>Male</td>
<td>156.13</td>
<td>38.18</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>120.7</td>
<td>23.8</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>135.47</td>
<td>35.02</td>
<td>48</td>
</tr>
</tbody>
</table>

Figures 8 and 9 demonstrate total averages and averages by gender for time spent physically active during the entire day. Figures 10 and 11 demonstrate total
averages and averages by gender for time spent physically active during physical education.

Figure 8. Average time spent physically active during the day.

Figure 9. Average time spent physically active during the day by gender.
Figure 10. Average time spent physically active during physical education.

Figure 11. Average time spent physically active during physical education by gender.

**Student Reactivity to Wearing Pedometers**

During the study, the students wore the pedometers sealed for the first five days, and unsealed for the last five days. There was a slight increase in the average number of
steps taken during those two separate periods. Figures 12 and 13 graphically depict those differences. However, a two-tailed, paired \( t \)-test established that this difference was not statistically significant for either step counts, \( t(8) = .75, p > .05 \), or time, \( t(8) = .49, p > .05 \).

![Figure 12](image.png)

Figure 12. Variation in steps between days of sealed versus unsealed pedometers.
Figure 13. Variation in time between days of sealed versus unsealed pedometers.
Discussion

The major finding of this investigation was that the average percentage of the contribution of physical education on the daily physical activity levels of students was approximately 17%. This falls at the high end of the findings of Tudor-Locke and Myers (2001), Keating (2001), and Scruggs, Beveridge, and Watson (2003). It also surpasses the recommendation of the President’s Council (2002) for the number of steps children should take each day. There were differences in the number of steps taken between males and females. On four days, females fell below the recommended number of steps to be taken during the day.

Other findings of this investigation align with previous studies performed relative to gender and BMI differences. Over the eight days, males took, on average, approximately 3,000 more steps than did the female participants. Although based on the use of different measurement tools (e.g., self-report and direct observation), this study’s data confirm previous research findings (USDHHS, 1996; McKenzie et al., 1995; Caspersen, Pereira, & Curran, 2000; Hovell, Sallis, Kolody, & McKenzie, 1999).

The difference in total daily steps between the individuals in the ‘healthy’ body composition group and the ‘at-risk’ body composition group, also is in agreement with previous studies by Steinbeck (2001), Berkey et al. (2000), and Bar-Or and Baranowski (1994), who found that obese children tend to be less physically active than non-obese children.

However, as the data in this study demonstrate, this difference in total daily steps emerged outside of the physical education period, since both BMI groups had
similar step counts during physical education. This can be explained by the structured physical education program this group of students was provided on a daily basis. Each student was required to participate fully in physical education and given an opportunity to find activities that were enjoyable to them.

Figure 2 shows the breakdown of the average number of steps taken during certain days in physical education. On three of the days, the students were to set up their own individual workouts with a goal to increase their heart-rate while exercising. The activities included basketball, rollerblading, scooter-ball, walking, tennis, soccer, football, volleyball, and exercising to fitness videos. These days were labeled as fitness days on Figure 2. The skill days were days when the students were learning how to play tennis. On these days, because of equipment shortages, half the class would practice their tennis skills, while the other half would participate in a game of kickball. It was during these class periods that the averages for the entire day were higher (13,000-15,000 steps) than the averages on the fitness days (11,000-14,000), which is the opposite of what one would expect. This is most likely because on fitness days, the students were spread out all over campus and had very little supervision. The researchers observed many students off-task or working at very low intensity levels.

On skill days, the group received about 20% of their total physical activity from physical education. On fitness days, the group received only about 14% of their total physical activity from physical education. The final group was composed of fitness testing days. During the first day of fitness testing, the students participated in pushups and curlups, which do not consistently register on the pedometers, and averaged about 11,000 steps. On day two of fitness testing, the students averaged
13,000 steps by participating in the mile run, the 20-minute walk/run, or the PACER test.

On the sixth day of data collection, the pedometers were returned to the students without the zip ties. This was done to in an attempt to determine if any differences would emerge in step counts if students were allowed to self-monitor how many steps they were accumulating. Ozdoba, Corbin, and Le Masurier (2004) followed up on the Vincent and Pangrazi (2002) study by looking at the amount of reactivity with unsealed pedometers. They came to the conclusion that for research purposes, it may be best to use sealed pedometers. In this study, the average number of steps taken on “sealed” days was slightly lower (M=12,668) than during “unsealed” days (M=13,319), which aligns with the findings of Ozdoba, Corbin, and Le Masurier (2004). This suggests that with middle school students sealing pedometers may not be as critical.

The component of time was also studied, and we found that students spent approximately 21 minutes involved in physical activity during their physical education class. This amount of time surpasses the Department of Health and Human Services (USDHHS, 2000) recommended amount of 50% per class. Further, physical education provided approximately 15.6% of the students’ daily physical activity.

Statistically, the components of time and step count had an almost perfect relationship. This finding is important because many of the physical activity recommendations are stated using measures of time and not step count (e.g., Department of Health and Human Services recommendation of 50% of class time),
and therefore provides further evidence that either time or steps can be used when doing research on the physical activity levels of students.

There were a few limitations to this study. Only eighth-grade students from one middle school participated, and these students were taught by the same instructor. Another limitation was that the pedometer cannot measure frequency or intensity of physical activity. It also does not measure activities such as biking and swimming, which are activities commonly participated in. Participation in this study was voluntary, however, the results can be generalized to certain middle school physical education populations participating in programs of similar curricular design. In terms of measuring the intensity levels of the students' activities, especially outside of physical education, the use of pedometers carries with it some inherent limitations, as well. However, this study shows that, despite its limitations, pedometers can provide valid and reliable results that are acceptable for physical education.

Future research in the area will be needed to focus on the influence of parental physical activity habits on children's physical activity levels utilizing pedometers. The purpose of this kind of study would be to determine if there is a correlation between a parent's activity levels and his/her child's physical activity levels.

In conclusion, we found physical education did provide a significant amount of physical activity for the students. Our findings also reconfirm, using different methods, what other studies have reported regarding the differences between physical activity levels of males versus females, and 'healthy' versus 'at risk' populations.
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Appendices
Appendix A
Literature Review

Evidence regarding the health benefits associated with regular physical activity has been presented to the public in numerous research studies and position statements (Center for Disease Control and Prevention [CDC], 1997; Lambert, 2000; Ekblom & Astrand, 2000; Corbin, Lindsey & Welk, 2000; American Heart Association [AMA], 1992). Despite this knowledge, there are still a significant number of individuals, children and adults alike, who do not get the recommended daily amount of physical activity. Our nation’s schools are in a key position to promote regular physical activity through participation in quality physical education programs (e.g., Sallis & McKenzie, 1991) based on national content standards (National Association for Sport and Physical Education [NASPE], 2004a). These content standards provide a foundation for the design and implementation of a quality physical education program, from kindergarten through grade 12. These quality programs are designed to develop health-related fitness, physical competence and confidence, and students’ knowledge in relation to physical fitness.

One of the key long-term outcomes of physical education programs is to have students develop and maintain a physically active lifestyle. The ultimate long-term demonstration of each program’s effectiveness is the students’ maintenance of an active lifestyle. Physical educators are consistently attempting to find different ways to promote lifetime physical activity within their programs. The pedometer is a useful, inexpensive, objective measurement tool that may be used to promote and monitor physical activity. This review of literature will provide information on (a) the importance of physical activity, (b) the characteristics and value of a quality physical
education program, (c) physical activity differences between gender and body composition, (d) the necessity of measuring physical activity, and finally, (e) the use of pedometers to quantify youth physical activity behaviors.

Importance of Physical Activity

The Center for Disease Control and Prevention (CDC, 1997) presented a set of guidelines for school and community health programs to promote physical activity participation. Many other government and health promotion agencies (i.e., National Institutes of Health [NIH], United States Department of Health and Human Services [USDHHS], The President’s Council on Physical Fitness and Sport) have presented similar information, with the ultimate recommendation being to increase physical activity levels of children and youth. Consequences of physical inactivity have been at the forefront of recent surges in the advocating of quality physical education programs. Obesity levels, cardiovascular risk factors, and type 2 diabetes cases among youth are at an all-time high in this country (USDHHS, 1996, 2000; CDC, 1997). Participation in physical activity can provide some protection and health benefits to children in these areas (Nation’s Health, 2001; CDC, 1997; Corbin, Lindsey, & Welk, 2000; USDHHS, 1996). Regular physical activity reduces the risk of chronic illness and increases overall wellness (AMA, 1992; USDHHS, 1996, 2000).

Despite the wealth of information on the protective effects of physical activity, a substantial amount of individuals in the population do not participate in regular physical activity. Furthermore, approximately 50% of the individuals who begin an exercise program will drop out between the first three to six months (Dishman, 1993).
Along those same lines, 30% of adults report they do not participate in leisure-time physical activity (USDHHS, 1996).

Exercise behavior patterns are established during childhood and adolescence. Therefore, if we are to reverse the trend toward increased physical inactivity and obesity, it is critical that children and youth become more physically active and maintain those levels as they grow into adults (Kulinna, Martin, Lai, Kliber & Reed, 2003). Published guidelines suggest that children and youth need at least 60 minutes of accumulated physical activity on all or most days of the week (Corbin & Pangrazi, 2003; Sallis & Patrick, 1994; NASPE, 2004b). Observational studies have shown that children engage in start-stop activity, half of which is sedentary activity (Corbin & Pangrazi, 1998; Council on Physical Education for Children [COPEC], 2004; Steinbeck, 2001; Bailey et al, 1995). Because of this, children should be given multiple periods of moderate activity (Corbin & Pangrazi, 1998; COPEC, 2004). These periods can be provided in structured and unstructured opportunities (Kohl & Hobbs, 1998; Sallis & McKenzie, 1991).

Other than the Healthy People 2010 (USDHHS, 2000) national health objectives specific to physical education, there are no standards for how many minutes students should spend being physically active during physical education classes. There are also few data regarding how the amount of physical activity received in physical education relates to the total activity levels during the day (McKenzie, 2001). Despite these shortcomings in the research, the CDC (1997) recommended that all students in grades K-12 be provided a comprehensive, daily physical education. The Healthy People 2010 document added to that recommendation by stating that at least 50% of
class time should be in physical activity (USDHHS, 2000). Meeting these recommended objectives would assure that students get a substantial percentage of the daily total physical activity recommendation (USDHHS, 2000; Sallis, & Patrick, 1994). However, recent studies have shown that many schools have reduced allocated curriculum time in physical education (e.g., Burgeson, Wechsler, Brener, Young, & Spain, 2001; NASPE, 2001). According to Burgeson et al., (2001), the percentage of schools that require physical education in each grade declines from 50% in grades 1 through 5, to 25% in grade 8, to 5% in grade 12. Furthermore, numerous other studies using direct observation at elementary and middle school levels have shown that physical activity levels in physical education classes fall well short of the HP 2010 objectives (McKenzie, Nader, et al., 1996; Stone, McKenzie, Welk, & Booth, 1998) providing little physical activity time (Simons-Morton, Taylor, Snider, Huang, & Fulton, 1994; Simons-Morton, Eitel, & Small, 1999).

In a study observing third grade students, Nader (2003) reported the children received two, 33-minute physical education sessions per week. During this combined time, only 25 minutes were spent in moderate to vigorous physical activity (MVPA). These results provide further evidence of the shortcomings of reaching the recommended physical activity levels presented in Healthy People 2010.

Vincent and Pangrazi (2002a) conducted a study that looked at the day-to-day activity patterns of elementary school children. Previous studies reported the inactivity of America’s youth, as well as the decrease in activity levels with age (Hovell, Sallis, Kolody, & McKenzie, 1999; Goran, Gower, Nagy, & Johnson, 1998). In contrast to these studies, Vincent and Pangrazi found that children’s activity levels remain fairly
consistent from 6-12 years of age. This study utilized pedometers to assess physical activity levels, providing a direct, objective measure.

Daily physical activity recommendations are not being met through physical education alone, so physical education programs should promote physical activity outside the school setting. In a study conducted by Sallis & McKenzie (1997), the SPARK (Sports, Play, and Active Recreation for Kids) health-related physical education program was introduced in an attempt to increase physical activity during physical education classes and outside of school. The program was found to increase physical activity during physical education class but not outside of school. Effective teacher training and support were found to be key contributors to these findings. Qualified physical education specialists are a key component to providing a quality physical education program.

Quality Physical Education Programs

Despite the findings that the amount of physical activity in physical education classes falls short of the suggested levels, researchers have provided good evidence that quality programs can lead to increases in physical activity in physical education classes (Simons-Morton, Parcel, Baranowski, Forthofer, & O’Hara, 1991; Sallis & McKenzie, 1997; McKenzie, Sallis, et al., 2004). Not only does physical education provide children with a significant portion of the physical activity recommended, it also helps students develop the knowledge and skill needed for the development of lifelong physical activity (CDC, 1997; Sallis & McKenzie, 1991; USDHHS, 1996). NASPE (1995, 2004) has developed national standards for physical education. These standards provide a foundation for the design and implementation of a quality physical
education program, from kindergarten through grade 12. These quality programs are
designed to develop health-related fitness, physical competence and confidence, and
students' knowledge in relation to physical fitness.

One goal of physical education should be to promote physical activity in youth
and ultimately throughout life (Corbin, 2002; CDC, 1997; NASPE, 1995; USDHHS,
1991, 2000). It has been suggested that students who participate in physical activity
during their physical education will compensate by reducing their after-school activity
levels (Rowland, 1998). However, Dale (1999) presented findings that the activity
performed during physical education does not reduce after-school activity levels. On
the contrary, it was shown to positively contribute to the overall activity during the
day. In a subsequent study involving 76 nine-year old children, accelerometers,
instruments that measure acceleration in a single plane, were used to assess the
influence of an experiment protocol on the children's day. On days when the children
worked on computers during their breaks and had no physical education classes, their
after-school physical activity was significantly lower than on days when children
participated in breaks outside and had physical education (Dale, Corbin, & Dale,
2000). Using the Self-Administered Physical Activity Checklist, Myers, Strickmiller,
Webber, and Berenson (1996) found that although most physical activity occurred
after school, children who reported no physical education class during school had less
physical activity overall.

Physical education classes can provide students with the opportunity for
regular physical activity (Ross & Pate, 1987). This can include participation in
traditional and non-traditional activities. Physical activity is something that needs to
be enjoyed in order for individuals to continue to participate. Competency and proficiency are two characteristics often needed for continuation of physical activity. One way to promote physical activity in students is to provide them with a curriculum revolving around sport. The use of sport education, developed by Siedentop (1994), has been shown to provide enjoyment and increased activity in many physical education classes. Hastie and Trost (2002) provided results that also provided evidence that the physical education setting can provide sufficient levels of moderate to vigorous physical activity. Arnett’s (2001) initial findings support the idea that a physical education curriculum that provides students with fitness and sport skill activities will allow them to continue physical activity for life. Many adults participate in community-based team sports programs. These numbers will continue to increase if children and adolescents are presented with programs that provide them the skills necessary to become competent and proficient in varying activity and sports skills, leading to lifelong participation in physical activity.

Mediating Variables that Affect Physical Activity Levels in Youth

Differences have been reported between physical activity patterns, gender, and body composition. During adolescence, gender differences in the amount of physical activity accrued during the day become more evident. Studies consistently show that males participate in more total and vigorous daily physical activity than females (USDHHS, 1996; McKenzie et al., 1995; Caspersen, Pereira, & Curran, 2000; Hovell, Sallis, Kolody, & McKenzie, 1999; Raustorp, Pangrazi, Stahle, 2004; Myers, Strikmiller, Webber, Berenson, 1996; Wilde, Corbin, Le Masurier, 2004).
The relationship between physical activity levels and the percentage of body fat shows a decrease in the amount of physical activity among children who are overweight (Steinbeck, 2001; Berkey et al., 2000). Bar-Or and Baranowski (1994) also reported that obese children tend to be less physically active than non-obese children. However, Ward and Evans (1995) reported that when total energy expenditure is measured, there appears to be little to no difference between the two populations. Raustorp, Pangrazi and Stahle (2004) reported that pedometers showed a difference among age groups and gender, but no correlations were found between step counts and body mass index.

Activity levels and body mass index were also compared in a study involving children from the United States, Sweden and Australia (Vincent, Pangrazi, Raustorp, Tomson, & Cuddihy, 2003). The authors concluded that American children tended to be the least active and have the highest rate of increase in BMI.

Assessment of Physical Activity

Historically, when school physical education programs have been asked to demonstrate their progress toward desired outcomes, fitness testing has been the most common form of showing impact. However, a recent shift in ideas is changing the emphasis from physical fitness to physical activity. The goal is now to demonstrate that physical education is helping children to develop a healthy lifestyle. Physical educators must try to provide evidence that their students are becoming more active during both physical education class and beyond. Corbin, Pangrazi, and Welk (1994) specify that the total amount of physical activity should be considered when implementing and evaluating physical education programs. Therefore, measuring the
accumulated physical activity of students throughout the day using pedometers is a way to assess progression toward the health guidelines.

One of the overarching goals behind the physical activity promotion movement is to reach the point where once adolescents reach adulthood, they will be able to enhance their quality of life through physical activity. In order to determine if the quality of life has been improved, measurement techniques must be created to track physical activity levels and health patterns. Valid and reliable measurement tools and procedures are needed in order to collect accurate data (Kohl, Fulton, & Caspersen, 2000). Current measurement techniques being used by physical education instructors include direct observation, heart-rate monitoring, accelerometry and the use of pedometers (Welk, 2002; Beighle, Pangrazi, & Vincent, 2001).

Self-report questionnaires are another tool used to assess physical activity. These questionnaires also have limitations, including recall bias (Ainsworth, Sternfeld, Slattery, Daguise, & Zahm, 1998; Welk, Corbin, & Dale, 2000), underestimation of activity (Bassett, Cureton, & Ainsworth, 2000), floor effects (Tudor-Locke & Myers, 2001), lack of sensitivity to walking (Pate, Ross, Dowda, Trost, & Sirard, 2003; Ainsworth, Leon, Richardson, Jacobs, & Paffenbarger, 1993). Self-report questionnaires offer a subjective tool for measuring physical activity. Researchers and practitioners are becoming more interested in using objective measurement tools, including pedometers (Tudor-Locke & Myers, 2001; Rowlands, Eston, & Ingledew, 1997).
Use of Pedometers

Pedometers measure ambulatory physical activity (walking and running) by detecting the vertical changes in movement produced by each step. The pedometer provides immediate feedback regarding activity levels. The accuracy and reliability of the pedometer has been demonstrated in numerous studies, making it an acceptable measurement device for children, adolescents and adults (Eston, Rowlands, & Ingledew, 1998; Kilanowski, Consalvi, & Epstein, 1999; Beighle & Pangrazi, unpublished). Tudor-Locke, Williams, Reis, and Pluto (2002) presented a systematic review of literature regarding the validity of pedometers against self-reported measures, accelerometers, and observation of physical activity. Their findings support the use of the pedometer as a simple and inexpensive tool used to produce valid assessment data.

The main use of the pedometer is to help the students monitor their daily activity levels and to set goals. Yamanouchi, Shinozaki, and Chikada (1995) reported 10,000 steps as the target goal for individuals to meet the national health recommendations for adults. Welk et al. (2000) provided evidence to agree with this recommendation. However, other studies have suggested this may not be an appropriate goal for everyone (e.g., Wilde, Sidman, and Corbin, 2001). Learning to set goals, based on individual differences and different circumstances, is a beneficial tool that will promote higher levels of performance and responsibility.

The pedometer does have certain limitations. It is unable to measure intensity, duration or frequency. However, because of the stop-and-go activity patterns of
children, and the emphasis on accumulated daily physical activity, Rowlands, Eston & Ingledew (1997) argue these limitations are acceptable.

Tudor-Locke and Myers (2001) presented methods and protocols for collecting pedometer data in order to ensure the consistent use of pedometers and accurately interpret and compare results. The authors provide a description of the options available for using the pedometers, including choice of metric, length of monitoring frame, data recording, and collection procedures. They also reviewed 32 published studies to compare results assessing ambulatory activity patterns. These findings reveal expected values for 8-10-year-old children to be 12,000-16,000 steps/day, and 7,000-13,000 steps/day for relatively healthy young adults.

The range of steps during a 30-minute physical education lesson has been shown to vary from 1,200 to 2,000, depending on the age-level and lesson (Keating, 2001). This is approximately 9-15% of the estimated daily step totals reported by Tudor-Locke and Meyers (2001) for healthy young adults. Scruggs, Beveridge, and Watson (2003) reported it would be reasonable to expect approximately 1800 steps from elementary school children (grades 1-2) during a 30-minute physical education class. Currently, there is no study that has a target range for the number of steps taken by students in middle school physical education classes. Using this finding and a minimum standard of 11,000 steps/day (President’s Council on Physical Fitness and Sport, 2002) for children, physical education would contribute approximately 16% of a child’s total daily steps. We can expect this number to decrease as children age (Goran, Gower, Nagy, & Johnson, 1998; Hovell, Sallis, Kolody, & McKenzie, 1999).
The monitoring frame mentioned above is the minimum amount of time (generally expressed in number of days) participants should wear the pedometer. Results of several studies have shown that approximately three to five days of monitoring is sufficient to assess the usual physical activity of children in grades 1-6, and eight to nine days of monitoring would be needed for adolescents. These results indicated that children in grades 1-6 have less day-to-day variability in their moderate-to-vigorous physical activity patterns (Gretebeck & Montoye, 1992; Trost, Pate, Freedsom, Sallis, & Taylor, 2000; Vincent & Pangrazi, 2002a). Determining the length of the appropriate monitoring frame depends on the target population.

Another concern revolves around the possible reactivity of children wearing the pedometers. Data can be recorded by the research practitioner or by the students. Either way, participants may alter their behavior patterns because they are aware of the monitoring. Vincent and Pangrazi (2002b) completed a study to determine reactivity in elementary school children. The pedometers were sealed and worn for eight days, and no reactivity was found. Sealing the pedometers may help prevent reactivity from occurring because the participants will not be aware of their activity levels. Ozdoba, Corbin, and Le Masurier (2004) did a follow up on the Vincent and Pangrazi study by looking at the amount of reactivity with unsealed pedometers and the occurrence of lost data because of accidental or intentional resets. The results of their study indicate that reactivity does not occur when monitoring children’s physical activity with unsealed pedometers. However, they also reported an increase in the amount of unusable data when the pedometers were unsealed, leading to the recommendation that for research purposes, it may be best to use sealed pedometers.
Pedometers can be used to motivate and promote physical activity as they provide immediate feedback to individuals regarding their current activity. Pedometers can also encourage parents to get involved in physical activity along with their children. Being able to monitor and track one's own physical activity levels can provide some motivation for utilizing the pedometer. Pedometers can be used to assess, promote and teach physical activity in numerous settings (Tudor-Locke & Bassett, 2004). The use of this tool allows physical educators to determine how much physical activity the students are getting.
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Yamanouchi, K., Shinozaki, K., & Chikada, K. (1995). Daily walking combined with diet therapy is a useful means for obese NIDDM patients not only to reduce body weight but also to improve insulin sensitivity. *Diabetes Care, 18*, 775-778.
Appendix B
INSTITUTIONAL REVIEW BOARD

TO: Hans van der Mars,
Exercise and Sport Science

RE: Determining the Contribution of Physical Education to the Daily Physical Activity Levels of Middle School Students (Student Researcher: Heidi Wegis)

IRB Protocol No. 2467

The referenced project was reviewed under the guidelines of Oregon State University's Institutional Review Board (IRB). The IRB has approved the application. This approval will expire on 3/10/2005. This new request was reviewed at the Expedited level. A copy of this information will be provided to the full IRB committee.

Enclosed with this letter please find the approved informed consent and assent documents for this project, which have received the IRB stamp. This information has been stamped to ensure that only current, approved informed consent and assent forms are used to enroll participants in this study. All participants must receive the IRB-stamped informed consent or assent document.

- Any proposed change to the approved protocol, informed consent form(s), or testing instrument(s) must be submitted using the MODIFICATION REQUEST FORM. Allow sufficient time for review and approval by the committee before any changes are implemented. Immediate action may be taken where necessary to eliminate apparent hazards to subjects, but this modification to the approved project must be reported immediately to the IRB.
- In the event that a human participant in this study experiences an outcome that is not expected and routine and that results in bodily injury and/or psychological, emotional, or physical harm or stress, it must be reported to the IRB Human Protections Administrator within three days of the occurrence using the ADVERSE EVENT FORM.
- If a complaint from a participant is received, you will be contacted for further information.
- Please go to the IRB web site at:
  http://ousp.oregonstate.edu/research/RegulatoryCompliance/HumanSubjects.html to access the MODIFICATION REQUEST FORM and the ADVERSE EVENT FORM as needed.

Before the expiration date noted above, a Status Report will be sent to either close or renew this project. It is imperative that the Status Report is completed and submitted by the due date indicated or the project must be suspended to be compliant with federal policies.

If you have any questions, please contact the IRB Human Protections Administrator at IRB@oregonstate.edu or by phone at (541) 737-3437.

Ms. Courtney Campbell and Wayne Kradjan
Institutional Review Board Co-Chairs
pc: 2467 file

Date 3/1/04

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Appendix C
December 15, 2004

Heidi Wegis
Department of Exercise and Sports Science
Langton Hall 121D
Oregon State University
Corvallis, OR 97331

Dear Heidi:

You have my permission for the eighth-grade students at Cheldelin Middle School participate in your study. We are excited that you have chosen Cheldelin as the population for your study, and anxious to hear the results. We are very proud of our physical education program and I hope the data you collect will provide us with more evidence of the quality of our program. Thank you for your request and we look forward to seeing you and the other researchers from Oregon State University, in the near future.

Sincerely,

Dawn Corliss
Principal
Cheldelin Middle School
Appendix D
Recruitment Script

Steps for Physical Education

I am working on my Masters' Degree at Oregon State University, and conducting a study that will look at how many steps you take in your physical education class and outside of class. I am looking for volunteers to wear pedometers for two weeks. How many of you know what a pedometer is? A pedometer is a simple device that hooks on the waistband of your shorts or pants, and measures how many steps you take. You will be asked to wear the pedometer for two weeks, Monday through Friday. I, or Dr. van der Mars, will come to your PE class every day and take a look at the number of steps you took the day before, and the number of steps you take in class that day.

The pedometers will be sealed during the day, but you may ask how many steps you took. All of the information I take will be completely confidential (I won't tell anyone your results) and will not affect your grade in this class in any way. Your participation will help me with my degree and I would greatly appreciate it. I have to have your permission and your parents' permission for you to participate in the study. Raise your hand if you are interested in helping me with my study.
[Hand out assent forms and parent consent forms]
Appendix E
Dear Parent/Guardian,

My name is Heidi Wegis and I am a graduate student at Oregon State University. I am conducting a research study to determine the physical activity levels of middle school students. Our goal is to measure the physical activity levels of students during physical education, as well as their activity during the rest of the day, using a pedometer. We will also look at the relationship of physical activity to gender, ethnicity, socioeconomic status, and body composition.

I am requesting your child’s participation which will involve wearing a pedometer from Monday through his or her physical education class on Friday. This process will also be repeated during the next week. A pedometer is a simple device that hooks on the waistband of your child’s pants or shorts and measures how many steps he or she takes.

Your child’s participation in this study is voluntary. If you choose not to have your child participate, or to withdraw your child from the study at any time, there will be no penalty. It will not affect your child’s grade or standing at school in any way. Likewise, if your child chooses to participate, it will not affect his or her standing in the physical education class.

The study will be conducted during the month of April, 2004. Prior to data being collected, two surveys will be completed. One survey is for you, the parent/guardian, to fill out and return with your student in the provided envelope. The survey will be used to provide background information on gender, ethnicity, socioeconomic status, and parental physical activity levels and your student’s physical activity levels. The second survey is for your child to fill out in his or her physical education class. This survey will be used to provide information on your child’s previous and current physical activity habits. Once the data collection begins, on the days your child participates, he or she will be given a pedometer at school and asked to wear it all day until he or she goes to bed. Please take the pedometer off if it could get wet in any way. The next morning, I would ask that you remind your child to put the pedometer back on when he or she gets dressed, and have him or her wear it to school until it is collected. Each day, a researcher from Oregon State University will be present in your child’s physical education class to collect data. Upon entering the class, your child will leave the pedometer he or she was wearing, before entering the locker room to prepare for physical education. The data will be collected, and the pedometer will be returned to your child prior to the start of the physical education class. At the end of class, the pedometers will be collected again so the researcher can record the steps taken, and then returned to your child before he or she leaves the class. Each day, your child will be asked to complete a prior day’s activity (PDA) sheet. The pedometers will be sealed closed to ensure proper data collection. Please encourage your child not to open it. Height and weight will be measured privately during the study.
There are no foreseeable risks to participating in this study. Neither you nor your child will have any costs or be compensated for participating in this research project.

The indirect benefit of your child’s participation is a better understanding of children’s activity levels that will assist physical education teachers in their effort to promote and measure physical activity.

The results of this project may be published in a journal and/or presented at a professional conference. Your child’s name or identity will not be revealed. In order to keep this confidential, only a code number will identify your child in this project. Documents that link your child’s name with this code number will be kept separate and secured from the completed data forms.

Questions are encouraged. If you have any questions about this research project, please contact me at 541-737-6794, or by email at wegish@onid.orst.edu. Or you may contact Hans van der Mars at 541-737-6613, or be email at hans.vandermars@orst.edu. If you have any questions about your child’s rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at 541-737-3437 or by email at IRB@oregonstate.edu.

Sincerely,

Heidi Wegis
Graduate Teaching Assistant
Department of Exercise and Sport Science

☐ My child has my permission to participate in this study.

☐ My child does not have my permission to participate in this study.

Student’s Name (printed)_____________________________________

Date ____________
Dear Student,

My name is Heidi Wegis and I am a graduate student at Oregon State University. I am doing a research study to find out how much your participation in physical education contributes to the amount of physical activity you get during a normal day. This letter will explain the project. You can ask any questions.

When you participate, we will ask you to do several things. Before we have you wear the pedometer, you will be asked to fill out a survey about the activities you participate in. Your parents will be asked to fill out a different survey. We will privately measure your height and weight during the study. You will be asked to wear a pedometer for eight school days. A pedometer is a simple device that hooks on the waistband of your pants or shorts and counts each step you take. You will wear it all day on Monday-Thursday for two weeks.

At the beginning of your physical education class, we will collect your pedometer and then give it back to you to wear during the class. At the end of class, you will be asked to return it to the researcher, who will check the pedometer, and strap it shut. He or she will then return it to you to wear for the rest of the day. You will also be asked to fill out a survey about the type and amount of physical activity you did the day before. The pedometer will be sealed, and I ask you not to break that seal and open it.

There are no risks to wearing a pedometer. If wearing the pedometer is uncomfortable, please notify me and we will try to fix the problem.

When we are done with the study, we will write a report about what we found out. We won’t use your name in the report.

We hope that you will want to be part of the project. Being part of the project is voluntary. If at any point you wish to stop participating, you may stop without being penalized. Your grade will not be influenced if you do or do not participate.

If you want to be in this study, please sign your name on the next sheet.

Sincerely,

Heidi Wegis
Graduate Teaching Assistant
Department of Exercise and Sport Science

I, ____________________________, want to be in this research study.

(Print your name here)

_________________________________ (Sign your name here) __________ (Date)

I am in 1st 2nd 3rd 4th 5th 6th 7th 8th period physical education (Please circle).

Researcher Statement

I have discussed the above points with the participants or, where appropriate, with the participant’s legally authorized representative, using a translator when necessary. It is my opinion that the participant understands the risks, benefits and procedures involved with participation in this research study.

_________________________________ (Signature of Researcher) __________ (Date)
This is a questionnaire for the parent/guardian of the eighth-grade student. The information will be used to study the relationship between physical activity and gender, ethnicity and socioeconomic status.

Your answers to the questions will not affect the child’s grade in the class. If you or your child are not comfortable answering a question, just leave it blank.

The questions that ask about your background will be used only to describe the types of students completing this survey. The answers you give will be kept private. In order to keep your name and your child’s name confidential, a code number will be assigned to identify your child in this project. No names will ever be reported. When you are finished with the questionnaire, please place it, along with the informed consent documents, in the enclosed envelope, seal the envelope and have your child return it to his or her physical education teacher.

Thank you very much for your help.
Parent/Guardian - Please complete the following form:

1. Child’s birthday: _________ / _________ / _________
   Month     Day     Year

2. Child’s gender (please circle):  Male    Female

3. Does your child currently participate in any after school physical activity type programs or sports?  YES  NO
   If yes, which ones?
   ____ soccer/football    ____ baseball/softball
   ____ swimming          ____ dance
   ____ music lessons or performance    ____ YMCA or day care
   ____ Other, please explain

4. Household income (please check):
   [ ] Under $10,000  [ ] $35,000-50,000
   [ ] $10,000-20,000  [ ] Over $50,000
   [ ] $20,000-35,000

5. Does your child receive Free or Reduced breakfast/lunch?  YES  NO

6. Your relationship to the child:
   [ ] Parent
   [ ] Grandparent
   [ ] Step-Parent
   [ ] Legal Guardian
   [ ] Other ____________________________
7. How do you describe your child? (Select one or more responses)

☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Hispanic or Latino
☐ Native Hawaiian or Other Pacific Islander

☐ White

8. Your relationship status (Check only one)

☐ Single
☐ Married or living with partner
☐ Divorced
☐ Other ____________________________

9. Number of people living in the home: _______________

10. Your physical activity habits:

☐ I am not physically active
☐ I am occasionally physically active (1-2 times/week)
☐ I am regularly physically active (3-5 times/week)

11. Type of exercise or activity you participate in (please list):

__________________________________________________________________________

__________________________________________________________________________

12. How well do you think your child likes physical activity?

☐ My child strongly dislikes physical activity
☐ My child dislikes physical activity
☐ My child likes physical activity
☐ My child loves physical activity

When you are done with this survey, please place it, along with the informed consent documents in the enclosed envelope, seal the envelope, and have your child return it to his or her physical education teacher. Thank you.
Student - Please complete the following form:

Pedometer Number: __________

How old are you? __________

Gender (please circle): Male Female

Physical Education Class Period (please circle): 1 2 3 4 5 6 7 8

On the next six questions, please circle the answer that is most appropriate for you.

1. On how many of the past 7 days did you exercise or participate in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?
   A. 0 days  E. 4 days
   B. 1 day  F. 5 days
   C. 2 days  G. 6 days
   D. 3 days  H. 7 days

2. On how many of the past 7 days did you participate in physical activity for at least 30 minutes that did not make you sweat or breathe hard, such as fast walking, slow bicycling, skating, or mopping floors?
   A. 0 days  E. 4 days
   B. 1 day  F. 5 days
   C. 2 days  G. 6 days
   D. 3 days  H. 7 days

3. On a typical school day, how many hours do you watch TV?
   A. I do not watch TV
   B. Less than 1 hour per day
   C. 1 hour per day
   D. 2 hours per day
   E. 3 hours per day
   F. 4 hours per day
   G. 5 or more hours per day
4. During an average physical education (PE) class, how many minutes do you spend actually exercising or playing sports?
   A. I do not take PE
   B. Less than 10 minutes
   C. 10-20 minute
   D. 21-30 minutes
   E. 31-40 minutes
   F. 41-50 minutes

5. During the past 12 months, on how many sports teams did you play? (Include school teams, Parks and Recreation, and/or Boys and Girls Club Teams)
   A. 0 teams
   B. 1 team
   C. 2 teams
   D. 3 or more teams

6. How well do you like physical activity?
   A. I hate physical activity
   B. I don’t like physical activity
   C. Physical activity is okay
   D. I like physical activity
   E. I love physical activity
Appendix G
Dear Parents:

This week we are beginning the study measuring the activity level of your son or daughter by counting the number of steps they take each day. Your child will be asked to wear the pedometer Monday through Friday for two weeks. The results of the study will be kept confidential. Please remind your child to wear the pedometer on the right side of the waistband of their pants or shorts until bedtime and to put it on again when he or she gets dressed in the morning. Encourage them to keep the pedometer sealed and to go about their normal activities. If you have any questions, please contact me at (541) 737-6794.

Thank you for your help.

Heidi Wegis
Research Assistant
Oregon State University
Department of Exercise and Sports Science

Hans van der Mars
Oregon State University
Department of Exercise and Sports Science
Appendix H
Previous Day’s Activity Questionnaire

Pedometer Number: __________

Date: __________

1. To get to school today, I:
   □ walked
   □ rode my bike
   □ rode the bus
   □ rode in a car

2. Yesterday, I participated in the following activities:
   □ WALKING __________ hours __________ minutes
   □ SOCCER __________ hours __________ minutes
   □ BASKETBALL __________ hours __________ minutes
   □ BIKE RIDING __________ hours __________ minutes
   □ SWIMMING __________ hours __________ minutes
   □ WATCHING TV __________ hours __________ minutes
   □ PLAYING VIDEO GAMES __________ hours __________ minutes
   □ DOING HOMEWORK __________ hours __________ minutes
   □ OTHER (please describe below) __________ hours __________ minutes

3. Yesterday, I was:
   □ Not Very Active
   □ Somewhat Active
   □ Active
   □ Very Active

4. Did you remember to wear the pedometer all day?  YES  NO

5. If not, how long was it off? __________

6. Did you remember to put it on right after you got up this morning?

7. If not, how much time went by before you put it on? __________

8. How many steps do you think you walked yesterday? __________
Middle School Physical Activity Data Collection Protocol

Pedometers

The purpose of this portion of the study is to measure the physical activity levels of all participating students. Pedometer step counts will be recorded for eight consecutive school days, beginning on a Monday and ending on Thursday of the same week, with the process being repeated during week two. This is to prevent the interference of issues regarding the assessment of weekend step counts. The following is a step-by-step protocol to guide data collection throughout this segment of the study:

PRIOR TO WEEK 1

1. Orientation
   - Explain, “Pedometers are machines that measure the number of steps you take.”
   - Show the Reset button.
   - Let students hold a pedometer, shake the pedometer, and reset the pedometer.
   - Explain that the pedometers must be worn on the belt, in line with the right knee. Let the children put the pedometer on and do a “class check” to make sure pedometers are in the proper position. The pedometers must remain in the upright vertical position in order to accurately register counts. If a student is wearing something without a firm waistband, pedometers can be worn on the underwear.
   - Politely and firmly explain, “The pedometers will be sealed with a plastic strip. If we find that you are taking the strip off, we may have to keep your pedometer and you will not be allowed to participate in the study.” Also explain, “it will be very evident if the strip is removed, so to eliminate problems, put the pedometer on and try to forget it is there.
   - Recollect all of the pedometers.
   - Explain the prior day’s activity (PDA) sheet. All students will fill out a PDA for every day. When analyzing the data, the PDA sheets will be used, specifically if a student’s activity level is unusually high or low.

2. Pedometer Distribution
   - Each participant will be assigned a pedometer number. Distribute based on designated pedometer number (#’s are engraved on the inside of the pedometer, and marked on the outside). This is done best by calling out
names of the students and explaining that from now on you will call out pedometer numbers when distributing.

- Have participants put the pedometer on and make note of the time. Every effort should be made to record data, seal the pedometers, and have the pedometer back on the students at the same time all eight days.
- Issues such as specials, assemblies, etc. will need to be considered when determining the time to collect data. Generally, the morning is most efficient as the “routine” works best with most classroom morning schedules.
- The researcher should develop a routine for daily pedometer distribution. As mentioned above, calling out pedometer numbers is efficient.

**MONDAY**

1. **Pedometer Distribution**
   - When students return from changing into their P.E. clothes, have them pick up their pedometer and put it on.
   - During the physical education class, the pedometers will not be sealed. Remind students to not open the pedometer during class.
   - Make note of the activities being done during the class period.

2. **Collect Pedometers**
   - When students return from physical education, have them place their pedometers in the tub prior to changing into their school clothes.

3. **Record Step Counts**
   - Open the pedometers and record the step counts for physical education.
   - Reset pedometer and set aside with face open. This will allow you to double-check that the pedometer has been reset during step 7.

4. **Reseal Pedometer**
   - After all the data has been recorded, begin sealing pedometers.
     - Double check the pedometer is reset prior to sealing.
     - Snap shut.
     - Put cable tie on.
     - Tighten cable tie.
     - Snip excess plastic.
   - Place gently in tub in numbered spot.
   - Seal each pedometer with a plastic cable tie (demonstration). Always open and/or seal pedometers in a different room. This will prevent the students from seeing you and “getting ideas.”

5. **Return Pedometers**
   - When returning pedometers, make sure students put them on immediately.
• Simply calling out pedometer numbers has been efficient in other studies.
• Before you leave, make sure the pedometers are on each student and you have all of the answers for your “needs” note.

6. Review of Procedures with Researcher
   • Remind researchers to establish a routine for collecting and returning pedometers efficiently.
   • The following is a very effective routine used in previous studies:
     o Students place pedometer in a “tub” when they arrive in the locker room and attendance is taken.
     o When they put the pedometer in the tub, they pick up a PDA sheet, fill it out, and place it in the tub, as well.
     o Students who have forgotten their pedometers should call home as soon as possible to see if the pedometer could be brought to school. (Forgotten pedometers will be addressed in data recording as well.)
   • Remind researcher to have participants fill out PDA sheet first thing in the morning. This will allow for the best activity recall for students.
   • You will also need an attendance sheet every day. This will let you know how many absences, “forgot”, etc. each day. (See Tuesday – Thursday step 2 and 3 for more.)
   • Again, students who forget pedometers should attempt to call home to see if anyone can bring the pedometer to school.
   • Review Pedometer Distribution as well

TUESDAY - THURSDAY

1. Collect Pedometers Before Dressing Down
   • Report to the gym and collect the pedometers at the beginning of the class period, prior to students dressing down for PE. Have students fill out the PDAs and place it, along with the pedometer, in the tub.
   • When carrying pedometers, please attempt to minimize excess shaking of the tubs and/or pedometers to prevent added counts.

2. Record Step Counts (this will involve two people, an opener/sealer and a recorder)
   • Data recording should take place away from the students.
   • Clip all cable ties and place pedometers to the side.
   • Record data and make any notes regarding problems or issues with the data collection (See below for standardization).
   • Standard abbreviations will include:
     o F = Forgot
     o L = Lost
     o D = Damaged
- Step counts seem unusual relative to the child’s other days (+/- 2,500 counts)
- 3 = Pedometer Returned
- * = Pedometer # Change

3. Summarizing “needs”

- Before returning the pedometers to the class, please make a “needs” post-it note listing the information you need to get from the students that do not have a step count for the day.
- It is helpful and efficient to make a list of students you need to talk to regarding “Forgotten”, “Lost”, “Damaged”, and “Questionable” pedometers, respectively. This will allow you to talk to groups of students with similar issues.
- The following are a list of scenarios you will be faced with and how to handle them with a “needs” note.

  - (F)orgotten Pedometer:
    - Ask the student, “Is there anyone at home that can bring the pedometer to you?”
      - If the answer is yes, you may have to show the teacher how to secretly “slip” the cable off, record the data/time, and reseal in the event that the pedometer arrives after you have left.
      - If the answer is no, tell the student NOT to put the pedometer on when he/she gets home. Put it on the next morning. This will eliminate missing two days of data. Also, firmly and politely remind the student that they “need to wear the pedometer in tomorrow morning.”
      - A follow up to a “No” response will be necessary the following day. This will be an attempt to find out when the pedometer was put on. Please make notes about this.
        - For example, ask, “When did you put the pedometer on?” If they look confused, give prompts such as, “Did you put it on yesterday after school?”

  - (L)ost Pedometer:
    - If a participant says the pedometer is lost, courteously encourage the student to find the pedometer and bring it in.

  - (D)amaged Pedometer:
    - Collect the pedometer and find out how it was damaged.
- Using your own discretion, determine if you will replace the pedometer with an extra pedometer or collect the damaged pedometer and thank the child for participating.
  - Reasons **not** to give a student another pedometer include: chewed by their dog, submerged in water, or, smashed. This type of damage can easily reoccur.
  - Reasons **to** give a student another pedometer include: broken clasp or slightly cracked casing.
- If a new pedometer is issued, on the Pedometer Step Count Data Sheet (PSCDS) please mark off the old number, write in the new number, and place an * by the participant’s name.
  - Questionable (?) Step Counts:
    - If you have a PDA for a student with a questionable step count, please set it aside for the head researcher to look at later.
    - If you do not have a PDA for the student, ask, “Can you remember what you did last night?” and record any answers on a PDA for the child.
    - Regardless of the response, please fill out a PDA with any information you could gather.
    - The previous steps ensure that we will have a PDA for all questionable step counts.

6. Return Pedometers For Physical Education
   a. When students return from changing into their P.E. clothes, have them pick up their pedometer and put it on.
   b. During the physical education class, the pedometers will not be sealed. Remind students to not open the pedometer during class.
   c. Make note of the activities being done during the class period.

7. Re-Collect Pedometers
   • When students return from physical education, have them place their pedometers in the tub prior to changing into their school clothes.

8. Record Step Counts
   • Open the pedometers and record the step counts for physical education.
   • Reset pedometer and set aside with face open. This will allow you to double-check that the pedometer has been reset during step 7.

9. Reseal Pedometer
   • After all the data has been recorded, begin sealing pedometers.
     o Double check the pedometer is reset prior to sealing.
     o Snap shut.
     o Put cable tie on.
     o Tighten cable tie.
     o Snip excess plastic.
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10. Return Pedometers
   • When returning pedometers, make sure students put them on immediately.
   • Simply calling out pedometer numbers has been efficient in other studies.
   • Before you leave, make sure the pedometers are on each student and you have all of the answers for your “needs” note.

11. Address Lost, Damaged, or Forgotten Pedometers
   • See step 3.
   • Detailed notes must be kept on the data sheet. This will be very helpful when analyzing the data after the project.

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<th>FRIDAY</th>
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1. Collect Pedometers Before Dressing Down
   • Same as above.

2. Record Step Counts
   • Same as above.

3. Keep Pedometers
   • To prepare for the next use, reset, seal, and place in tub.

4. Address Lost, Damaged, or Forgotten Pedometers
   • On the last day, attempt to reduce the number of pedometers lost. This can be accomplished by asking the teacher to remind the students who have forgotten or lost their pedometers to bring them in the next school.

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<th>WEEK TWO</th>
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Repeat Process with data collection beginning during Monday’s physical education classes and ending at the beginning of classes on Friday.