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PEDAGOGY

Integrating the Pedometer Into Physical Education: Monitoring and Evaluating Physical Activity, Pedagogical Implications, Practical Considerations, and Recommendations

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Abstract

The necessity for physical activity during physical education has gained increased and widespread attention during the last few decades. However, without monitoring mechanisms it is challenging for physical education teachers to (a) get a notion of the extent to which lessons are providing physical activity, (b) evaluate the effectiveness of efforts to increase physical activity, and (c) determine whether students are reaching the recommended 50% moderate-to-vigorous physical activity target. In this paper, we argue the advantage of physical education teachers monitoring and evaluating physical activity by integrating the pedometer into the physical education program. We also provide physical education teachers with the pedagogical implications, as well as the practical considerations and recommendations, of integrating the pedometer into physical education lessons.

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A profound and robust body of evidence shows a relationship between regular physical activity and a broad range of health benefits among youth (age ≤ 18; Poitras et al., 2016). Consensus statements suggest that youth should accumulate at least 60 min/day of moderate-to-vigorous physical activity (MVPA). Since the majority of today's youth do not meet this recommendation (Hallal et al., 2012), public health strategies and efforts to promote physical activity are deemed critical. In this regard, schools are cost-effective and ideal settings for proactively promoting physical activity, because schooling uniquely reaches virtually all young people, irrespective of their socioeconomic and ethnic group. Also, schools generally possess facilities and equipment required to deliver physically active sessions and programs. As part of the school, the curricular subject physical education (PE) provides great opportunities for delivering knowledge, skills, and abilities that promote short- and long-term physical activity (Hills, Dengel, & Lubans, 2015). In their seminal paper, Sallis and McKenzie (1991) emphasized the role of PE in public health strategies, and a main goal of such efforts was to provide youth with physical activity. Ever since, the necessity for physical activity during PE classes has gained increased and widespread attention among health organizations and authorities. For example, the World Health Organization (2013) has called for the provision of quality PE including opportunities for physical activity as an integral part of creating health-promoting environments. On the 20th anniversary of the publication of Sallis and McKenzie's paper, steps forward and backward were summarized by the authors and the concept of health optimizing physical education (HOPE) was presented (Sallis et al., 2012). As part of HOPE, the authors recommended that PE would provide youth with ample and enjoyable MVPA representing at least 50% of the lesson time (Sallis et al., 2012).

Although the educational characteristics, central objectives, and goals of PE are dissimilar across countries and school systems, the opportunity to provide youth with MVPA during the school day appears to be a common denominator. Physical activity is one dimension of high-quality PE, and some of the accountability can arguably be demonstrated by young people being physically active during lessons. Taken together, however, evidence suggests that youth do not

reach the 50% MVPA target (Hollis et al., 2017; Hollis et al., 2016). Meta-analyses show pooled estimates of 45% (Hollis et al., 2016) and 41% (Hollis et al., 2017) of MVPA during PE lessons for elementary school and secondary school students, respectively. Data also indicate that the percentage of MVPA during PE is sometimes low. For example, a recent study from Sweden showed that students spent only 25% of the PE lessons in MVPA (Fröberg, Raustorp, Pagels, Larsson, & Boldemann, 2017). Possible explanations for students not reaching the 50% MVPA target are speculative, yet PE requires youth to undertake instructions, demonstrations, and observations, which suggests that maintaining high levels of MVPA can be challenging (Fröberg et al., 2017). Appropriate strategies to build physically active lessons in PE should therefore be developed and established. Interventions reveal that MVPA levels can increase through relatively modest modifications (Lonsdale et al., 2013). Against such a background, some researchers published a paper presenting the supportive, active, autonomous, fair, and enjoyable (SAAFE) framework for designing and delivering organized physical activity sessions for youth. The active principle involves strategies such as optimizing session structure and activity selection through, for example, the introduction of small-sided games or multiple game/grids, avoiding elimination activities, and maximizing available equipment (Lubans et al., 2017). We appreciate the recommended strategies and believe that the SAAFE framework will assist PE teachers to provide physically active sessions among youth. Nonetheless, without mechanisms of monitoring, it might be challenging for PE teachers to (a) get a measurable notion of the extent to which lessons provide physical activity, (b) determine whether students are reaching the recommended 50% MVPA target, and (c) evaluate the effectiveness of efforts for increasing physical activity. In such a context, pedometers might be appropriate and practical tools for monitoring and evaluating the physical activity dimension of PE. As addressed, there might also be several pedagogical advantages of using pedometers as supplements to traditional teaching approaches (Beighle, Morgan, & Pangrazi, 2004; Beighle, Pangrazi, & Vincent, 2001; Cuddihy, Pangrazi, & Tomson, 2005; Morgan, Pangrazi, & Beighle, 2003).

The purpose of this paper is twofold. Given the recent findings of low MVPA levels during PE (Hollis et al., 2017; Hollis et al., 2016), the first purpose is to argue that PE teachers can advantageously integrate the pedometer into PE to monitor and receive immediate feedback whether or not students are reaching the recommended 50% MVPA target, as well as evaluate the effectiveness of efforts for increasing physical activity. Inspired by previous work (Beighle et al., 2004; Beighle et al., 2001; Cuddihy et al., 2005; Morgan et al., 2003), the second purpose is to outline additional pedagogical implications, practical considerations, and recommendations for integrating the pedometer into PE.

Integrating the Pedometer Into Physical Education

The Pedometer

Pedometers are relatively cost-effective, waist-worn devices used for objectively measuring so-called free-living ambulatory physical activity in terms of steps (Lubans et al., 2014). Figure 1 illustrates a pedometer with a built-in belt clip. Due to the simplicity and accuracy of monitoring physical activity in terms of the number of steps taken, pedometers have gained increased credibility and acceptance as a practical measuring and intervention tool (Lubans et al., 2014).

Pedometers have strengths, such as providing immediate visual feedback, which constitutes a basis for reflection about physical activity. They might also act as an environmental cue to be physically active, because of the continuous feedback and thus a reminder of one's current physical activity level. Some advantages of using pedometers over other complex devices, such as accelerometers and heart rate monitors, include the simplicity of maintenance and data handling. Besides battery replacement and a few practical considerations discussed later on, generally no expensive and time-consuming care is needed. In addition, no extensive data process and analysis are required because the pedometer provides immediate visual feedback through the display. A detailed description of the science behind pedometers can be obtained elsewhere (De Vries et al., 2009; Lubans et al., 2014; Strath et al., 2013).

Figure 1. An open (left) and closed (upper-right corner) pedometer (Yamax SW200 Digi-walker) with a clamshell design and featuring a built-in clip (lower right corner). All images retrieved from www.yamax.co.uk. Reprinted with permission from the copyright holder.

In this article, we argue that PE teachers can easily integrate the pedometer into PE to monitor and receive immediate feedback about reaching the recommended 50% MVPA target, as well as evaluating the effectiveness of efforts for increasing physical activity.

Monitoring and Evaluating Physical Activity

Several studies have reported guidelines for quantifying MVPA levels through measuring steps per minute during PE lessons (Scruggs, 2007a, 2007b; Scruggs et al., 2003; Scruggs, Beveridge, Watson, & Clocksin, 2005; Scruggs, Mungen, & Oh, 2010). Based on these data, Scruggs (2013) conducted secondary analysis involving a large sample of first to 12th graders to further investigate the validity of steps per minute guidelines. The analyses demonstrated strong positive correlation between pedometer-determined steps per minute and observed MVPA (Scruggs, 2013), suggesting that pedometers can be used as an indicator of MVPA levels during PE lessons. Additional analysis revealed that the optimal cut-point for accurately determining whether students were reaching the recommended

50% MVPA target was 82 steps/min. Slightly adjusted, however, 80 steps/min was recommended as an appropriate cut-point for practitioners to conduct time-effective calculations for informal assessment (Scruggs, 2013). Based on this cut-point, Table 1 presents the number of steps required (within 5-min intervals) for youth to reach the 50% MVPA target across PE lessons lasting 30 to 60 min. For example, an average of 3,200 steps would be required for youth to reach the 50% MVPA target during a 40-min PE lesson (80 Steps × 40 Min = 3200 Steps).

Table 1
Yamax Determined Steps per Minute to Reach the 33% and 50% Moderate-to-Vigorous Physical Activity Target Across Physical Education Lessons of Differing Duration

Lesson duration (minutes)	Number of steps to reach the target	
	33%	50%
60	3600	4800
55	3300	4400
50	3000	4000
45	2700	3600
40	2400	3200
35	2100	2800
30	1800	2400

Note. The 33% and 50% target step values are converted from the 60 and 80 steps/min cut-point (originally 60.6 and 82.2 steps/min), respectively (Scruggs, 2013).

Moreover, integrating pedometers into PE to monitor physical activity provides information that can be used for lesson modifications aimed at increasing the physical activity level. If the level is lower than recommended, PE teachers are advised to work in a structured and strategic way by initially establishing baseline step values and then incrementally increasing the number of steps for students to advance toward the 33% and 50% MVPA target, respectively (Table 1). The teacher can thus use the pedometer to evaluate the effectiveness of efforts for increasing physical activity, such as

adopting/modifying equipment, rules/prompts, and boundary/playing area or any other strategy similar to those included in the SAAFE framework active principle (Lubans et al., 2017). Because of the strong correlation between steps per minute and MVPA (Scruggs, 2013), PE teachers have successfully designed and delivered lessons with higher MVPA levels if the step values have increased (compared to the baseline) as a result of any adoption/modification of the teaching approach or lesson plan. In this regard, however, PE teachers must acknowledge the great variabilities of MVPA levels shown across PE lesson task/activities as it will directly affect the number of steps taken. For example, one study showed that dance lessons provided approximately 4–6% of MVPA, whereas the corresponding figure for fitness tasks was 33–37% (Fröberg et al., 2017). The evaluation process should hence be conducted in a relatively standardized manner through comparison of step values for similar lesson tasks/activities (e.g., compare steps values for dance and fitness lessons separately) or lesson plans.

In the remaining parts of this study, we outline additional pedagogical implications as well as practical considerations and recommendations of integrating the pedometer into PE. We also offer suggestions on learning activities that might inspire PE teachers who use pedometers to educate students about physical activity. These pedagogical implications and suggestions on learning activities were inspired by previous work (Beighle et al., 2004; Beighle et al., 2001; Cuddihy et al., 2005; Morgan et al., 2003).

Raising Awareness Regarding Physical Activity

The body of evidence shows that regular physical activity has numerous beneficial health effects during childhood (Poitras et al., 2016) and suggests that a physically active lifestyle should be a central part of healthy living. In this regard, integrating pedometers into PE provides opportunities for PE teachers to raise awareness regarding physical activity mainly in two ways. First, as pedometers offer an objective measure of free-living ambulatory physical activity, PE teachers can educate youth that *all* types of physical activity (irrespective of accumulation pattern) have implications for health and well-being. As vigorous and very vigorous physical activity might be unsuitable for less physically active individuals, an important part

of PE includes educating youth that moderately intensive physical activities, such as brisk walking, which are accurately captured by pedometers, also affect a broad range of health outcomes.

Second, ample data suggest great disparities between young people's perceived and actual physical activity levels. For example, an adolescent's self-reported measures of physical activity are prone to bias and error due to misreporting (Adamo, Prince, Tricco, Connor-Gorber, & Tremblay, 2009; Chinapaw, Mokkink, van Poppel, van Mechelen, & Terwee, 2010; Helmerhorst, Brage, Warren, Besson, & Ekelund, 2012) and overestimation of their physical activity by up to 200% compared to objective measures (Adamo et al., 2009). This discrepancy might be explained by the abstract nature of physical activity and cognitive shortcomings that might affect the ability of youth to recall the spontaneous and intermittent movement patterns that characterize youthful physical activity (Baquet, Stratton, Van Praagh, & Berthoin, 2007; Sanders, Cliff, & Lonsdale, 2014). Because youth appear to be somewhat unaware of their physical activity level, pedometers provide a concrete feedback and comprehendible measure that PE teachers can use to raise awareness regarding physical activity. In addition, pedometers offer opportunities for PE teachers to educate youth about physical activity intensity levels and thus the meaning of light, moderate, and vigorous physical activity, as well as the intensity levels across various task/activities (e.g., the intensity level of brisk walking and invasion games). As part of the educational approach, PE teachers can experimentally challenge their students to estimate the number of steps they might accumulate during, for example, 15 minutes of brisk walking (or across a whole lesson) and then contrast these estimates against actual pedometer-measured steps. Also, PE teachers can challenge their students to measure their stride length and calculate the number of steps required to move 1 mile/kilometer or the accumulated distance they move during a single PE lesson or a week or an entire semester of lessons. When adopting or modifying any teaching approach, PE teachers can also organize discussions around topics such as why the physical activity level increased or decreased, when introducing small-sided invasion games as opposed to the full-scale version.

Ultimately, PE teachers can also allow their students to wear the pedometer during and outside the school day, as it would give them

opportunities to gain insight into their daily physical activity level and patterns. Such an approach might help youth to understand physical activity as a complex concept involving several domains and activities (Pettee Gabriel, Morrow, & Woolsey, 2012). For example, PE teachers can allot homework involving an assignment such as keeping a log of in- and out-of-school physical activity distributed across PE, the whole school day, and leisure time. After some time, PE teachers can arrange discussions based on the main findings (e.g., what is the contribution of PE to your daily physical activity?). Allowing for pedometers to be worn both in and out of school can also create opportunities for youth to introduce pedometers to their parents. In this regard, youth can monitor their parents' physical activity level for a few days and discuss with them goal-setting strategies such as encouraging them to reach the recommended 7,000 to 8,000 steps/day (Tudor-Locke, Craig, Brown, et al., 2011).

Raising Awareness Regarding Physical Activity Recommendations

Integrating pedometers into PE creates opportunities for PE teachers to raise awareness regarding recommendations for steps per day. According to research, the recommended 60 min/day of MVPA is likely to be achieved through accumulation of approximately 11,000 to 12,000 and 13,000 to 15,000 steps/day among girls and boys aged 6 to 11, respectively, and 10,000 to 11,700 steps/day among youth aged 12 to 19 (Tudor-Locke, Craig, Beets, et al., 2011). Based on these figures, reaching the 50% MVPA target during a 40-min PE lesson would constitute approximately 25% of the steps required for youth to meet the lower boundary of the steps per day recommendations, irrespective of age group (Table 1). However, reaching the 50% MVPA target during the same lesson duration would provide 33% of the recommended 60 min or more per day of MVPA (i.e., 50% of 40 min = 20 min MVPA). The discrepancy across the two types of physical activity recommendations (i.e., steps per day vs. minutes of MVPA) can likely be explained by different measurement outcomes and their underlying assumptions. Taken as a whole, however, PE lessons lasting 40 to 60 min and reaching the 50% MVPA target would contribute to approximately 25% to 50% of the physical activity recommendations—a fact that can be highlighted by PE

teachers as part of the approach to judge the quality of activities in promoting physical activity (see next section). As part of the teaching approach, PE teachers can thus compare step values accumulated during specific activities (e.g., 10 min of fitness tasks) with steps per day recommendations.

Judging the Quality of Activities in Promoting Physical Activity

Pedometers create for opportunities for PE teachers to make judgments regarding the quality of activities in promoting physical activity. This might be a key feature of integrating the pedometer into PE, because having knowledge of activities effective in promoting physical activity might influence health promotion behaviors and strategies. In terms of learning activities, PE teachers can use the pedometer to highlight and compare step values during tasks such as brisk walking and invasion games. Similarly, youth can also be challenged to estimate the number of steps they are expected to accumulate during a task and then contrast these against the actual pedometer outcome. During lessons, PE teachers can also pay attention to the number of steps taken rather than the game score by, for example, comparing teams' accumulated steps rather than points scored during invasion games. Such a teaching approach would emphasize that the physical activity, rather than the points scored, is the primary outcome of interest.

Motivation, Self-Monitoring, and Goal-Setting Strategies

The pedometer might act as a motivational tool that increases physical activity during PE lessons. Because immediate visual up-to-the-minute feedback is continuously provided, the PE teacher can use the pedometer to set step targets for students to aim for during PE lessons. PE teachers can, for example, challenge their students (or encourage the students to challenge themselves) to reach a specific number of steps during any given activity. Surprisingly, some PE teachers have experienced that their less skilled students connect with the pedometers to a greater extent than their more skilled peers (McCaughtry, Oliver, Dillon, & Martin, 2008). This is an inspiring feature of the pedometer, since a lack of motivation might be challenging for some PE teachers. However, some students might initially be motivated and become engaged during lessons as a result of bringing pedometers into PE, yet they may become less enthusiastic when

the novelty wears off (McCaughtry et al., 2008). In cases when PE teachers first use the pedometers as a motivational tool for increasing physical activity during lessons (e.g., in classes where the physical activity level and engagement is low), they might consider using them rather irregularly to maintain their novelty. In other cases, PE teachers can aim to create an educational climate where pedometers are a recurrent and integrated part of the approach of teaching youth about physical activity.

It might be argued that PE teachers should focus on delivering knowledge, skills, and abilities with carryover effects, meaning that students should be offered opportunities to acquaint themselves with health-promoting behaviors and strategies. Understanding appropriate pedometer use, including experience of self-monitoring and goal-setting strategies, might create a basis for youth to use pedometers to monitor and increase their physical activity levels. Ultimately, those taught appropriate pedometer handling during their school days might possess the prerequisites to monitor their physical activity with meaningful goal-setting strategies to continue physical activity later in life. In this regard, research shows that pedometer-based interventions comprising elements such as self-monitoring and goal-setting strategies have been proven effective in promoting physical activity among youth (Lubans, Morgan, & Tudor-Locke, 2009) and adults (Kang, Marshall, Barreira, & Lee, 2009). Thus, evidence suggests that pedometers—in addition to their use in goal-setting strategies—should be included as an integral part of physical activity programs as a method of promoting health and well-being. In addition, one study showed that monitoring weekly pedometer-determined physical activity at ages 12 to 14 and then repeating the procedure at four occasions from adolescence into adulthood resulted in higher physical activity levels at age 30 compared to other national data (Raustorp & Fröberg, 2017).

Practical Considerations and Recommendations

Choosing a pedometer that provides valid and reliable measures of steps is important for monitoring physical activity in PE. Also, choosing a dependable pedometer is essential as frustration might arise among youth due to lack of agreement when comparing step values yielded by the pedometers after performing the same task (McCaughtry et al., 2008). The choice of pedometer is a key issue

because reliability differs across commercially available brands and models. One dependable pedometer brand is Yamax (Yamax Corp., Tokyo, Japan, www.yamaxx.com), as their devices have gained credibility as a research-grade instrument (De Vries et al., 2009; Tudor-Locke et al., 2006). In a study determining the 80 steps/min cut-point for the 50% MVPA target, Scruggs (2013) used the Yamax Digi-Walker SW651 and SW701 models. Applying the 80 steps/min cut-point to determine whether students have reached the recommended 50% MVPA target while using different pedometer brands would likely introduce bias and offer invalid measures of steps per lesson. Moreover, besides accuracy, PE teachers should also choose the pedometer brand and model depending on durability and design. For example, it might be worth considering a pedometer model with a clamshell design with concealed buttons that prevent accidental resetting of the pedometer and loss of step data. In addition, pedometer models with a built-in belt clip are easy for the user to attach to the waist.

To distribute and collect pedometers might be a time-consuming task. PE teachers are therefore recommended to develop and establish systematic and time-efficient routines for distributing and collecting the pedometers. Similarly, PE teachers might experience some logistical barriers, such as maintaining (e.g., checking for accuracy and battery power) and tracking the pedometers when using them across several classes and grade levels simultaneously (McCaughtry et al., 2008). In such cases, PE teachers can develop a rotation system where the pedometers are used systematically in a point-operation manner (e.g., on a weekly basis) in different classes (McCaughtry et al., 2008).

Pedometer wear-location is also important as it might affect accuracy. It is recommended that the pedometer be positioned on the right side (midaxillary line; Graser, Pangrazi, & Vincent, 2007). Furthermore, clothing featuring loose elastic waistbands might be inappropriate for adequately attaching waist-worn pedometers. Loose-fitting clothing might absorb similar vertical force that occurs during steps and hence introduce bias (Cuddihy et al., 2005). For prevention of such bias, the pedometer might be positioned at waist level on the back. Bias in step values might also be present among heavyset youth because the location of the pedometer might be

altered from the vertical plane to the horizontal plane due to the excessive body fat located around the waist (Cuddihy et al., 2005).

We further recommend that PE teachers occasionally check and verify the pedometers for accuracy by counting steps over a short walk and comparing pedometer steps against counted steps. If a substantial difference is detected between pedometer steps and counted steps, PE teachers should check and change the battery. If differences still remain, the pedometer might be broken and should be sent back to the company for repair or replacement. In addition, the pedometers should occasionally be shake tested to verify accurate registration of vertical movement according to the following procedure: hold the pedometer in the position as if it was waist-worn; shake it 30 to 50 times and compare the number of shakes with the step values shown on the pedometer display. If inter-device differences exceed 5% (Vincent & Sidman, 2003), the same process as described above (i.e., check/change battery, etc.) is recommended.

Tampering such as shaking the pedometer to artificially increase the number of steps during PE lessons might be a source of error of which PE teachers must be aware (Lubans et al., 2014). To prevent such behavior, PE teachers should proactively discuss this issue and devise management for students who continuously shake the pedometers (McCaughtry et al., 2008).

Although pedometers might act as a motivational tool for monitoring and increasing physical activity, situations might arise when the students consistently check the number of steps taken for comparison purposes (McCaughtry et al., 2008). To avoid such time-consuming behavior, PE teachers can strategically develop periodical class checks when the students briefly interrupt their activity to check the pedometer and share the step values with their peers before continuing the lesson (McCaughtry et al., 2008). Moreover, although PE teachers might experience some students becoming increasingly motivated by using the pedometer, one concern might be peer competitiveness, which, in the worst-case scenario, negatively affects some students' motivation toward being physically active. However, PE teachers might counteract such concerns by avoiding individual comparisons and evaluations of step-per-day achievement in a competitive way but rather make class-level judgments regarding the quality of tasks in promoting physical activity.

Taken as a whole, we believe that concerns such as competitiveness are outnumbered by the positive pedagogical implications of integrating the pedometer into PE lessons.

Although pedometers are practical tools for monitoring and evaluating the desirable outcomes of physical activity, some limitations should be acknowledged. Waist-worn pedometers are incapable of measuring steps during water-based activities (e.g., swimming), cycling (e.g., stationary cycle), skateboarding or rollerblading, and nonambulatory tasks (e.g., exercises positioned seated on resistance-training machines). PE teachers should recognize whether the lesson plan involves ambulatory activities that produce steps. The school might also arrange opportunities for PE teachers to experimentally examine pedometers (e.g., during workshops) and discuss possible reasons why the pedometer accurately registers steps during some tasks but not others. PE teachers should also realize that pedometer-determined outcomes can be influenced by body weight (less accurate for overweight users) and speed of locomotion (less accurate during slow walking, i.e., ≤ 54 m/min (Beets, Patton, & Edwards, 2005).

Table 2 presents a checklist for PE teachers to use when integrating pedometers into PE. Based on previous work (McCaughtry et al., 2008), PE teachers will probably face a number of challenges and pitfalls when integrating pedometers into PE, some of which Table 2 presents.

Table 2
Checklist for Physical Education Teachers When Integrating Pedometers Into Physical Education, as Well as Anticipated Challenges and Pitfalls

Recommendations
Introduction
• Demonstrate basic functions, appropriate wear-location (positioned in front of the hip), and provide opportunities for familiarization.
• Discuss and establish a regulatory framework and guidelines for appropriate pedometer usage.
• Develop and establish systematic and time-efficient routines for distributing and collecting pedometers.

Table 2 (cont.)

During Lessons

- Supervise pedometer usage and verify appropriate wear-location.
- Watch for and note pedometer tampering (i.e., shaking the pedometer to artificially increase the number of steps) to reduce source of error.
- Log step values across different lesson tasks and lesson plans.
- Establish baseline step values and steadily increase the number of steps by approximately 10% per week, aiming for the 33% and 50% moderate-to-vigorous physical activity targets (see Table 2 for steps values across lesson of varying duration).

Outside Class

- Check and verify the pedometers for accuracy by counting steps over a 100- to 200-meter walk and compare pedometer steps against counted steps.
- Shake test the pedometer to check and verify accurate registration of vertical movement. Hold the pedometer in the position as if it were attached to the waist; shake it 30 to 50 times and then compare the number of shakes with the step-values visualized through the display.

Anticipated Challenges and Pitfalls

- Certain clothing (e.g., baggy pants/shorts with loose elastic waistbands) might be inappropriate for attaching waist-worn pedometers.
- Tampering, such as shaking the pedometer to artificially increase the number of steps, introduces errors.
- Certain physical education activities might increase the risk of pedometer damage (e.g., contact sports).
- Logging step values might be a time-consuming task.

Concluding Remarks

In this paper, we argued that PE teachers can monitor and receive immediate feedback about whether students are reaching the recommended 50% MVPA target, as well as evaluate the effectiveness of efforts for increasing physical activity, by integrating the pedometer into PE lessons. Although physical activity is one dimension of high-quality PE, some might argue that the central objectives and goals of PE involve knowledge, skills (e.g., generalizable movement

and behavioral skills), and ability to perform physical activities, rather than monitoring actual physical activity. However, as far as we are concerned, PE teachers can evaluate physical activity and design and deliver physically active lessons without abandoning the central objectives and goals of PE. There is no necessary contradiction between the two aspects of PE, particularly not as pedometers also have a number of pedagogical implications for educating students about physical activity.

In our study, we have also outlined additional pedagogical implications of integrating pedometers into PE. Providing a complete list of pedagogical implications was beyond the purpose of this paper, and there are several other innovative ways for PE teachers to use the pedometer to educate youth about physical activity. For example, some pedometers estimate the number of kilocalories expended (e.g., based on step value and body weight), thus offering opportunities for PE teachers to discuss other lifestyle-related issues such as physical activity energy expenditure in relation to body-weight maintenance.

In terms of financial requirements, pedometers are cost effective and far less expensive than other electronic devices such as accelerometers and heart rate monitors. The cost of purchasing a class set of 25 Yamax pedometers (which can be used across all classes and grade levels) would be approximately USD $600 to $650. This relatively high cost is likely influenced by the numerous pedagogical implications, as outlined above.

Integrating pedometers into PE also provides opportunities for PE teachers to create and co-construct meaningful cross-curricular educational units, for example, using the number of steps and the stride length for calculating distance moved, or calculating the number of steps taken across an entire semester of PE lessons calls for adequate mathematic skills. Furthermore, by calculating the distance moved during the school year in PE, the PE teacher can carry out an imaginary class journey by having students study the location they would have reached by moving that many steps.

Last, assuming that physical activity is one dimension of high-quality PE, this paper might also have implications for PE teacher educators as they can introduce the pedometers to PE teacher candidates during their teacher education. In this regard, PE teacher

educators might take inspiration from this paper, as well as previous work (Beighle et al., 2004; Beighle et al., 2001; Cuddihy et al., 2005; Morgan et al., 2003), and develop theoretical–practical lesson plans involving presentation of the rationale of integrating pedometers into PE, along with a practical session in which PE teacher candidates become familiarized with the pedometer.

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